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Is Basque Perfective Past a True Perfective? Evidence from a Visual World Paradigm Experiment

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Abstract

Aspect, which refers to the unfolding of events in time, can be found lexically and grammatically encoded in several languages. This study focuses on grammatical perfectivity, which is traditionally described with the main conditions of culmination and totality. The purpose of this study is to investigate how Basque speakers process grammatical aspect, by contrasting perfective and imperfective constructions in the past tense. Specifically, it aims to examine to what extent Past Perfective tense triggers representations of result state saliency of accomplishments in speakers' minds. For that purpose, a Visual World Paradigm (VWP) experiment with eye-tracking was conducted. Participants were presented with pairs of images depicting events in their ongoing and completed stages while hearing sentences in perfective and imperfective tenses. Participants' eye-movements were tracked in order to detect the image that best matched the mental representation triggered by the sentences. Past Perfective tense was expected to attract more looks at the completed event, while Progressive Past was expected to draw more looks at the ongoing image. The offline and online results confirmed that hypothesis: participants were significantly more likely to prefer the picture that matched the grammatical aspect. Still, the target preference was slightly less pronounced in the perfective condition. The results suggest that Basque Perfective Past and Past Progressive are effective at generating representations of completion and ongoingness, respectively. Furthermore, we conclude that Basque Perfective Past can be compared to Spanish *Pretérito Indefinido* when it comes to expressing completion of events.

Keywords: Basque Perfective Past, perfectivity, VWP, grammatical aspect, *Pretérito Indefinido*.

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List of abbreviations

1	First person	NEG	Negation
3	Third person	NP	Noun Phrase
ABS	Absolutive	OE	Ongoing Event
ACC	Accusative	PFV	Perfective
ALL	Allative	PL	Plural
Asp	Aspect	PRF	Perfect
AspP	Aspect Phrase	PROG	Progressive
AspectPERF	Perfective aspect	PRS	Present
Aux	Auxiliary	PST	Past
AuxP	Auxiliary Phrase	p	p-value
B	Coefficient	ROI	Region Of Interest
BAC	Basque Autonomous Community	SD	Standard Deviation
		SE	Standard Error
C	Complementizer	SG	Singular
CAUS	Causative	SOV	Subject-Object-Verb
CE	Completed Event	SVO	Subject-Verb-Object
CL	Classifier	T	Tense
DEL	Delimitative	TE	Participial suffix (- <i>t(z)en</i>)
DP	Determinant Phrase	TP	Tense Phrase
DUR	Durative	TU	Participial suffix (- <i>tu/-du</i> , - <i>Ø</i> , - <i>i</i> and - <i>n</i>)
EEG	Electroencephalogram		
ERG	Ergative	V	Verb
F	Femenine	VP	Verb Phrase
GEN	Genitive	VWP	Visual World Paradigm
IMPFV	Imperfective	vP	Functional verb Phrase
INE	Inessive	Z	Z-value
MAX _E	Maximization operator		

1 Introduction

Aspect provides information on how an event unfolds in time. Contrary to tense, which specifies the time when an event takes place, aspect determines the manner in which an action, an event or a state develops in a specific time setting, with regard to features such as duration, completion or repetition. Depending on the form through which that information is conveyed, lexical aspect and grammatical aspect are typically differentiated.

1.1 Lexical aspect

Lexical aspect, also known as Aktionsart, addresses the manner in which the inherent meaning of a predicate conveys information about the unfolding of an event. Lexical aspect does not focus on the implications of grammatical forms, but only on the lexical connotations of the verb. Taking into account the different types of attributes that the meaning of the predicate can suggest about the event, lexical aspect can be classified in several ways.

Several criteria are considered when it comes to determining and labeling lexical aspect. Firstly, we can look at dynamism, the semantic feature that determines if an event involves a noticeable alteration or flow of energy that unfolds over time. If it does not, it would generally be called a state. Then, we can establish if the event has duration, i.e. if it extends over a period of time, or if it is a punctual occurrence. It is also interesting to note its telicity, namely if an event has an inherent result that the event itself leads to. On the contrary, if it does not have a built-in telos, it is considered to be atelic. Apart from that, iterativity is the semantic feature that implies that an event is repeated.

Lexical aspect is most commonly classified into four main categories, according to Vendler's (1957) classification: states, activities, accomplishments and achievements. States are the only ones that are not dynamic. Nevertheless, they have duration and they are atelic. Activities have dynamicity and duration, but they do not have a telos. Accomplishments and achievements, on the other hand, are both dynamic and telic. They differ in the fact that accomplishments have a duration whereas achievements are momentary or punctual and they generally imply a sudden change of state.

Years later, Comrie (1976) refined Vendler's (1957) classification for the Aktionsart, by adding some changes. On the one hand, he combined activities and accomplishments into a single category called "processes". He argued that, in spite of accomplishments having a natural endpoint, both activities and accomplishments take time to unfold, and their focus is on the ongoing process of the event instead of on a specific endpoint. Furthermore, according to Comrie (1976) the two categories overlap, as there are predicates that could be interpreted as both having or not having an endpoint. On the other hand, he added another category to the existing ones, named "semelfactives". That category of predicates is similar to achievements in that they are both momentary and have an endpoint. However, semelfactives imply single occurrences that reach an endpoint instantly, while achievements have an internal process which leads to the endpoint. Comrie (1976) defines "semelfactive" as a term to refer to an event that "takes place once and once only" (p. 42).

1.2 Grammatical aspect

Unlike lexical aspect, grammatical aspect is conveyed through morphological markers. Specific verb forms and constructions, prefixes and suffixes added to the verb, or auxiliary verbs bear the responsibility of conveying information about aspect in different languages. While lexical aspect applies to all languages, the manner in which grammatical aspect is materialized varies noticeably from language to language. On top of that, some languages are believed to fully rely on lexical aspect to express aspectual connotations. These dissimilarities complicate the search for a common definition when it comes to describing terms such as perfectivity or imperfectivity, which are labels used in the classification of grammatical aspect.

1.2.1 Perfectivity

As we mentioned, the grammatical aspect of perfectivity (PFV) has not been uniformly defined across languages. Comrie (1976) asserted that the different meanings associated with perfectivity in the past have all failed to describe PFV as a uniform term, both independently and combined. In fact, these definitions cannot encompass the distinct interpretations of PFV in several languages. Due to that, Comrie (1976) proposed a new definition by asserting that "perfectivity indicates the view of a situation as a single whole, without distinction of the various separate phases that make up that situation" (p.16).

Klein (1995) later suggested that this definition was unfit for it to be established as a common understanding of PFV. As a matter of fact, Comrie’s (1976) interpretation of perfectivity views an event as “a single whole” observed from a reference point. It does not consider the stages of the event that are implied through the inherent meaning of the verb. Because of that, the internal structure of the event is ignored, even though it might sometimes naturally encode completion. Later, Comrie’s (1976) definition was incorporated into Dahl’s (1985) proposal for the “prototypical PFV” (1), which is a collection of meanings or properties of PFV. It is based on three different conditions, all of which are important.

- (1) A PFV will typically denote a single event, seen as an unanalysed whole, with a well-defined result or end-state, located in the past. More often than not, the event will be punctual, or at least, it will be seen as a single transition from one state to its opposite, the duration of which can be disregarded. (Dahl, 1985, p. 78)

As stated in (1), one of the conditions of the prototypical PFV is culmination. In other words, the perfective grammatical aspect is expected to denote an event with a “well-defined result or end-state” (Dahl, 1985, p. 78). Thus, culminated events are those that have reached their inherent endpoint. Culmination is often lexically denoted in the predicate: the meaning of the verb can lexically determine the nature of the moment in which an action is expected to end. Meanwhile, a PFV operator, together with the surrounding context of the predicate, will assert that the culmination is indeed attained. A classic example of this would be a PFV operator affecting an accomplishment that includes a quantized Incremental Theme argument. This would mean that the verb in the accomplishment involves an object that is gradually affected by the verb’s action. The event is expected to end when the object has fully undergone the action implied by the verb. The Russian example in (2) illustrates this.

- (2) Masha s.jela^{PFV} prjanik
Masha PFV.ate ginger.bread.cookie.SG.ACC
‘Masha ate (and finished eating) a/(all) the (whole) cookie’ (Filip, 2017, p. 169)

The predicate “eat a cookie” is an accomplishment, because it is an action with a duration and a specified endpoint. The DP “a cookie” is a quantized Incremental Theme argument that is gradually affected by the action of “eating”, and the action is expected to culminate when that cookie has been fully eaten. Hence, the predicate establishes the condition of culmination, whereas a PFV operator sets a culmination requirement. Anyway, in the case

of Russian, it could be that grammatical PFV aspect is not realized through any morphological marker. As argued by Filip (2003), prefixes such as *s-* that Slavic languages use to derive verbs are not grammatical PFV aspect markers. Contrarily, perfectivity is a semantic property of the verb itself. Coming back to (2), the culmination requirement settled by the PFV operator is met by the predicate which denotes that the action is coming to an end. That means that denying culmination in (2) would lead to a contradiction. It is logical to assume, then, that PFV ensures culmination when it is applied to a specific sort of predicate.

A second condition fundamental in Dahl's (1985) "prototypical PFV" definition is totality, as PFV has to refer to "a single event, seen as an unanalysed whole" (Dahl, 1985, p. 78) (1). The property of totality refers to an event when it is an indivisible complete self, with a clear beginning and end. It also means that the event cannot be divided into smaller parts with the same semantic implication. Totality is linked to Krifka's (1989, 1992) description of quantization, which is based on the mereological understanding of aspect. While an event can be broken down into smaller units with a similar denotation, a quantized predicate such as "arrive" or "sneeze" cannot be divided into parts that denote the same event as the one expressed in the predicate. Quantization differs from telicity in that it focuses on the internal structure of the event, whereas telicity focuses on its endpoint. It is true that all quantized predicates are telic, but telicity does not necessarily require quantization. As for culmination, it is related to totality, because a culminated event is quantized and must have taken place as a whole, but not all total or quantized events entail culmination. Semelfactives in Slavic languages are an instance of this, as we will argue shortly.

The third condition in Dahl's (1985) characterization of the PFV is punctuality, as he maintains that, when it comes to perfectivity, "more often than not, the event will be punctual" (p. 78). Punctuality entails that the beginning and the end of the event occur in a single moment. Thus, it is an event with no proper parts and hence quantized. Even if punctual events naturally fulfill the totality condition, they might not always entail culmination. In fact, not all punctual events have a clear result, and Slavic semelfactives prove this reality. Semelfactives, as discussed earlier, are events that are momentarily completed and only occur once. They are certainly quantized events because they do not contain subevents in their meaning. However, they do not entail culmination, as they do not possess a well-defined result state. As an example, Filip (2017) mentions the Russian word *blesnut'* ('flash (once)'), which denotes a single punctual event that does not culminate.

1.2.2 Exceptions to prototypical PFV

Filip (2017) argues two specific instances of PFV forms that do not fit in Dahl's (1985) "prototypical PFV" definition, as they do not meet any of the culmination, totality or punctuality conditions. These are not exceptional cases, since they are well-defined in their own aspect systems. On the one hand, there are "atelic predicates", which are predicates that question the expectations of perfectivity in Slavic languages. On the other hand, "non-culminating accomplishments" in languages such as Hindi and Thai show that the combination of an accomplishment with a PFV operation does not always result in the entailment of culmination.

Firstly, a common example of an "atelic predicate" in Russian is presented in (3). The verb *my pojezdili* ('we went for a ride') is unquestionably perfective, as it meets the common requirements for perfectivity in Slavic languages. Nevertheless, it is not quantized, as it does not denote a single whole event, but the event can actually be divided into proper parts. As the totality condition is not complied, culmination is also not met, since a culminated event must have taken place in its entirety. The predicate does not really denote a clear result of the event of riding. Apart from that, the action is also not punctual, because an event like 'going for a ride' has duration, although its length is unspecified.

- (3) My *po.jezdili*^{PFV} po našemu gorodu
We DEL.drive.PST on our town
'We went for a ride / took a ride around our town' (Filip, 2017, p. 172)

In Slavic languages, attaching prefixes to verbs can result in grammatically perfective derived verbs. That is because prefixes add meaning and lexical nuances to the base form of the verb, and not because prefixes such as *po-* are actual PFV morphological markers. In fact, some prefix-verb combinations are lexicalized and hold their specific meaning. Specifically, the semantic notion contributed by the prefix *po-* in (3) does not really match with the "prototypical PFV" assumptions: delimitative prefix *po-* suggests a set of delimited events, although their temporal boundaries are quite vague. This reveals how Slavic prefixes might contradict PFV expectations at times.

Secondly, “non-culminating accomplishments” are also problematic according to Dahl’s (1985) interpretation of the PFV. Filip (2017) includes examples of two particular languages: Hindi and Thai. Those instances demonstrate how, even if accomplishments denote the culmination point of an event, the PFV operator does not necessarily incorporate the culmination requirement, so the events might not have reached their culmination.

(4) Hindi Simple PFV example:

maya-ne biskuT-ko khaa-yaa par us-e puuraa nahiin khaayaa.
 Maya-ERG cookie-ACC eat-PFV but it-ACC full not eat-PFV
 ‘Maya ate a cookie, but not completely’ (Arunachalam & Kothari, 2012, p. 16)

First of all, “non-culminating accomplishments” occur in Hindi in the form of constructions such as (4). The PFV operator can adopt two forms in this language: the simple PFV form and the complex PFV form. The complex form always entails culmination, so it would be ungrammatical to deny that the event has reached its culmination point. For instance, it would be paradoxical to declare that “Maya ate the cookie”, and then to assure that “she did not finish it”, considering that the culmination point denoted by the predicate “eat a cookie” is the moment in which the whole cookie is consumed.

However, simple PFV forms, which can also be used to imply perfectivity, do not require culminated events, so their culmination can be unproblematically denied. In fact, it is the context that provides information on when the event terminates, and it does not inevitably have to be at its point of culmination. It is possible to affirm that simple PFV forms are employed in Hindi to refer to events that do not terminate at their culmination point, but somewhere before that moment. For this specific reason, Arunachalam & Kothari (2012) assert that simple PFV forms include “partially completed” events in their denotation.

(5) Thai semi-perfective example:

Surii téɛŋ klɔɔn k^huîn
 Surii compose poem ascend
 ‘Surii composed/will compose a/the poem’ (Koenig & Muansuwan, 2000, p. 167)

Apart from that, as far as Thai “non-culminating accomplishments” are concerned, they consist of accomplishment-based PFV constructions that do not result in culmination. The PFV element is a semi-perfective marker that is contributing to the aspectual meaning of the inherently imperfective verb stem. That marker is an additional verb that is chosen from a limited batch and can co-occur with perfective markers. In the case of (5), the semi-perfective marker is *k^huîn* (‘ascend’). These kinds of markers do not necessarily imply that the action has culminated, but they often refer to specific parts of the event. Whether the action is fully completed or not is determined by the context. In other words, Thai semi-perfective markers are ambiguous as they can entail the event being completely or partly culminated, depending on the surrounding context. Similar instances of accomplishments with no culmination entailment can be found in several languages such as Chinese, Korean or Tagalog.

In both examples of “non-culminating accomplishment” in Hindi and Thai events were not quantized, but they were rather understood as containing subparts. Hence, neither of them complies with the condition of totality in Dahl’s (1985) “prototypical PFV” description. As a consequence, they violate the culmination condition, because the events have not culminated as a whole, and they also infringe with the punctuality condition, because, as all accomplishments, they are extended in time.

In fact, all these “unpredictable” cases are not really marginal, but they are a basic part of the aspect system of their corresponding language. The fact that they are treated as “oddities” is due to the fact that generalizations based on the English language have been taken as paradigms for the rest of the languages. Based on the evidence that in English PFV accomplishments culmination cannot be denied, PFV accomplishments in other languages are expected to act in the same manner, and otherwise they are referred to as a rarity. Surprisingly, we do also encounter “exceptions” in English, namely sentences where accomplishments under the scope of a PFV operator do not actually entail culmination. Hay et al. (2015) provided the grammatically acceptable example in (6) to prove that. According to them, the culminated interpretation of *eat the sandwich* arises through implicature rather than from the inherent meaning of the predicate. This is why the telic interpretation can be canceled by providing additional information.

(6) *She ate the sandwich but as usual she left a few bites.* (Hay et al, 2015, p. 139)

The frequency of crosslinguistic instances where PFV operators do not entail the expected requirements make us reconsider the semantics of PFV. As the discussed examples have shown, culmination, totality and punctuality conditions established by Dahl's (1985) to define the typical PFV do not encompass all the interpretations of PFV. In reality, distinct aspectual systems of different languages attach different meanings to PFV, so it is logical to wonder whether there really is a unified way to define and understand it. In the following section I will briefly explain the solution proposed by Filip (2017), who attempts to provide an alternative manner to understand grammatical perfectivity.

1.2.3 Filip's (2017) solution

In accordance with Neo-Davidsonian event semantics, events have to be central to the meaning, and they are denoted by verbs. In addition to that, events and participants are related to each other through thematic roles, which are labels that categorize participants in events. According to the mereological perspective of aspectual classes, verbs have an eventuality type, which can be classified as a state, a process or an event, as part of their meaning. That eventuality type is a set of eventualities that are ordered in a "part-of" relation. The eventuality type labeled as "event" comprises accomplishments and achievements, both of which are telic. Tense operators connect eventualities to reference points in time, while grammatical aspect operators are modifiers of eventuality descriptions that create new eventuality descriptions.

Taking that into account, Filip (2017) suggests a maximization operator MAX_E , which is introduced by all PFV forms and is applied to a set of events of a specific eventuality type: state, process or event. The MAX_E operator identifies the maximal stages of the eventualities. Nevertheless, the basic meaning of the verb might not provide enough information for the MAX_E operator to identify a single, unique maximal stage for the eventuality it describes. The context of the eventuality should be considered to interpret which the greatest stage within the eventuality actually is. Apart from that, it is important to bear in mind that eventualities can be described in multiple ways, and that events can never really be measured.

In spite of that, it is possible to indirectly measure them by considering their participants and their run times. As verbal predicates are linked to arguments through thematic roles, we can gather information about an event by observing the object. Incremental relations are step-by-step changes that occur to the object as an event unfolds. To put it differently, there is a direct correspondence between the subparts of an event and the gradual changes or states that the event induces in the object. For instance, the predicate *eat two cookies* consists of a set of quantized events, because its object *two cookies* is quantized. Similarly, event stages can be denoted by run times, namely phrases such as *for an hour* in a predicate like *walk for an hour*, denoting a direct relation between the running of time and the unfolding of the event. In this manner, the aspectual class establishes the individuation of criteria, whereas PFV introduces the maximization operation.

To sum up, in languages with grammatical aspect, a MAX_E operator often introduced by PFV morphology ensures that only the greatest event stage is considered. Still, languages differ in how they introduce the PFV morphologically and syntactically, as well as in the manner in which they interpret the effects of the MAX_E operator. In some cases, the maximization requirement is met when the event culminates at the culmination point implied by the inherent meaning of the predicate. However, in other instances, the event ceases to develop at some contextually specified moment.

In Slavic languages, MAX_E is phonologically null, as PFV is not inserted through any overt grammatical aspect marker. This seems to go against the common belief that argues that PFV aspect in Slavic languages is marked by prefixes added to verbs. Actually, Filip (2017) defends that Slavic languages express PFV by means of lexicalization rather than morphological marking. In other words, it is the verbs' implicit meaning which determines if the denoted grammatical aspect is perfective or imperfective, and not a morphological marker added to the verb. In fact, even though Slavic verbal prefixes can influence a verb's aspect, they can also co-occur with suffixes with imperfective meaning or even create imperfective verbs. Therefore, they cannot be solely responsible for marking PFV aspect. Apart from that, in Germanic languages such as English with no grammatical PFV, MAX_E operator is phonologically null, contextual information plays a big part in deciding how an utterance is interpreted in the real world.

1.3 Basque aspect

Now let's delve into the tense and aspect system of Basque. There are two types of tenses depending on their morphosyntactic structure: compound tenses, also called periphrastic, and simple tenses. Both types of tenses have present and past forms. Compound tenses are the most common, as all verbs in Basque can have this form. They are formed by two words: the first word is a participle constituted by a main verb and a participial suffix, while the second word contains an auxiliary verb (including its agreement and mood inflections) together with a tense marker. On the other hand, simple tenses can only be adopted by synthetic verbs. They are composed of a single word, including a main verb and a tense marker. While compound tenses can have both perfective and imperfective interpretations, simple tenses are always interpreted as imperfective.

If we examine the morphological structure of compound tenses, we can see that there are two types of participial suffixes as well as two different auxiliary components. The participial suffixes can be separated into perfective and imperfective. The perfective suffix has four allomorphs (*-tu/-du*, *-Ø*, *-i* and *-n*), whereas the imperfective suffix is *-t(z)en*. As for the auxiliary component, it is derived from either the verb *izan* ('be') or the verb *edun* ('have'). According to Arregi (2000), *izan* is used in intransitive clauses, to denote individual-level properties, whereas *edun* is used in transitive clauses, and can only be found as a tensed auxiliary. Apart from that, tense seems to be marked in both compound and simple tenses, generally with *-Ø* in the present, and with *-n* suffix in the past tense.

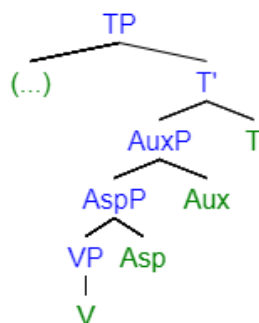
Synthetic verbs are a reduced set of verbs that can appear both in simple and compound tense forms. Meanwhile, non-synthetic verbs, which are all the remaining verbs, can only surface as a compound tense. Among more than 30 synthetic verbs listed by Euskaltzaindia (1979), the official regulatory institution of the Basque language, some of the most common are *izan* (individual-level 'be'), *egon* (stage-level 'be'), *joan* ('go'), *etorri* ('come'), *eraman* ('carry'), *ekarri* ('bring'), *eduki* ('have'), *ibili* ('walk'), *jakin* ('know') and *erabili* ('use'). As mentioned by Arregi (2000), they do not form a uniform semantic group. In terms of transitivity, they can be both transitive (*eraman*, *eduki*, *erabili*) and intransitive (*egon*, *etorri*, *ibili*), and as far as lexical aspect is concerned, they can both suggest states (*izan*, *eduki*, *jakin*) or activities (*joan*, *ekarri*, *erabili*).

The morphological differences of simple and compound tenses can be examined by analyzing their syntactic structure. Starting with compound tenses, these are two-word forms that both synthetic and non-synthetic verbs can adopt. As suggested before, they can emerge in four different versions, by combining two tenses (past and present) with two participial suffixes (perfective and imperfective). As both Laka (1990, 1993) and Arregi (2000) argue, they involve an Asp projection and have an overt aspectual morphology. According to them, verb roots adjoin to their closest functional heads through a head-to-head movement and that results in the formation of two separate words. First, the root of the main verb moves to the Asp head forming a participle. In addition, another verbal root adjoins the T head to form the auxiliary verb. You can observe the process of formation of the compound form of the synthetic verb *ibili* in (7).

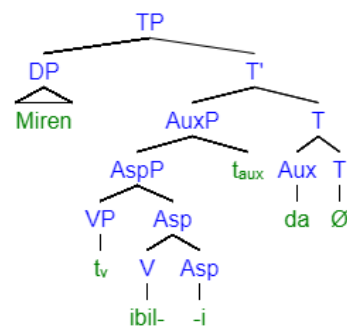
(7) Construction of the compound tense form of the synthetic verb *ibili* ('walk').

Miren	ibil-i	da
Miren	walk-PFV	Aux.PRS
'Miren has walked'		

a.



b.



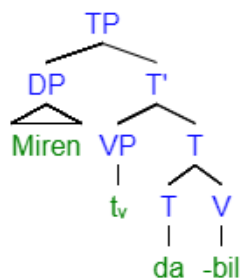
Apart from that, simple tenses are formed by a single word, and they are only possible with synthetic verbs. Besides, they can appear in present and past tense forms, but unlike compound tenses, they always denote imperfective aspect. They do not possess any overt aspectual morphology, so the presence of an aspect projection in these kinds of constructions is debated: Laka (1990) argues that simple forms also have an Asp projection, while Arregi (2000) defends that they do not involve an aspect projection. Each of these hypotheses involve different approaches to a similar outcome. Arregi's (2000) arguments for his hypothesis will be further examined in section 1.3.2.

Following Laka's (1990) belief, in simple tenses, the main verb head-moves and adjoins to the Asp head, which is realized as \emptyset , then continues rising to the T head. Thus, Laka (1990) believes that simple forms always have an Asp projection, and it is the presence (or the absence) of aspectual morphology that determines whether the verb raises or not to the inflectional head. Arregi (2000), on the other hand, believes that the main verb moves to the tense head because, in the absence of an Asp head, T is the closest functional head to the verb. For this reason, the main verb receives the tense inflection instead of an auxiliary verb. Arregi's (2000) and Laka's (1990) proposals for the generation of simple tense forms can be compared in (8a) and (8b). In the end, the outcome of both proposals is the same: in both cases, V ends up adjoining the tense head.

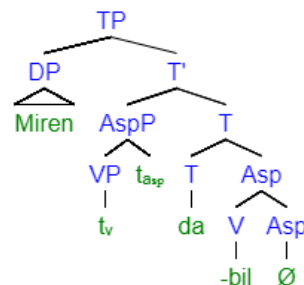
(8) Construction of the simple tense form of the synthetic verb *ibili* ('walk').

Miren dabil
Miren walk.IMPFV.PRS
'Miren walks/is walking'

a. Arregi's (2000) proposal



b. Laka's (1990) proposal



In conclusion, the difference of the internal structure of compound and simple tenses results from different types of head movements in each of the forms. In the compound tense, the main verb moves to the Asp head, and it spells out at that level. On the contrary, in the simple tense, the main verb ends up moving all the way to the T head. Arregi (2000) assures that both movements are triggered by a morphosyntactic requirement that demands inflectional categories such as Asp and T to have a verbal root adjoined to them. At the same time, as verbs need to have an inflection, they move to the closest functional head.

1.3.1 Correlation between morphology and meaning

Concerning the aspectual meaning that these structures arise, they can suggest a perfective or an imperfective interpretation. Note examples with verbs *jan* ('eat') and *etorri* ('come') in (9). The auxiliary verbs included in the compound tenses are derived from different verbs in the two verbs. The auxiliary is derived from *edun* ('have') in the case of the verb *jan* ('eat'), because it is a transitive verb. *Du* is the present form of the auxiliary, whereas *zuen* is the past form. The auxiliary that corresponds to the verb *etorri* ('come'), on the other hand, is derived from *izan* ('be'), due to the intransitive condition of the verb. The two variations of the auxiliary verb corresponding to the verb *etorri* are present *da* and past *zen*.

As displayed in tableau (9), perfective meanings are always conveyed through a compound tense with a perfective participial suffix (*-tu/-du*, *-Ø*, *-i* and *-n*), both with non-synthetic and synthetic verbs. The perfective suffix is *-n* with the former verb (9a) while it is *-i* with the latter (9d). The selection of the perfective suffix allomorphs is idiosyncratic and depends solely on the verb. As for imperfective meanings, Arregi (2000) argues that they can be habitual, denoting that an event occurs repeatedly, or non-habitual. Habitual meanings are always conveyed with a compound form, this time with an imperfective *-t(z)en* suffix, no matter the type of the verb. (9b) and (9e) show examples of that.

(9) Aspectual semantics of Basque tenses (Arregi, 2000, p. 7)

	Perfective	Imperfective habitual	Imperfective non-habitual (unmarked)	Ambiguity
Non-synthetic verbs <i>jan</i> ('eat')	a. Compound _{Pfv} <i>ja-n du/zuen</i>	b. Compound _{Impfv} <i>ja-ten du/zuen</i>	c. Compound _{Impfv} <i>ja-ten du/zuen</i>	Compound _{Impfv} is ambiguous.
Synthetic verbs <i>etorri</i> ('come')	d. Compound _{Pfv} <i>etorr-i da/zen</i>	e. Compound _{Impfv} <i>etor-tzen da/zen</i>	f. Simple <i>dator/zetorren</i>	Compound _{Impfv} is <u>not</u> ambiguous.

Contrarily, imperfective non-habitual meanings are conveyed through different constructions in the case of non-synthetic and synthetic verbs. With synthetic verbs, the simple tense expresses non-habitual imperfectivity, with no aspectual marker. The present (*dator*) and past (*zetorren*) versions of the simple tense of verb *etorri* ('come') are indicated in (9f). As

simple tenses are speculated not to have an Asp projection, they would represent the unmarked form. Nonetheless, non-synthetic verb forms do not possess a simple form or any other construction that exclusively conveys non-habitual imperfectivity. Thus, they express that particular aspectual meaning with the imperfective compound form (9c).

However, that signifies that two different imperfective meanings are conveyed through the same syntactic construction, and that supposes an ambiguity. If we compare (9c) and (9f) examples, it is obvious that they employ two different constructions to express the same aspectual connotation. Apart from that, (9b) and (9c) show identical constructions of the same non-synthetic verb that entail different aspectual meanings: habituality and non-habituality. Therefore, the ambiguity lies in the fact that synthetic verbs have separate constructions to convey the two different types of imperfective aspectual meanings, habituality and non-habituality, whereas non-synthetic verbs use the same syntactic structure, which can be understood as habitual or non-habitual aspect.

Arregi (2000) maintains the general assumption that distinct aspectual meanings correspond to particular syntactic structures, in a manner in which syntax and semantics are directly related. Under this belief, the contrasting constructions denoting non-habitual imperfectivity in synthetic and non-synthetic verb classes would have to have identical internal structures. Then, structures with non-synthetic verbs with a non-habitual meaning would also lack an Asp projection. If that was true, non-synthetic verbs would inevitably head-move to the next nearest functional head, namely the tense head. Nevertheless, non-synthetic verbs do not do that, and they form a compound tense instead in that context.

(10) *V-to-T Movement* condition:

V moves to T only if V belongs to the synthetic class.

In order to justify the head movement to T with synthetic verbs in non-habitual readings and the absence of such a head movement when it comes to non-synthetic verbs, Arregi (2000) proposes the condition stated in (10). That condition substantiates the fact that non-synthetic verbs use a compound tense form to denote non-habitual imperfective aspect, and not a simple tense form. Coming back to (9b) and (9c) examples, they are both compound tenses with an imperfective participial suffix *-t(z)en*, but the former involves an Asp projection in their structure while the latter does not. Nevertheless, the fact that different morphological markers do not have a corresponding specific aspectual meaning would have further implications: it

would mean that the participial suffixes that are attached to the main verb in compound tenses are not necessarily aspectual markers, or at least they are not in the case of imperfectivity. Arregi (2000) supports this idea, and his reasoning will be summarized in the following section.

1.3.2 Arregi's (2000) approach

Arregi (2000) states that the function of participial suffixes is not exclusively to convey grammatical aspect. On the contrary, Laka (1990) treats all participial suffixes as grammatical aspect markers. In addition, she believes that all tense forms, including simple tenses, have an aspectual projection in their syntactic structure, even if that projection is realized as $-\emptyset$ in simple tenses. She argues that the fact that simple tenses do not possess any overt aspectual morphology is the reason why verbs head-move up to the tense head instead of staying in the Asp head. However, one of the allomorphs of the perfective suffix is $-\emptyset$ in verbs such as *bete* ('fill'), *gorde* ('keep'), *jo* ('hit') and *hil* ('die'), and it is employed in perfective compound tenses like *bete da* ('has been filled') or *hil da* ('has died'). For some reason, the presence of a null aspectual marker in those cases does not trigger movement to the tense head. Then, it could be that grammatical aspect is not always conveyed through overt aspectual markers.

According to Arregi's (2000) perspective, what really matters is the presence of an Asp projection, and not the existence of overt aspectual morphology. As explained previously, he holds that constructions interpreted as non-habitual imperfective never have an Asp projection, neither if they are compound tenses with non-synthetic verbs nor if they are simple tenses with synthetic verbs. That suggests that imperfective compound tenses can result from two different constructions, one with an Asp projection, and one without. Thus, when an imperfective compound tense is interpreted as non-habitual, the participial suffix is not functioning as an aspectual marker. Actually, Arregi (2000) argues that no participial suffix is truly a materialization of Asp, not even the perfective suffix. To prove that, it is necessary to examine other uses of perfective and imperfective suffixes, and see if they always contribute to the aspectual meaning in the same manner.

(11) Verb focus construction in perfective aspect.

Zabal-du	egi-n	da	ate-a
open-TU	do-PFV	Aux.PRS	door-the.ABS
'The door has OPENED'			

(12) Verb focus construction in the imperfective aspect.

Ja-n	egi-ten	du	ume-a-k
eat-TU	do-IMPFV	Aux.PRS	child-the-ERG
‘The child EATS’			

First of all, perfective participle suffix *-tu* and all its allomorphs are commonly employed in verb focus structures such as (11) or (12). Verb focus in Basque consists in bringing the focused verb to the beginning of the phrase together with verb *egin* (‘do’), with which a perfective or imperfective compound tense is formed. The focused verb always carries the suffix *-tu*, but that does not affect the aspectual outcome of the phrase. Instead, the suffix attached to the verb *egin* seems to influence the aspect selection. For instance, in the example in (11) the focused verb *zabaldu* has *-tu*, but it is the *-tu* suffix attached to *egin* what determines that the phrase is in the perfective aspect. In the second example (12), *-tu* suffix attached to the verb *jan* does not have an effect on the imperfective reading of the phrase, which is determined by the *-t(z)en* suffix in *egin*.

Arregi (2000) maintains that, if *-tu* and *-t(z)en* suffixes were genuine realizations of Asp, they would have the same meaning in all contexts, and otherwise they would vary in accordance with their function. However, the different allomorphs of *-tu* do not depend on that, but rather on the specific verb they are attached to. Then, the fact that suffix *-tu* does not entail aspect in some environments is enough to argue that it is actually never a reflection of the Asp projection. Suffix *-t(z)en* acts similarly, in that it can sometimes be used to convey non-habitual imperfective readings, as we will discuss next.

Before that, it is relevant to note that *-t(z)en* is in reality the combination of two suffix markers: derivational suffix *-t(z)e* and inessive case suffix *-n*. As far as the contexts in which *-t(z)e* is applied are concerned, it is normally used together with a case marker so as to form non-finite phrases that can be introduced in certain constructions. (13a), (13b), (13c) and (13d) are just a number of typical examples with different case suffixes. The examples are based on the ones in Arregi (2000, p. 13).

- (13) a. Liburu-ak irakur-tze-a dibertigarria da
 book-the.PL.ABS read-TE-ABS fun be.PRS
 ‘Reading books is fun’
- b. Hortz-ak garbi-tze-ko ordu-a da
 tooth-the.PL.ABS clean-TE-GEN time-ABS be.PRS
 ‘It is time to brush (your) teeth’
- c. Partida irabaz-te-agatik zorion-du du
 match.the.ABS win-TE-CAUS congratulate-PFV Aux.PRS
 ‘(He/she) has congratulated (him/her) for winning the match’
- d. Ohe-ra joa-te-ko esa-n dit aita-k
 bed-ALL go-TE-GEN tell-PFV Aux.PRS dad-ERG
 ‘Dad has told me to go to bed’

In (13a), *-t(z)e* is used with an absolutive case marker, which implies that the whole embedded clause is the subject that receives the absolutive case from the main verb. In (13b), *-t(z)e* is in combination with genitive case marker *-ko*, which denotes that the embedded clause is a complement of the noun *ordu*. In (13c), *-t(z)e* and causative marker *-agatik* form a causative clause. In all these examples the choice of the case marker is quite predictable. Nonetheless, the usage of the genitive marker in (13d) is not so easy to predict. That is also the case when the inessive case marker is used together with the suffix *-t(z)e*. Several examples similar to those specified in Arregi (2000) are provided in (14).

- (14) a. Melodia abes-te-n entzu-n nuen
 melody.the.ABS sing-TE-INE hear-PFV Aux.PST
 ‘(I) heard (him/her) singing the melody’
- b. Plater-ak garbi-tze-n amai-tu nuen
 dish-the.PL.ABS clean-TE-INE finish-PFV Aux.PST
 ‘(I) finished washing dishes’
- c. Telebista ikus-te-n dago
 TV.the.ABS watch-TE-INE be.PRS
 ‘(He/She) is watching TV’

In (14a), the union between *-t(z)e* suffix and the inessive marker creates an embedded clause that complements the perception verb *entzun*. In (14b), *-t(z)en* is part of a periphrastic construction that carries aspectual information: specifically, it entails the culmination of the predicate denoted in the embedded clause. Finally, in (14c) *-t(z)en* is utilized together with verb *egon* ('be'), which generally denotes stage-level properties, and its combination with the suffix *-t(z)en* suggests progression of an event, in this example, the event of watching TV. The construction in (14c) conveys a similar meaning to that implied in a construction with particle *ari*. We will discuss that kind of construction in the following section. As can be noted, none of the uses of suffix *-t(z)en* provided here denotes a habitual imperfective aspectual interpretation, in the way it supposedly does in the classification discussed in (9). As a consequence, the suffix *-t(z)en* cannot be assumed to be directly linked to the realization of a concrete or any sort of aspectual projection.

Apart from that, the operation of negative fronting in Basque provides an argument in favor of the structural difference of compound and simple tenses defended by Arregi (2000). In fact, in negative structures, T moves to the head of the negation head, so the fact that only the auxiliary undergoes this movement in compound tenses is proof that the participle does not rise to T, and therefore, it is not affected by the head-movement. However, there is also some counterargument to Arregi's (2000) view, as in the focus movement phenomenon described by Ortiz de Urbina (1989) T-to-C movement results in the movement of both the participle and the auxiliary in compound tenses. Nevertheless, Uriagereka (1992, 1999) offers an alternative approach to this, arguing that these kinds of focus constructions could be explained by phrasal movement rules.

In spite of counterarguments, Arregi's (2000) proposal supposes implications on our previous understanding of the role of participial suffixes in Basque. To be more specific, Arregi (2000) concludes that distribution of participial suffixes "has to do with morphological properties of verbs" (p. 25), and not so much with their role of denoting grammatical aspect. This makes one wonder whether, as it is the case with Slavic prefixes, grammatical aspect is actually not realized through morphological markers. However, this approach does not deny the fact that the selection of participial suffixes might somehow be related to denotation of aspectual class.

1.3.3 About progressive *ari*

On a different note, it is relevant for this research to discuss the composition and use of verb constructions with *ari*. Those include the participial suffix *-t(z)en*, the progressive particle *ari* and an auxiliary verb (15b). The presence of *ari* implies that the phrase should be interpreted as progressive. If the particle was removed, the phrase would be ambiguous and could be understood as denoting habitual imperfective aspect. Due to the presence of *ari*, the main clause only possesses one absolutive argument, which is *mutila* in (15b). As might be observed, the verb in the main clause is intransitive in the construction with *ari* (15b), unlike in the sentence without *ari* (15a). Apart from that, the presence of the progressive particle *ari* triggers the disappearance of the ergative marker *-k* at the end of the subject in sentence (15b).

- (15) a. Mutil-a-k gutun-a idatz-i z-u-en
 Boy-the-ERG letter-the.ABS write-PFV 3SG-have-3SG.PST
 ‘The boy wrote the letter’
- b. Mutil-a gutun-a idaz-ten ari z-e-n
 Boy-the.ABS letter-the.ABS write-IMPFV PROG 3SG-be-PST
 ‘The boy was writing the letter’

The reason for that is the following. In the transitive phrase (15a), the subject *mutilak*, which has an agent thematic role, is in ergative case and this is marked by the *-k* at the end of the word. The direct object *gutuna*, on the other hand, has a theme theta-role and it is in the absolutive case, with no case marking (\emptyset). (15b) is the same as the previous phrase, but it contains the progressive *ari*, preceded by the imperfective participial suffix. Although *mutila* continues having an agent role, it is in the absolutive case instead of the ergative, and it bears the correspondent null ending (\emptyset).

According to Laka (2004), *ari* is a word of the verb category. In fact, it is an intransitive verb that takes a clause as a complement. *Idatzi* is the verb of that embedded clause in the case of (15b). Thus, when progressive *ari* is there, two different absolutive cases appear, one in each of the phrases. In (15b), *mutila* is the only argument of the intransitive verb *ari* in the main clause, and therefore has an absolutive case; on the contrary, *gutuna* is the direct object of the transitive verb *idatzi* in the embedded clause, and hence also has an absolutive case.

1.4 The Past and the Perfect in Spanish

In this section, the Perfective Past and the Present Perfect forms in Spanish will be introduced. There are reasons to suggest that Spanish Perfective Past, also known as *Pretérito Indefinido*, is not as unambiguous as Russian PFV at conveying prototypical perfective meanings. According to Fábregas (2015), this tense form indicates that a final endpoint has been reached. However, it does not necessarily imply that the event has been completed. For example, the completion of an event denoted by an accomplishment predicate in the Spanish Perfective Past can be denied by introducing an adverbial phrase such as *durante tres horas* ('for three hours'), which delimits an event's duration (Janda & Fábregas, 2019). The example in (16) illustrates this.

- (16) a. *Juan leyó el libro, pero no lo terminó.
Juan read.PFV.PST the book but NEG it finish.PFV.PST
'Juan read the book, but he didn't finish it'.
- b. Juan leyó el libro durante tres horas, pero no lo terminó.
Juan read.PFV.PST the book for three hours

pero no lo terminó.
but NEG it finish.PFV.PST
'Juan read the book for three hours, but he didn't finish it'

The sentence in (16a) shows how it is generally ungrammatical to deny the completion of an accomplishment such as 'reading a book' in *Pretérito Indefinido*. On the other hand, the example in (16b) includes the modifier *durante tres horas*, a time adverbial which delimits the duration of time in which the event of reading takes place. This sentence is grammatical, suggesting that the completion implication of the perfective can be canceled through such adverbials in Spanish. In Russian, that would not be possible, as the failure of completion would require an imperfective tense form. This example proves how *Pretérito Indefinido* does not necessarily entail completion: even if the natural endpoint of an event can be lexically implied in a predicate (an accomplishment), but the completion of the event can still be denied through the context. Therefore, it is clear that the interpretation of Spanish Perfective Past is influenced by several factors which are beyond the entailment of completion, as it happens with perfective tenses in other languages that we previously presented.

Aside from the Perfective Past, the Perfect is another tense form that is susceptible to cross linguistic variation. Van Der Klis, Le Bruyn, & De Swart (2022) carried out a contrastive study on the division of labor between Past and Perfect tenses across a number of western European languages. In narrative texts, the Past and the Perfect verb forms compete in different contexts, and their presence varies cross linguistically. In general, in languages with a clear perfective/imperfective tense division, perfective tenses are used to describe events in a narration, whereas imperfective tenses describe states.

The novel *L'étranger* examined in Van Der Klis, Le Bruyn, & De Swart's (2022) study presents a singular case in the narrative discourse of literature: it employs a Perfect tense, the French *Passé Composé*, to narrate the occurrences of the story. The main characteristic of this Perfect tense in comparison to the *Passé Simple* or the Perfective Past is that it simply lists events in a detached manner, creating a literary effect intended by the author. The researcher compares the translations of the *Passé Composé* in the novel to contrast the uses of Perfect tenses across languages. In their study, a Perfect tense is described in terms of morphosyntax, as being formed by a 'have' or 'be' auxiliary and a past participle.

The study showed that the use of the Perfect in different languages is in a subset relation, in which languages are on a spectrum of a more or less restricted Perfect usage. On that spectrum, Greek has the most restrictive Perfect, whereas French and Italian possess the most liberal Perfect. There are several factors that influence the usage of Perfect: regarding lexical semantics, it is relevant if the verb is stative or dynamic; regarding compositional semantics, it is certainly important to know if an event is bounded; as for dynamic semantics, having a narrative or a non-narrative context makes a great difference; in terms of pragmatics, the delivery of information and the speaker's intention relatively influence the usage of the Perfect.

As for the role of the Perfect in Spanish, *Pretérito Perfecto Compuesto* or Spanish Present Perfect has a rather limited use in comparison with French or Italian Perfect, but it is more liberal than English or Greek Perfect. The study showed that, in terms of lexical semantics, Spanish uses *Pretérito Indefinido* rather than the Perfect with stative verbs such as 'be' or 'have', as well as with verbs that describe cognitive states such as 'think' or 'want'. As for narrative usage, Spanish prefers *Pretérito Indefinido* to narrate a succession of events in the past instead of *Pretérito Perfecto Compuesto*. On the contrary, French, Italian or German are more open to employ the Perfect in that context.

Apart from that, Spanish also requires *Pretérito Indefinido* in past events where a past time reference is made through, for example, a time adverbial. Dutch can use a Perfect tense in that kind of context, while Spanish or English are required to always use a Past tense. Nevertheless, Spanish and English differ from each other in their restrictions on Perfect when it comes to pragmatics: presupposed events in English are required to be in the Past tense, whereas they are not in Spanish, so *Pretérito Perfecto Compuesto* can be used in that situation. For English, unless it is completely new information, it cannot go in the Perfect. In conclusion, on the spectrum of Perfect usage limitations, Spanish is more restricted than Dutch but less so than English.

1.5 Summary

To sum up, we have discussed the role of lexical and grammatical aspect in depicting the unfolding of events in different languages. Lexical aspect, embedded within the verb itself, portrays the inherent nature of the event. Grammatical aspect, on the other hand, entails different meanings in different languages, and there is no consensus for a cross linguistic understanding of it. This is why there are so many instances where the conditions of culmination, totality and punctuality of the “prototypical PFV” established by Dahl (1985) are not fulfilled. Atelic predicates in Slavic languages and non-culminating accomplishments in languages like Hindi or Thai are examples of that. Filip (2017) provides a solution for the semantic disambiguation of grammatical aspect by introducing the MAX_E operator.

As far as Basque grammatical aspect is concerned, we have delved into the aspect system of Basque, which relies on compound and simple tenses to express aspect in various manners. Compound forms can be adopted by all verbs, and they are formed by two complex heads which are a participle and an auxiliary. Simple tense forms, on the contrary, can only be used by a small set of verbs denominated synthetic, and are formed by a single word with no overt aspectual marking. There is debate on the existence of an aspectual projection in both of those verb forms.

On the one hand, Laka (1990) argues that there is always an Asp projection and the morphological difference between the two types of tenses lies on a head movement phenomenon triggered by the lack of overt aspectual marking. On the other hand, Arregi (2000) defends that the presence or the absence of an aspectual projection in the internal structure of a tense form correlates with its aspectual denotation. He also affirms that the realization of aspect in Basque does not depend on explicit morphological marking. He suggests that participial suffixes might not directly encode aspect, but rather be linked to other factors.

Finally, some key elements for this study have been brought into the discussion. Firstly, a progressive periphrastic form has been described, which consists in a combination of the participial suffix *-t(z)en* with the particle *ari*. This form will be described again, as it is relevant for the experiment that is part of this study. In addition to that, the Spanish Past tense *Pretérito Indefinido* and the Perfect tense *Pretérito Perfecto Compuesto* have been presented and characterized. Later on, we will discuss their similarity to Basque tenses.

Following this line of interest, in this research, we would like to pursue two main objectives: i. to understand the role of participial suffixes in Basque more in depth by observing how they are interpreted in terms of grammatical aspect; and ii. to compare them to aspectual markers in other languages.

2 Visual World Paradigm

This study will use Visual World eye-tracking to investigate the behavior of native speakers of Basque when interpreting various aspect forms in the language. Intuitions about truth conditions have been tested in the past, as a means of getting to the bottom of the meaning of several linguistic features. Psycholinguistic experiments on the processing of aspect in real time can be a good source of information about the understanding of verbal aspect from a cross linguistic perspective. In particular, the Visual World Paradigm (VWP) is an experimental methodology that combines spoken and visual stimuli to learn about how spoken language is perceived. Tanenhaus et al. (1995) first expanded the use of VWP methodology in the field of psycholinguistics.

In a VWP experiment, the eye-movements of subjects are regularly tracked while they are looking at a supervised visual display. Eye-movements or saccades are extremely sensitive to linguistic content introduced through audio stimuli, and they have an immediate consequent

response to the visual stimuli that is presented to them. That direct response is unconscious and cannot be controlled. The rapid eye-movements of speakers are a result of the fast processing of language within the speaker's mind, and differentiate the information contained in the language in a temporally fine-grained manner. Hence, VWP with eye-tracking is a well-suited methodology to study the particular mental representations that the processing of difference tense and aspect forms can trigger in the minds of Basque speakers. In the past, eye-tracking has been proved to be a successful methodology to understand linguistic processing, as we will discuss further on in this section.

In a typical Visual World Paradigm experiment, static images are employed to depict imagined referents or concepts. Apart from that, they can also be used to represent time frames of dynamic eventualities. As most events have a temporal dimension or duration, they can be broken down into individual phases or frames. Static images are ideal to depict the different phases of an eventuality. Thus, they can be helpful to understand the mental representations that grammatical aspect features trigger in the mind of a speaker. In fact, Smith (1995) believes that grammatical aspect determines the perspective from which the events described by the verb are observed. In this manner, a particular phase of the whole unfolding of the event is emphasized and made salient.

In order to examine which particular phase of an event is emphasized with perfective and imperfective conditions, static images can represent a frame in which the event is still in the process, and another one where the result state of the event is shown. Considering that grammatical aspect makes a specific point of the event salient, data gathered through eye-tracking would reveal the image that best matches the cognitive representation triggered in the mind of a subject as a response to aspectual input. Previous behavioral tests on aspect processing have successfully gathered information through judgment tasks, even before eye-tracking studies became so widespread.

In this section, we will firstly discuss a couple of decision task experiment based studies (Madden and Zwaan, 2003; Ferreti et al., 2007) that made important contributions to the understanding of grammatical aspect processing. Secondly, we will talk about significant Visual World eye-tracking studies in Chinese (Zhou et al., 2014) and Italian (Foppolo et al., 2021) that laid the groundwork for the type of experiment that is conducted in this study. Thirdly, we will describe the two studies by Minor et al. (2022a, 2022b) which were the basis

of this particular study. Finally, we will discuss a newer study by Vos et al. (2023) that introduces alternative approaches to the discussion of grammatical aspect processing.

2.1 Previous studies on grammatical aspect processing

In this section we will present previous relevant studies that utilized picture matching decision tasks to test the understanding of grammatical aspect. On the one hand, Madden and Zwaan (2003) discussed how perfective aspect emphasizes the stage of the eventuality when the action is completed. On the other hand, Ferreti et al. (2007) noticed how other contents such as location information became more salient with the imperfective aspect.

Firstly, Madden and Zwaan's study (2003) investigated how grammatical aspect influences the mental models that readers construct. In three experiments, participants read sentences describing events in the perfective or imperfective aspect, and then looked at pictures depicting the same events at various stages of completion. The researchers measured the accuracy of the matching exercise, as well as the response time of the participants.

The results proved that it was more likely for readers to match perfective sentences with completed events than with ongoing events. This suggests that the perfective forms encourage readers to build mental representations of events that are in a completed state. On the other hand, participants did not show a preference for either completed or in-progress pictures when they encountered imperfective forms. This implies that the imperfective aspect is more flexible when creating mental representations related to the described events in the readers' minds. In addition, the researchers accounted for a factor that could potentially be influencing the results of the study; the ambiguity of the completed pictures could have induced participants to interpret them as ongoing events. For this reason, an additional experiment was conducted to demonstrate that the lack of effect of the imperfective sentences was not caused by that ambiguity.

Secondly, Ferreti, Kutas & McRae's study (2007), also investigated the manner in which grammatical aspect influences people's understanding of written language. A series of experiments showed how grammatical aspect can quickly activate the speaker's existing knowledge about the real world, including the locations where the events occurred. Specifically, imperfective aspect was shown to activate information about location more effectively than perfective aspect. A combination of behavioral tasks and brain activity

measurements were explored. In the first experiment, they tested the speed at which locations arose in participants' minds when they heard separate verbs. In the second experiment, the researchers tested how likely participants were to anticipate location-related information when reading perfective and imperfective verbs. In the third experiment, the researchers investigated how verb aspect affects our understanding of locations. Participants' brain activity was measured using EEG, in order to observe the level of predictability of the location in ongoing and completed sentences, and they discovered how verb aspect had an effect on this predictability.

The results suggested that grammatical aspect and knowledge about the world interacted in the comprehension of a sentence. This challenges some existing theories that rely on "spreading activation", the belief that understanding a word activates related concepts in the mind. The study showed that grammatical aspect can modulate this activation process, as different representations can be brought to the mind based on the condition of grammatical aspect. The study showed the manner in which the aspect of a verb influenced the mental representations that readers made when reading sentences. Imperfective aspect generally had a higher chance of generating depictions of characters, objects, locations and instruments than the perfective aspect, which triggered the idea of completion more effectively. Overall, the study underlined the importance of grammatical aspect in the understanding of sentences.

2.2 Previous studies with eye-tracking

As far as eye-tracking is concerned, two previous studies that employed the methodology will be described here. In the first one, Zhou et al. (2014) made use of eye-tracking to test Mandarin speaking children and adults' abilities to process grammatical aspect. In the second study, Foppolo et al. (2021) adopted Visual World eye-tracking methodology to learn about the aspectual information encoded in specific morphemes in Italian.

2.2.1 Zhou et al. (2014)

The study by Zhou et al. (2014) aimed to investigate Chinese children's understanding of aspectual information. Eye-tracking was used to see if they would react to the aspectual information contained in a verb form (with an ongoing or completed morpheme) by looking at a picture that had a corresponding visual representation of either an ongoing or completed event. If children could process the meaning of the aspectual markers by hearing the different

verb forms, their eye-movements would react fast accordingly. The fact that Chinese can have minimal pairs of sentences containing different aspectual markers is useful for this kind of eye-tracking experiment. Two groups of participants were involved in the experiment: Mandarin speaking adults and children. The 34 adults participating in the experiment were university students. As for the children, there were 99 children from 3 to 6 years old involved, and they were divided in three different age groups.

The set of stimuli for the experiment consisted of visual and audio content. In each of the 16 experimental items, a visual display of two pictures was shown to the participants: an ongoing and a completed version of the same event. Each visual display had two corresponding spoken sentences, one with the perfective *-le* morpheme and another one with the durative and therefore imperfect *-zhe* morpheme. A couple of examples of sentences with these morphemes are exhibited in (17). Only one of the two versions of the sentence showed up in each trial. Besides, the position of the pictures also changed in different trials. All sentences had a parallel structure, and they contained vocabulary that was familiar for the children. In each experiment, experimental items consisted of 8 *-le* and 8 *-zhe* sentences. Regarding filler items, they were 16 in total and they had the same structure as the experimental items. Nevertheless, the visual display consisted of two pictures depicting different events, either in their ongoing or completed version. Target and filler items were randomly arranged.

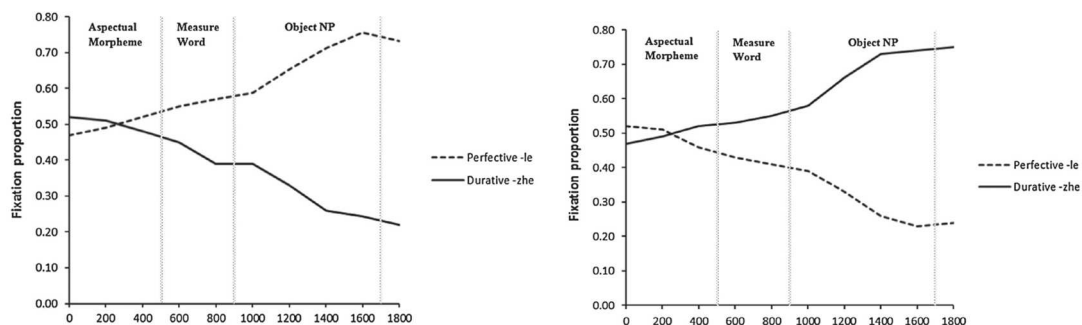
- (17) a. Laonainai zhong-le yi-duo xiaohua.
 old lady plant-PFV one-CL flower
 ‘The old lady has planted a flower.’ (Zhou et al., 2014, p. 265)
- b. Laonainai zhong-zhe yi-duo xiaohua.
 old lady plant-DUR one-CL flower
 ‘The old lady is planting a flower.’ (Zhou et al., 2014, p. 265)

As far as the procedure is concerned, as discussed earlier, Visual World Paradigm was used to examine participants' reactions to pictures triggered by linguistic audio input. During the experiment, the pictures were shown to the participants on a monitor while they listened to a sentence. Then, participants had to identify the picture that depicted the sentence that the talking puppet had articulated. Meanwhile, their eye-movements were monitored by an eye-tracker. The whole experiment consisted of 4 practice trials and 32 test trials, 16 of which were

experimental items and 16 fillers. The eye-movements of the participants were recorded 4 seconds from the moment that the sentence was uttered.

Concerning the results, the data gathered through eye-tracking was analyzed to see if the participants looked at the target picture in each of the trials. The results were represented in generalized linear mixed models such as (18a) and (18b). Adults and children turned out to demonstrate similar patterns. They looked more at the Completed Event (CE) when they heard the perfective morpheme *-le*, and less when they heard the durative morpheme *-zhe* (18a). Conversely, they looked more at the Ongoing Event (OE) when they heard the durative morpheme *-zhe*, and less when they heard the perfective morpheme *-le* (18b). The three age groups of children showed similar results to (18). Finally, Zhou et al. (2014) examined whether children responded as rapidly as adults to the information contained in the aspectual markers. According to the gaze data, there were no significant differences between the response times of the adults and the three age groups of children. Thus, every participant needed a similar amount of time to process that information.

(18) a. Proportion of looks to the CE (Adults) b. Proportion of looks to the OE (Adults)



(Zhou et al., 2014, p. 268)

The conclusions drawn from this study were the following. Firstly, the results of the experiment proved that three-year-olds were as capable as adults to use aspect to interpret events in time. On top of that, that understanding occurred immediately, both in the case of adults and children. The onset of the aspectual morpheme was the cue that triggered the eye-movements in all cases. That implied that the processing of the aspectual information occurred equally fast with adults and children. The study proved that specific cues within the verb triggered the piece-by-piece creation of a mental representation in the minds of speakers. It also showed that this methodology is effective when it comes to identifying the processing and understanding of grammatical aspect.

2.2.2 Foppolo et al. (2021)

Foppolo et al. (2021) also employed eye-tracking methodology to study the cognitive processing of perfective aspect in Italian. Researchers were interested in how quickly Italian speakers could make assumptions about completion based on grammatical aspect and specific visual representations of events. In Italian, the perfective aspect interacts with durative and non-durative eventualities in different manners. In fact, in the context of the perfective form, durative events still require extra information (e.g. a definite object) to indicate completion. Contrastively, in non-durative events the meaning of completion is inherently implied.

Taking that into account, the researchers wanted to contrast the speed of aspectual information processing in durative and non-durative verb sentences, by making them choose between completed and non-completed event depictions. Consequently, they prepared two experiments. In the first one, participants heard sentences in the perfective form with durative and non-durative verbs, and they were shown two pictures depicting the same event, one completed and the other one in the process. They had to pick the best fitting picture to the sentence they just heard. They predicted that durative events would need more time to process, as the meaning of completion is not inherent in them. The second experiment repeated the same procedure, but it addressed an issue raised from the complexity of the pictures in one of the conditions in the first experiment.

32 Italian native speakers participated in the first experiment. While listening to sentences describing events in the perfective aspect, they were presented with two pictures. The target picture was one that depicted a completed event. The competitor, on the other hand, was a picture where the event was either incomplete, or involved a different object. Participants' goal was to look at the matching picture, but they were not asked to select it.

Three distinct conditions were given: telic-critical, telic-control or late-control. In the telic-critical condition, sentences included durative verbs in the perfective form, and the pictures illustrated a completed and a partially completed event. The completed target picture showed the object described in the sentence, while the competitor showed a different object. In the telic-control condition, sentences had non-durative verbs in the perfective, and were combined with pictures depicting the same object in a complete and an incomplete state. Finally, in the late-control condition, sentences had stative verbs and were paired with pictures

that depicted different objects: the target picture with the mentioned object and the competitor with a different object.

Before the experiment started, the pictures and sentences were normed to ensure that they conveyed the meaning that they were intended to convey. The eye-tracking during the experiment concentrated on registering the speed of participants in identifying the completed picture based on duration and grammatical aspect. To observe how information is incrementally processed, the time frames considered for the analysis of the results included the whole verb phrase. With the gathered gaze data, statistical models were created to analyze the likelihood of looking at the target picture throughout the three conditions. The results confirmed that the reaction time for non-durative actions was shorter than that of durative actions, suggesting that the entailment of completion requires a longer processing time for durative actions than for momentary events in the perfective aspect.

However, Foppolo et al. (2021) noticed that the difference of speed between telic-critical and telic-control conditions to select the target picture could be affected by a greater visual complexity in the durative sentences, because the pictures represented different objects undergoing the action. On the contrary, in non-durative verb sentences the shown object was the same in the two pictures. In order to address that complexity issue, a second experiment was conducted with a different group of 35 Italian speakers, and following the same procedure as before. Nevertheless, the pictures in the telic-critical condition depicted the same object in the ongoing and completed versions of the same event. This alteration guaranteed a more equitable comparison between the two conditions.

In this second experiment, participants looked at the target picture earlier than in the first experiment in the telic-critical condition. That revealed that the understanding of the aspectual notion was quicker when the same object was depicted in the two stages of completion. The difference of reaction times in telic-critical and telic-control conditions was not significant in the second experiment, so participants needed a similar amount of time to process aspect in both. Nonetheless, this study confirmed that people use grammatical cues to interpret the meanings encoded in a sentence, which provide information about the unfolding of an event. Apart from that, it revealed that visual complexity can affect the processing time of the completion entailment, and it postpones the identification of a matching representation.

2.3 Eye-tracking Russian, English and Spanish aspectuality

Following the methodology adopted by Zhou et al. (2014) to investigate aspect processing in adult and underage Chinese speakers, Minor et al. (2020) carried out a similar study, which resulted in a series of parallel experiments. Firstly, Minor, Mitrofanova, & Ramchand (2022) examined the perception of aspectual marking in Russian past tense verbs. The eye-tracking revealed that participants' gaze patterns were sensitive to the specific points within the verb. Secondly, Minor, Mitrofanova, Guajardo, Vos, & Ramchand (2022) repeated the experiment including Spanish and English, and observed remarkable differences in the interpretation of different aspect constructions in the three languages. In the next sections, both studies are described in detail.

2.3.1 Fine-grained aspect processing in Russian

Minor, Mitrofanova, & Ramchand's (2022) research investigated how Russian speakers interpreted perfective and imperfective verb tenses. The study was based on Zhou et al.'s (2014) previous Visual World experiment on Chinese speakers. Following a similar method, eye-tracking was employed to record participants' eye-movements in a picture matching decision task. The experiment attempted to determine the specific points of the perfective and imperfective utterances where the aspectual information is conveyed to speakers. In other words, researchers intended to understand the fine-grained details about grammatical aspect processing in Russian.

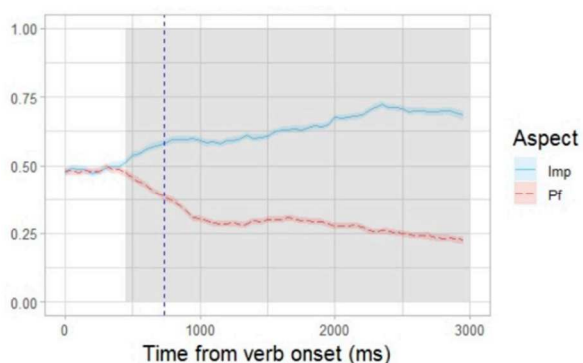
124 adult native Russian speakers participated in the experiment, and they were mostly recruited from universities. The experiment consisted of 24 test items and 24 fillers. Test items included a visual display of two side-by-side images: one exhibited an ongoing event or an event in its process of unfolding (OE), whereas the other one showed the same event but in a completed state (CE). In the recorded material, there were preamble sentences formed by stative verbs in the Simple Past which set the events in the past tense. Apart from that, there were target sentences in both the perfective and imperfective verb forms. Each participant would only hear one of the two versions per item, and the arrangement of the pictures was also balanced across participants. All sentences had the same SVO structure.

As for the test items, in half of them, the difference in aspectual marking consisted of the presence or the absence of a perfectivizing prefix. In the other half of the test items, the aspectual difference depended on the presence or the absence of an imperfectivizing suffix. Both perfective and imperfective verb forms had a comparable length, and that facilitated the distinction of the cues within the verb. As for the filler items, they were similar to the test items, but the pictures displayed different events which were either ongoing or completed. Therefore, the target picture was solely identified based on the meaning of the verb.

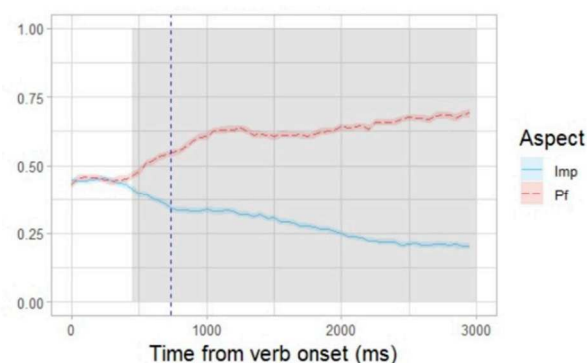
The experiment took place in a laboratory setting, where participants sat in front of a 22-inch monitor and an SMI RED500 eye-tracker which recorded their eye-movements. Audio stimuli were presented to them through speakers, and they were told to point at the picture that best matched the audio out of the two pictures on the screen in every item. In each trial, there was a preamble stage and a target stage. In the preamble, participants heard a spoken sentence that set the events on time while looking at a smiley face on the screen. During the target stage, two pictures showed ongoing and completed events side-by-side, the same event in the case of test items, and different events in the case of fillers. They also heard a spoken imperfective or perfective target sentence, according to which they picked one picture or the other. Both their offline answers and their gaze patterns were recorded.

In the picture matching offline task, participants overwhelmingly chose the target response for each of the aspect conditions. In the imperfective condition, the OE was chosen, whereas the CE was the preferred option in the perfective condition. The gaze data revealed a similar pattern. Using a statistical method of cluster based analysis, time frames were isolated in which participants looked significantly more at the target picture. When they heard the imperfective verb forms, participants had a significantly large proportion of looks to the Ongoing Event from 450 ms to 3000 ms after the verb onset (19a). On the other hand, when they heard the perfective verb forms, the Completed Event received a significantly greater proportion of looks in the same time frame (19b).

(19) a. Proportion of looks to OE



b. Proportion of looks to CE



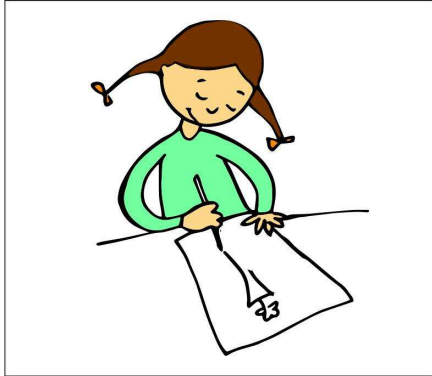
(Minor et al., 2022b, p. 9)

Apart from that, Minor et al. (2022b) calculated the earliest time where participants looked significantly more to the target picture, and that was 525 ms after the onset of the verb. Considering that a verb's average length was 731 ms, it is confirmed that participants processed the aspectual information even before the verb ended. The researchers also compared the length of time that participants needed to identify the target picture, based on the condition of whether the aspectual marking was encoded in a prefix or a suffix. It turned out that participants took longer to process aspect information when it was encoded by a suffix compared to a prefix.

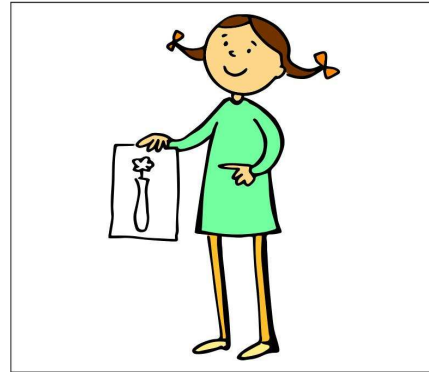
To sum up, the offline and eye-movement results proved that participants greatly preferred the target pictures in each condition: the ongoing picture for the imperfective condition, and the completed picture for the perfective. In addition to that, the processing of the aspect information occurred very rapidly, even before the offset of the verb. That suggested that Russian speakers were able to react to cues within the verb. Besides, the position of the aspect marker affected the speed of the processing: when aspect was marked by a prefix, participants could process the aspectual information faster than when it was marked by a suffix. The results confirmed that aspect features could be integrated into the minds of speakers even before the verb finished. Overall, the study showed that eye-tracking could be used in a new manner to gather information about the processing of small morphological pieces.

to each of the participants. In the imperfective sentences, the ongoing picture was coded as target, whereas the completed picture was coded as target in the perfective utterances.

(23) a. Ongoing Event (OE)



b. Completed Event (CE)

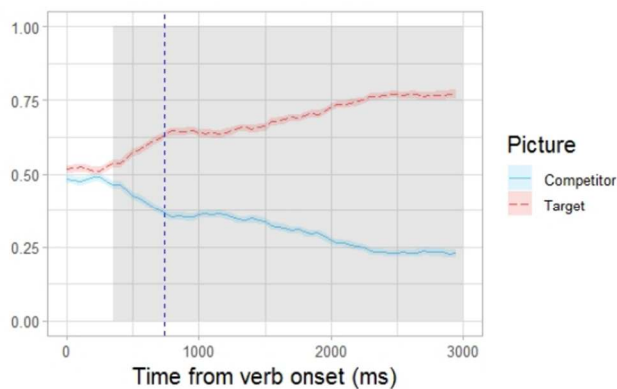


Aside from that, there were 24 filler sentences consisting of two side-by-side images that depicted two different events, but both ongoing or completed. Besides, the characters that performed the events remained the same in both pictures. In each of the 48 trials, participants had to choose the representation that better matched the spoken sentence they had heard, and their eye-movements were tracked in that process. Therefore, both the participants' answers to the items (offline results) and their eye-tracking data (online results) were collected to learn about aspect processing in each of these experiments.

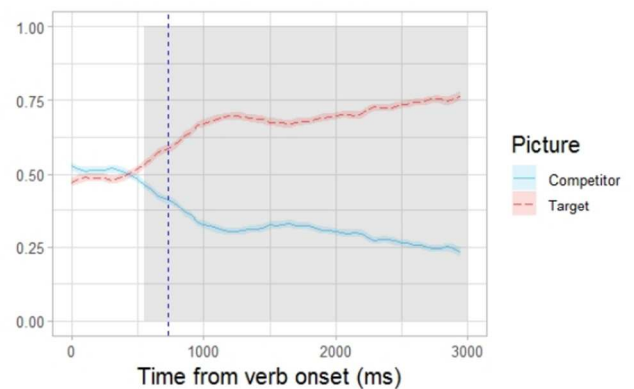
Regarding results, as previously mentioned, the Russian Imperfective Past showed a great preference for ongoing interpretations in the offline responses (98%), and offline responses for the Perfective Past definitely proved that the completed interpretation was the most widely preferred (95%). Furthermore, the difference in accuracy between the two aspectual conditions was not statistically significant ($p = 0.26$). As for online results, they certainly reflected the offline findings. The probability of looking at the Ongoing Event was significantly above chance when the imperfective sentence was heard, while hearing the perfective sentence significantly increased the likelihood of gazes directed towards the Completed Event.

(24) depicts the data collected through eye-tracking in a cluster based permutation analysis. The OE picture is coded as target in the imperfective condition, while the CE picture is coded as target in the perfective condition. In both conditions, the preference for the different pictures is clearly distinguishable almost from the beginning of the onset of the target sentence: starting from 350 ms in the imperfective condition and from 550 ms in the perfective condition. The results prove that the Russian perfective aspectual marker truly invokes an interpretation where the culmination of the event has been reached.

(24) a. Imperfective condition in Russian.



b. Perfective condition in Russian.



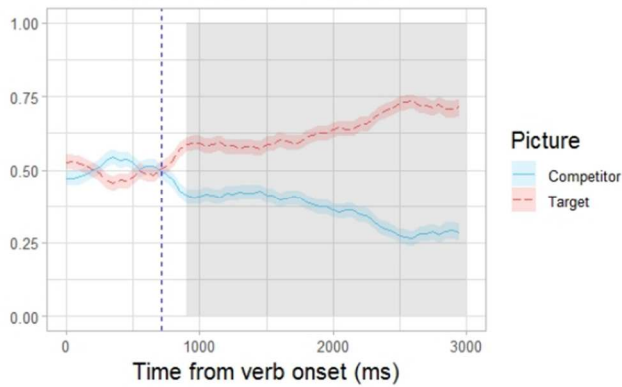
(Minor et al., 2022a, p. 739)

As for results in Spanish, offline results showed that 97% of times Spanish speakers chose the Ongoing Event after hearing an imperfective sentence. The preference for the Completed Event with the perfective sentences, however, was not so extreme as in the case of Russian. Nevertheless, they still preferred the completed picture 83% of the time. As for the gaze data, the online results were similar to the offline results. There was a significantly higher proportion of gazes directed at the Ongoing Event when participants heard the imperfective sentence. On the other hand, participants were much more likely to look at the Completed Event when they heard the Preterite sentence. Still, the chances were not as high as in the Russian experiment.

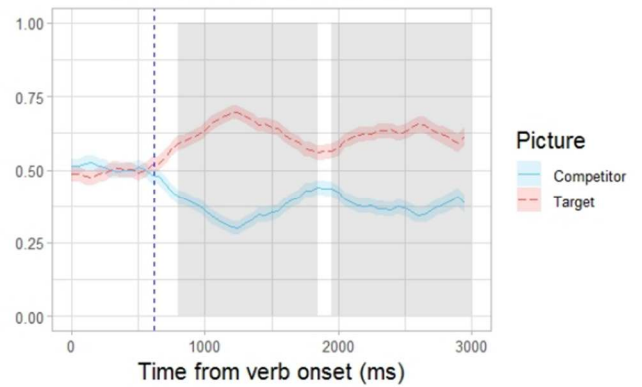
These results were reflected in a cluster-based permutation analysis (25). The OE picture was coded as target again in the imperfective condition, while the CE picture was the target in the perfective (Preterite) condition. On the one hand, when hearing the imperfective sentence, participants specially focused on the ongoing picture starting from 900 ms. On the other hand, the probability of looks at the completed picture when the perfective sentence was heard was only above chance in two different time frames: from 800 ms to 1850 ms, and from

1950 ms to 3000 ms. Those two intervals are shadowed in gray in (25b). The results prove that participants still showed a small degree of hesitation when picking the best fitting representation for the perfective statement.

(25) a. Imperfective condition in Spanish.



b. Perfective condition in Spanish.

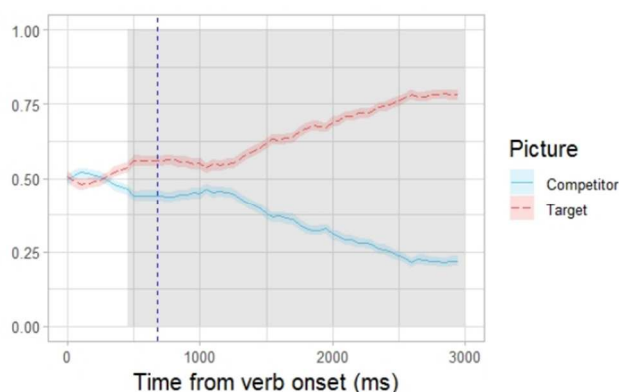


(Minor et al., 2022a, p. 741)

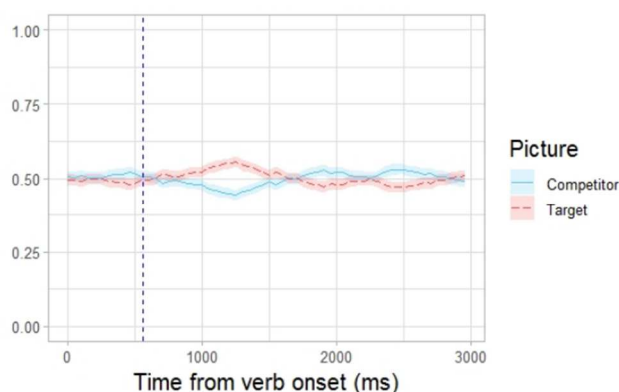
Concerning the results of the English experiment, they were the most surprising. Offline results demonstrated that 95% selected the Ongoing Event as a depiction of the progressive sentence. That aligns with the results for the imperfective tenses in the other languages. However, offline data showed that participants did not have a strong inclination towards any of the two options when hearing the Simple Past sentence. Actually, only 54% chose the completed event. As for the online data, it confirmed the unexpected results. The chances of participants looking at the Ongoing Event were significantly high when they heard the progressive utterance. On the contrary, when hearing the Simple Past sentence, participants' eye movements showed no preference, and their gazes shifted indiscriminately between the two images.

The cluster-based permutation analysis in (26) depicts the results from the gaze data. Like in previous occasions, the OE is the target in the imperfective condition with the progressive tense, while the CE is targeted in the perfective condition with the Simple Past tense. As displayed in (26a), the probability of looks in the direction of the target picture becomes prominent at 450ms, even before the verb offset marked by the dotted blue line, and stays above chance until 3000ms. Meanwhile, (26b) shows how, in the Simple Past condition, there are no time frames where the probability of looks to either of the competing pictures becomes statistically significant.

(26) a. Progressive condition in English.



b. Simple past condition in English.



(Minor et al., 2022a, p. 742)

To sum up these results, it appears that imperfective verb forms direct participants' gazes to the ongoing image, but there is some variation when it comes to constructions believed to be perfective verb forms. Russian perfective certainly highlights the result state of the event. Spanish Preterite also does, though to a smaller degree. Nonetheless, English Simple Past, which is traditionally believed to indicate perfectivity, does not necessarily evoke an image of completeness, not even when the Simple Past affects a telic event. From this, Minor et al. (2022a) draw a number of conclusions. Perfective aspect implies the condition of boundedness, which is separate from narrative sequencing ability. It can either be defined in terms of totality (Krifka, 1989) or maximality (Filip, 2017) conditions.

The specification of boundedness can be more or less effective depending on how high it is located in the morphosyntactic structure. In the case of Russian, it is located inside the vP, at the lexical level, and the entailment of culmination is very strong. In Spanish, the boundedness feature is located outside the vP as a functional element, so the entailment of culmination is not so strong. As for English, perfective aspect is not specified, as Simple Past does not really entail boundedness. Grammatical aspect is deduced from a combination of lexical aspect, pragmatics and the surrounding context of the statement.

In the past, narrative sequencing has been used as a basis to determine a completion entailment in Simple Past tense. In other words, the Simple Past's ability to advance reference time in a sequence of distinct events has been employed as justification to state that Simple Past tense is perfective. Nevertheless, according to the approach of Minor et al. (2022a), narrative progression should be separated from the definition of perfectivity, and boundedness condition should rather be emphasized to identify grammatical aspect.

2.4 Simple Past vs. Perfect in English

Finally, I discuss a more recent study by Vos, Minor & Ramchand (2023) that expanded the previous Visual World eye-tracking study by Minor et al. (2022a) by exploring two different alternatives to the English experiment. On the one hand, they replaced the Simple Past with the Perfect, in order to see if that tense would trigger a higher number of looks in the direction of the completed event. On the other hand, they replaced stative verbs in the preamble sentences by more dynamic events in the Simple Past, to create conditions of narrative progression which might lead to stronger completion entailments if the theoretical link between these two diagnostics is indeed valid.

According to Vos et al. (2023), the Present Perfect and Past Perfect tenses in English are periphrastic constructions which combine the auxiliary verb “have” in its present or past form, together with a participle. The Present Perfect tense in particular can be replaced by the Simple Past in several contexts. As stated by Reichenbach (1947), Present Perfect tense differs from Simple Past tense in that reference and utterance time are the same in the Present Perfect, while reference time precedes utterance time in the case of Simple Past. Apart from that, following the Indefinite Past Analysis described in (27), the past event entailed by the Present Perfect has relevance in the present.

(27) *The Indefinite Past Analysis:*

The (present) perfect is an assertion of a past event, with a pragmatic component/presupposition requiring present relevance (Vos et al., 2023, p. 6).

As far as the reference to the result state is concerned, the Resultant State Analysis in (28) defends the idea that Present Perfect entails a past event. Nevertheless, it hugely depends on the lexical aspect of the event described on the predicate. It is mostly in accomplishments where the result state of an event is more salient. Parsons (1990) asserts that accomplishments in the Present Perfect have two different readings: one in which the resulting state of the event is highlighted, and another one in which the present state after the event is emphasized. When the result state is highlighted, Present Perfect is believed to be better than Simple Past at asserting the existence of a result state.

(28) *The Resultant State Analysis:*

The (present) perfect is a present tense assertion of a situation that carries with it an entailment of a past event (Vos et al., 2023, p. 6).

To test the aspectual understanding of perfect tenses in English, Vos et al. (2023) adapted the English experiment in Minor et al. (2022a) by substituting the Simple Past tense for a Past Perfect tense. Hence, in a first experiment Past Progressive and Past Perfect were contrasted. Past perfect tense was chosen due to the fact that the preamble sentence set the event in the past. In addition to that, a second experiment contrasted Present Progressive and Present Perfect, and adapted the preamble sentences to the present tense.

The procedure followed at conducting the tests was exactly the same. Both the offline and online results of the participants were recorded. Firstly, participants heard a preamble sentence that set the events in the present or in the past. Then, while the target sentence was being played, a visual display of two side-by-side images was presented to the participants. One showed an event in progress, whilst the other showed the same event at its result state. Participants were asked to pick the picture that best matched the target sentence. Perfect and progressive target sentences were randomized in a manner in which all verbs were presented in different tenses to different participants. Besides from the experimental items, there were as many filler exercises that consisted in choosing the correct option out of the two different ongoing or completed events.

Regarding the results of the first experiment with the past tenses, 76 participants completed the experiment. In the offline results, the ongoing picture was selected 97% of the times when hearing the Past Progressive, and 95% chose the completed picture when hearing the Past Perfect tense. The proportion of looks to the target pictures was also highly above chance in the gaze data. The OE, which was the target in the progressive condition, had a significantly high proportion of looks from 450 ms to 2000 ms after the verb onset. As for the CE, it was coded as the target in the perfect condition, and it attracted an especially high proportion of looks from 550 ms to 2000 ms after the onset of the main verb.

The results in the second experiment with Present Progressive and Present Perfect tenses revealed a comparable tendency. Offline results demonstrated that 95% selected the OE with the progressive tense, and 87% chose the CE when hearing the Present Perfect. In accordance with those results, people were slightly less likely to perceive the event as culminating when the Present Perfect was used compared to the Past Perfect. As for the gaze data, it exhibited that participants had a moderate preference for the OE for the progressive tense from 750 ms to 1250 ms from the onset of the auxiliary verb, and a more significant preference for the same picture from 1800 ms to 2500 ms again. In the Present Perfect condition, participants noticeably preferred the target CE from 1300 ms to 2500 ms after the verb onset. Both in the first and second experiment, perfect tenses proved to be more successful than Simple Past at triggering the visualization of a completed event.

In conclusion, both Past and Present Perfect tenses conveyed the culmination meaning quite satisfactorily and nearly mirrored the results for the progressive tenses, which were preferably represented by OEs. Still, the results in the perfect condition in English were not as straightforward as the results for Russian perfective. This suggests that English does not actually possess a tense that underlines the saliency of the result state as effectively as Russian perfective. Nevertheless, there is a possibility that the failure at denoting culmination in English could be related to the lack of a completion entailment in the surrounding context of the sentence. In fact, Simple Past tense has been proved to be successful at describing a sequence of distinct completed events that form a narrative progression.

However, Vos et al. (2023) argue that narrative completion has to be disassociated from salience of result state, because it is not a reliable criterion to determine the perfectivity of a verb tense. With non-stative verbs, Simple Past does indeed advance narrative time by presenting a series of non-overlapping events. On the contrary, Past Progressive causes overlapping of events that occur at the same time. In a similar manner, stative verbs in Simple Past tense create the same effect of overlapping and do not discriminate between separate events. That implies that narrative completion and result state prominence are not necessarily equivalent in English.

Contrary to Simple Past, Present Perfect does not generate narrative progression, even if it does emphasize the result state of events. Vos et al. (2023) speculated whether the completion entailment could depend on the discourse context that the verb tense is surrounded by. In order to test this, they prepared a third experiment. In Minor et al.'s (2022a) experiment, preambles consisted of stative verbs in Simple Past tense, so they overlapped with the eventualities in the target sentences. A more dynamic narrative sequencing could avoid overlapping, so preambles were changed to adverbial clauses with verbs denoting non-stative eventualities. This third experiment tried to discover if an ideal narrative sequencing with the Simple Past would accentuate the saliency of the result state.

Therefore, the experiment maintained the contrast between Simple Past and Past Progressive tenses in target sentences, but altered the preambles, so that the sequencing of the events would be more dynamic. Three different preambles were tested here: two adverbial clauses with “before” (29a) and “after” (29b) and a non-stative eventuality, and a third preamble clause that contained a stative verb (29c). The images presented to the participants were an Ongoing Event (OE) and a Completed Event (CE) once again. There were 24 test items and 24 filler items, and both offline and gaze data was recorded.

(29) a. Before the boy went to school...

b. After the boy came home...

c. It was early in the morning...

(Vos et al., 2023, pp. 20-21)

The offline results of the experiment showed that, with progressive sentences, participants exceedingly preferred the ongoing picture for all three preamble type conditions. The equivalent results for the Simple Past sentences, on the other hand, also showed similar results for the three conditions, but none of the ongoing and completed images was particularly preferred by the participants. As for the eye-tracking information, cluster based permutation analyses for the three conditions for the Simple Past tense demonstrated that the distribution of looks to the two pictures was around chance level (50%). In fact, participants were slightly more likely to look at the competitor (ongoing) image, than to stare at the completed event. Thus, the gaze data coincided with the offline results. The study concluded that manipulating the context was not enough to emphasize result saliency with Simple Past tense.

The results proved that, indeed, narrative completion did not necessarily signify result state saliency. This was deduced from the fact that, while Present Perfect made the result state salient, Simple Past did not really, not even with verbs where the culmination point of the eventuality was denoted. Contrastively, while Simple Past advanced narrative time, Present Perfect was not successful at narrative sequencing. This poses a problem in identifying perfectivity, as it implies that grammatical aspect does not inevitably depend on verb tense morphology, at least in languages such as English, which have no aspectual morphology.

According to the Kleinian analysis of grammatical aspect (Klein, 1994), a perfective tense should draw attention to both the ongoing and the completed pictures, as both the action and the result state are denoted by it. In that sense, the Simple Past would be considered ideally perfective. Slavic perfectives, however, generally refer to the result state only, so they do not fit in the Kleinian analysis of aspect. That is because the Kleinian perspective does not require an explicit focus on culmination when it comes to perfectivity. For English, the denotation of the existence of a culmination point together with the Simple Past is not enough to entail that the telos has been reached. On the contrary, the perfect tense clearly draws more attention to the result state. The Visual World eye-tracking experiments have proved that.

3 The experiment

In this section, we will present the eye-tracking experiment which was carried out with Basque speakers for the present study. In the first section, various aspects of the experiment will be thoroughly detailed. That will include the participants, the employed materials, the procedure, the main predictions and the data analysis methods. In the second section, the results of the experiment will be exhaustively described and interpreted. That will include the results of the offline judgment task and the online gaze data collected through eye-tracking.

3.1 Materials and methods

Several factors regarding the experiment will be presented here. Firstly, we will describe the participants who completed the experiment. Secondly, the materials employed for the experiment will be presented in detail. Then, we will outline the whole procedure of how the experiment was conducted, to later discuss the predictions for the results. Finally, the result data analysis methods will be described at the end of this section.

3.1.1 Participants

A sample of 30 participants completed the experiment on their personal computers. Specifically, adult native Basque speakers were targeted. These Basque speakers could have another mother tongue apart from Basque, most probably Spanish or French, due to the geographical situation of most Basque speakers, on both sides of the border between Spain and France, at the northern end of the Pyrenees.

Thanks to a questionnaire that they had to complete at the beginning of the experiment, the following statistical data about the participants was collected. Concerning age, more than a half of the participants (16 of the 30) were in the 18-30 age group. Apart from that, one third of the participants (10 out of 30) were in the 44-56 age group, while the rest of them (4) were 57-69 years old. Therefore, two separate age ranges can be distinguished among participants: one group was born and raised during and in the aftermath of Francisco Franco's dictatorship and its restriction of education in minority languages; the other one was born in democracy, having free access to education in Basque.

This is reflected in the information collected about their educational background. Specifically, they were asked about the language in which they completed their basic studies. First, it is relevant to define the three main current linguistic models of education in the Basque Autonomous Community (BAC), which refer to the language of instruction in each institution. In Model A, Spanish is the language of instruction and Basque is taught as a second language. In Model B, both Basque and Spanish are used as languages of instruction. In Model D, which has become the most popular in recent years, Basque is the main language of instruction and Spanish is taught as a subject (Zalbide and Cenoz, 2008). All 16 participants in the age group 18-30 participating in the experiment received their education in Model D. As for the rest of the participants, less than a half (6 out of 14) were educated in an equivalent to Model D. That implies that their access to Basque language through education was more limited.

As for the first language of the participants, 8 out of the 30 declared having another language in addition to Basque as their first language, most probably Spanish. The rest of the participants considered Basque to be their only mother tongue. Finally, regarding vision ability, 26 out of 30 affirmed either having good vision or corrected vision with glasses or contact lenses. Overall, participants could successfully complete the experiment.

3.1.2 Materials

Concerning the materials for the experiment, there was visual and audio content. First of all, the visual displays consisted of pairs of pictures which were shown to participants. The pictures were the same as the ones utilized in Minor et al.'s (2022a) experiments on aspect processing in Russian, Spanish and English. In experimental items, the competing pictures depicted two stages of the same event, one representing the process stage of the event (OE), and the other illustrating the result stage of the event (CE).

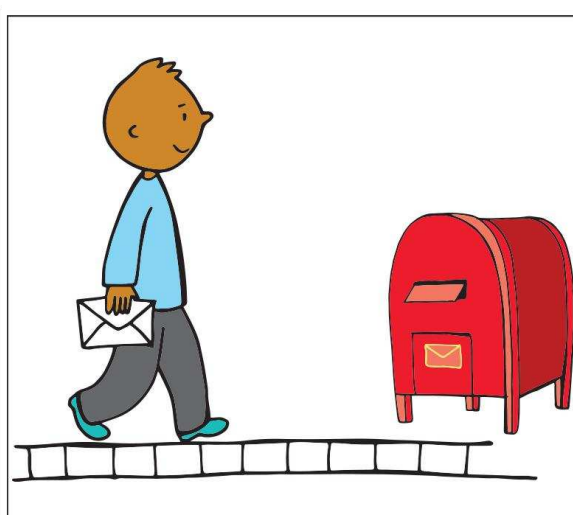
For example, as you can observe in (30), for the event of writing, there was an image of a person in the process of writing a letter (30a), and another one depicting the result of writing a letter, showing the actor of the event taking the fully-redacted letter to the letterbox (30b). There were 24 pairs of pictures of this kind, and their distribution as well as their order of appearance was randomized in order to avoid any bias. In filler items, in lieu of showing two different phases of the same event, two different events were depicted, both in the ongoing or the completed stage of the event. There were another 24 pairs of images for the filler items.

(30) Example of visual display of experimental item with the predicate *gutuna idatzi* ('write a letter').

a. Ongoing Event (OE)



b. Completed Event (CE)



As far as the audio materials are concerned, they were a series of sentences of three distinct types: preambles, target or experimental sentences and filler sentences. Starting with the preambles, they were introductory sentences which were played before target and filler sentences, to set the events at a specific point in the past. In order not to affect the interpretation of the following sentences, stative verbs were used in these preamble sentences. Simply, they

presented a situation in the past tense, which involved one of the next four individuals: *neskatoa* ('the girl'), *mutikoa* ('the boy'), *amona* ('grandma') and *aitona* ('grandpa'). In (31) we present examples of preamble sentences.

- (31) a. *Eskola orduan, neskatoa ikasgelan zegoen.*
 'At school time, the girl was in the classroom'.
 b. *Egun euritsu batean, amona etxean zegoen.*
 'On a rainy day, grandma was at home'.
 c. *Mutikoak atsegin zuen etxeko lanak egitea.*
 'The boy liked to do chores'.

As for target sentences, they were either in Perfective Past tense or Past Progressive tense with *ari*. On the one hand, as was described in an earlier section, the Perfective Past tense in Basque is always a compound tense, which includes a participle and an auxiliary verb. The target sentences in Perfective Past were formed by the lexical verb with the perfective verb ending (*-tu/-du, -i, -n*), and the past auxiliary verb *zuen*, which is derived from the verb *edun* ('to have'), used in transitive sentences. The choice of auxiliary verb as well as the agreement markers attached to it suggest that there are two arguments, one ergative and one absolutive. The auxiliary verb also possesses a past tense marker *-(e)n* at the very end, as it can be observed in the example at (32). The target sentences always included a quantized direct object with an absolutive case marker, which ensured the status of accomplishments to the sentences; in the case of (32), the object that undergoes the verb's action is 'the pencil'. As for the subject, it is omitted by pro-drop and expressed through agreement markers, due to reasons we will discuss later.

- | | | |
|---------------------------------|-------------|------------------|
| (32) Arkatz-a | zorroz-tu | z-u-en |
| pencil-the.ABS | sharpen-PFV | 3SG-have-3SG-PST |
| '(He/she) sharpened the pencil' | | |

On the other hand, the imperfective construction chosen to contrast with the Perfective Past tense was one that contained the progressive particle *ari*. Target sentences in the Past Progressive tense with *ari* consisted of a lexical verb with an imperfective verb ending (*-t(z)en*), particle *ari* and the past auxiliary verb *zen*, derived from the verb *izan* ('to be'). The fact that the *izan* auxiliary is used in this construction might seem initially surprising in that *izan* is generally employed in intransitive constructions. The reason for that is explained in the first

chapter: the presence of *ari* implies that there is an embedded clause headed by the lexical verb, which is the complement of *ari*, the verb of a main clause. According to Laka (2004), in constructions with *ari*, there are two separate verbs and two different arguments which receive an absolutive case from each of the verb roots, as it happens with intransitive phrases in Basque. This can be appreciated in the imperfective target sentence in (33). The subject of the main clause in (33) is once again omitted, but the agreement markers in the auxiliary verb only signal one absolutive argument.

The reason why a Past Progressive construction with *ari* was selected over an Imperfective Compound Past tense was the ambiguity that the latter form generates without further clarification. As discussed in the first chapter, non-synthetic verbs in an imperfective compound form can be interpreted as both habitual and non-habitual. Therefore, we considered a construction that expressly communicates progressiveness to be more adequate to contrast with the completeness notions that we wanted to convey with the perfective tense.

- (33) Arkatz-a zorroz-ten ari z-e-n
pencil-the.ABS sharpen-IMPFV PROG 3SG-izan-PST
‘(He/she) was sharpening the pencil’

Now, it is convenient to refer back to the intransitivity of the main clause in the Imperfective sentences because of the presence of *ari*, as well as to the absence of the subject in target and filler sentences. There were some adjustments made when adapting the experiment to Basque. Mainly, it is evident that the presence of *ari* causes the change of case markers attached to arguments in the sentence. In a transitive sentence such as (32), the subject carries an ergative marker *-k*, whereas in an intransitive sentence such as one with *ari* (33), the subject is in the absolutive case and thus carries no case marking (*-∅*). For instance, we could imagine that the agent of the event was *mutikoa* (‘the boy’) in (32) and (33). If it was the subject of a transitive sentence, ‘the boy’ would possess an ergative marker (*Mutikoa-k arkatza zorroztu zuen*; ‘The boy sharpened the pencil’), but if it was the subject of a phrase headed by *ari*, the NP would possess no marker (*Mutikoa arkatza zorrozten ari zen*; ‘The boy was sharpening the pencil’).

The change in the case marking could pose a problem in the experiment because it could serve as a hint for participants to predict the grammatical aspect of the target sentence, which should be introduced later in the sentence through a specific tense. It is possible that participants could end up associating the ergative case marking with perfectivity, and the lack of it with imperfectivity. In order to avoid this issue, the subject was omitted from the target and filler sentences and mentioned previously in each of the preambles. This is a possibility in Basque, due to the fact that, as stated by Ortiz de Urbina (1989), Basque is a pro-drop language that allows the omission of arguments. All the arguments of the verb are replicated in the agreement markers attached to the auxiliary verb, so their mention is not mandatory. However, we still referred to the subjects in the preamble, so that it is clear who the agent of the action that is being carried out is.

On a different note, there is another complication related to Basque's SOV word order, which is unrelated to the language's case marking system. Firstly, due to the fact that the verb as well as the aspectual marking are located at the very end of the phrase in Basque, we were concerned that the participants might not have enough time to process the verb tense before deciding for the picture that best fits to the sentence they just heard. Because of this, we had to add a common formula (*irudian ikus dezakezuenez*; 'as you can see in the picture') at the end of all target and filler sentences. This phrase does not affect the original meaning of the sentence and provides some time for the participants to process the tense form they just heard, while we are tracking their eye-movements.

Below I display the full list of verbs that were used in target sentences (34). It is important to know that these are all transitive two-argument verbs, as well as being non-synthetic. In other words, they can only be inflected in compound tenses, and never in simple tenses. Concerning the lexical aspect of the predicates in the sentences formed with these verbs, they can either be considered accomplishments or achievements. The difference lies in that accomplishments have a duration in time, while achievements are more punctual events. In any case, all verbs represent dynamic events or actions, and the presence of a quantized object that is gradually or instantly affected by the verb's action in the predicates suggests that there is a telos to be reached.

(34) List of target sentence verbs.

BASQUE	ENGLISH	BASQUE	ENGLISH
EDAN	‘drink’	JOSI	‘sew’
ERAIKI	‘construct’	KONPONDU	‘fix’
ERAITSI	‘demolish’	LANDATU	‘plant’
EROSI	‘buy’	LURPERATU	‘bury’
ESKEGI	‘hang’	MARGOTU	‘paint’
GARBITU	‘clean’	MARRAZTU	‘draw’
HAUTSI	‘break’	MOZTU	‘cut’
IDATZI	‘write’	PUZTU	‘blow up’
IRAKURRI	‘read’	UREZTATU	‘water’
IREKI	‘open’	ZATITU	‘slice’
JAN	‘eat’	ZORROZTU	‘sharpen’
JETZI	‘milk’	ZURITU	‘peel’

Finally, the third type of sentences were filler sentences, which contain periphrastic constructions that explicitly imply that the action is finished or is occurring at a specific point in time. Periphrastic expressions that suggest culmination of events include: *-t(z)en amaitu* (‘finish -ing’), *-tu/-du, -i, -n berri* (‘just’) (35a), *-t(z)ea lortu* (‘be successful at’) (35b). On the contrary, expressions that suggest that the action has not finished include: *-t(z)en ahalegindu* (‘try to’), *-t(z)ea erabaki* (‘decide to’) (35c), *-t(z)eari ekin* (‘start -ing’). Aside from these constructions, the fillers were similar to the target sentences: they had an omitted subject, a quantized object and a fitting auxiliary verb. Furthermore, they were all in the past tense. Some examples of filler sentences are provided below (35). In filler items, participants had to choose between two different ongoing or finished actions, which depicted two distinct events instead of two distinct stages of the same event.

(35) a. *-tu/-du, -i, -n berri:*

Su-a piz-tu berri z-u-en
Fire-the.ABS turnon-PFV just 3SG-have-3SG-PST
'(He/she) just turned on the fire'

b. *-t(z)ea lortu:*

Gaztelu-a osatze-a lor-tu z-u-en
Castle-the.ABS construction-the.ABS get-PFV 3SG-have-3SG-PST
'(He/she) got to construct the castle'

c. *-t(z)ea erabaki:*

Telebista itzaltze-a erabaki z-u-en
TV-the.ABS turningoff-the.ABS decide-PFV 3SG-have-3SG-PST
'(He/she) decided to turn off the TV'

3.1.3 Procedure

The experiment was sent through email and accessed through a link. Participants completed the experiment at their own homes, with a Personal Computer equipped with a webcam, from which their eye movements were tracked through WebGazer. According to Vos et al. (2022), WebGazer is a popular open-source web-based eye-tracking library. It has advantages and disadvantages when we compare it to more traditional eye-tracking methods. Infrared eye trackers, for example, are common in research labs, but they are costly and not easy to carry. In comparison, WebGazer is free and publicly available, easily accessible and privacy-friendly. That said, it does have a lower accuracy rate than an infrared eye tracker. Nevertheless, Webgazer is compatible with online data collection platforms such as JATOS or Gorilla, making it a convenient tool for online studies like this.

First of all, participants were informed about the general purpose of the experiment and asked for their consent to retrieve data from their answers. Before the experiment, they filled in a questionnaire about some background information regarding their age-group, vision ability, mother tongue and language of education. After that, ensuring that the audio and webcam were working properly, they received instructions about the task that they had to complete. After a first round of calibration of the eye-tracking, they started with the experiment. There were three more calibration sessions during the experiment to make sure that the eye-tracking system was working properly.

In each experiment, there were 24 target and 24 filler items, presented in a randomized order. First, participants had to click on a dot in the middle of the computer screen, and they would listen to a preamble sentence which set the narrative in the past. After that, a visual display of two pictures would appear on the screen. While looking at these pictures, participants heard either a target or a filler sentence. Meanwhile, the eye-tracking system would record their eye-movements. After each trial, the participants' task was to click on the picture that best represented the sentence they just listened to. After a few seconds of processing the sentence they just heard, participants clicked on one of the two pictures. Both the data from the judgment task as well as the gaze data from the eye-tracking were collected in this manner.

In experimental items, participants had to choose between two different depictions of the same event. One of the pictures showed an individual carrying out an event (OE), while the other picture depicted the same individual with the event completed (CE). Participants had to process the aspectual information coded in the imperfective and perfective tenses in the sentences and associate it to one of the two representations of the action. As for filler items, they involved an easier task: participants had to choose between two pictures that depicted different events, but in a similar stage in their process. They were either two ongoing actions or two completed actions. Similarly as with experimental items, participants were tasked to pick the picture that best represented the audio stimuli they were exposed to.

3.1.4 Expectations

With this eye-tracking experiment, we seek to gather information about the processing of grammatical aspect in Basque. Specifically, we are contrasting perfective and imperfective constructions in the past. The verb tenses that have been selected to represent contrasting aspectual meanings are the Perfective Past and the Past Progressive. The objective of this experiment is to visualize to what extent Perfective Past and Past Progressive tenses in Basque trigger a representation of culmination or ongoingness of events in native speakers' minds. By observing how Basque speakers process the grammatical aspect of accomplishment-based sentences in those two tenses, we can get to understand the ability of these verb forms to entail meanings associated with perfectivity and imperfectivity. In this case, we are mainly interested in Perfective Past tense's ability to evoke result state meanings, in combination with accomplishment predicates. Therefore, the main research question for this experiment is the following:

(36) RQ: To what extent does Basque Perfective Past tense give rise to the salience of the result state in telic event types?

The possible results for the experiment are various, taking into account the diverse results gathered in previous studies (Minor et al., 2022a). Firstly, there is a possibility that, in a similar manner as it occurs with English Simple Past, the Basque Perfective Past sentences are not directly interpreted as culminated events, but their interpretation is rather underspecified, giving results indistinguishable from chance. Then, the tense would not actually entail result state saliency, and its interpretation would be very dependent on contextual factors and the speakers' world knowledge. Secondly, it is possible that Basque Perfective Past is more similar to Spanish *Pretérito Indefinido*. If that was the case, the probability of Perfective Past accomplishment sentences implying the culmination of events would be higher than 85%, but their interpretation would still not be so straightforward in some instances. A third possibility is the case of Russian, in which the perfective form was proven to nearly always highlight the result state, precisely 97% of the time. If Basque Perfective Past acted similarly, it would most successfully meet Dahl's (1985) "prototypical PFV" requirements for perfectivity related to the entailment of culmination. Finally, Basque might not pattern with any of these three languages, but instead exhibit a distinct pattern.

The hypothesis that we will propose here is that accomplishments in the Perfective Past trigger culminated interpretations in the majority of cases, in an analogous manner to Spanish *Pretérito Indefinido*. Nevertheless, I do not expect Basque perfective forms to trigger those interpretations in such an unequivocal manner as Russian perfective forms do. On the other hand, it is also true that Perfective Past is the only perfective tense construction in the past that Basque possesses, whereas languages such as Spanish or English also have a Perfect form, which undeniably entails culmination, as it was proven in Vos et al.'s (2023) experiments contrasting Continuous and Perfect forms in English. In principle, we assume that Basque does not possess a tense form that suggests the realization of a result state to the same extent as the Perfect does in Spanish or English, but the Perfective Past tense should at least suggest that kind of meaning to a large extent.

As for the Past Progressive tense, we predict that it will be interpreted as the other imperfective pasts in Spanish, English and Russian languages, that is, it will highlight the ongoing stage of the event. Thus, we expect participants to choose the ongoing picture when hearing the Past Progressive. In conclusion, the CE will be codified as the Target in the perfective condition, while the OE will be codified as the Target in the imperfective condition.

3.1.5 Statistical analysis

This section describes how the analysis of the offline and online results was completed. The offline data refers to the results gathered from the judgment task, in which participants had to choose one of two pictures while hearing imperfective and perfective sentences. On the other hand, online data refers to the eye-tracking information gathered by the WebGazer application in the form of timestamps and coordinates. In other words, the gaze data includes information regarding which picture on the screen each participant was looking at while hearing the verbal input in each condition. Hence, the independent variable was the grammatical aspect of each of the verb tenses: the imperfective aspect in the case of Past Progressive sentences, and the perfective aspect in the case of Perfective Past sentences. As for the dependent variable, it was the accuracy of the participants to look at the Target picture which was different depending on aspectual condition: the OE in the imperfective condition, and the CE in the perfective condition. Statistical analyses of offline and online results were performed using RStudio/2023.12.1.

Firstly, the analysis of the offline data was performed with the raw results, by calculating the mean accuracy and the Standard Deviation (SD) values of the responses given by the participants in each condition. The mean accuracy of both conditions was represented in a bar plot, by creating a visualization using the ggplot2 package. Then, a logistic regression model was fitted in order to assess the accuracy in the different conditions, by including aspect as an independent variable and accuracy as a dependent variable. The significance of the difference of accuracy between conditions was also considered. Odd ratios were reported to display the importance of the Target preference in each condition.

In order to account for participant and item variability, a mixed-effects logistic regression model was fitted with lme4 package, integrating the participant and item factors, which might affect accuracy. These were considered along with the fixed effect of the aspect condition. The model formula is provided in (37). The analysis included odd ratios reporting the significance of Target preference in each aspect considering mixed effects, as well as the difference of the accuracy scores in the imperfective and the perfective conditions. In addition to that, histograms were employed to picture the distribution of accuracy scores across participants and items in both conditions, to see if these factors really had an effect on the raw offline results of the experiment. Histograms were arranged with package gridExtra.

(37) Formula for the mixed-effects logistic regression model (offline data):

```
glmer(Accuracy ~ 1+Aspect + (1+Aspect|Participant) + (1+Aspect|Item), data =  
data_exp, family = 'binomial')
```

Secondly, as far as the analysis of the online data is concerned, the results were represented in plots presenting the proportions of looks to the Target picture and the Competitor picture, first in the imperfective condition, and then in the perfective. The representations included eye-tracking data from the verb onset until 3000 ms afterwards, and only looks to the pictures were considered for the analysis. Besides, vertical lines were used to mark the average time points that delimited the different parts of the periphrastic verb constructions in the sentences: the participles, the particle *ari* and the auxiliary verb.

In each of the conditions, the plots were carefully visually examined in order to understand the participants' reactions to the aspectual information coded within the verb tense. Specifically, the visual inspection considered details such as points in which the proportions of looks towards the Target pictures started to increase or the consistency of the increase of participants' preference for a specific picture. Parting from those characteristics, inferences about the processing and the location of the aspectual information were made.

Finally, a statistical analysis based on a mixed-effects logistic regression model was carried out. For that purpose, a Region Of Interest (ROI) was chosen — from the offset of the participle containing the aspectual suffix to 1500 ms later — and divided into 300 ms time bins. The binarized data from those time bins was analyzed in the two aspectual conditions. The model included both aspect and the order of the 300 ms time bins in the ROI as fixed effects, so as to observe if there was any interaction between the two predictor variables. The model formula for the described analysis of the online data is provided in (38). Subsequently, the emmeans package was used for conducting post-hoc comparisons after fitting the mixed-effects model (39). In this manner, it was possible to know if the preference for the Target picture was significant in each of the aspectual conditions.

(38) Formula for the mixed-effects logistic regression model (online data):

```
glmer(TargetBinary ~ Aspect*TimeBin + (1+Aspect| Participant) + (1+Aspect | Item),  
data = data3, family = "binomial")
```

(39) Formula for post-hoc comparisons with emmeans:

```
test(emmeans(m4, ~ 1|Aspect))
```

3.2 Results

In this section, we will present the results of the experiment. Firstly, the offline results of the judgment task will be analyzed, both the raw data as well as the data accounting for mixed effects. Secondly, the gaze data collected through online eye-tracking with WebGazer will be analyzed by visualizing the proportion of looks to the Target in each condition.

3.2.1 Offline results

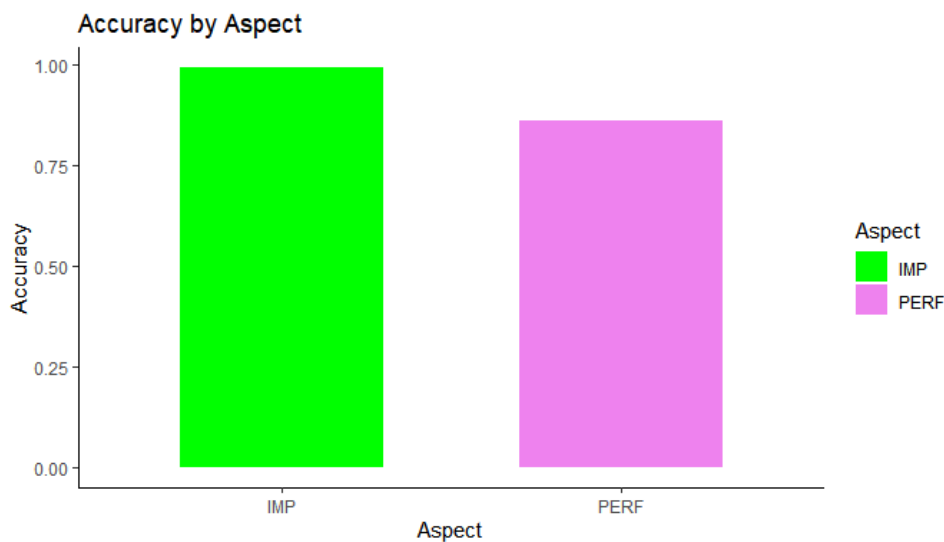
Starting with the offline data, the Ongoing Event (OE) was coded as the Target in the imperfective condition, while the Completed Event (CE) was the Target in the perfective condition. The table in (40) shows the raw offline results for the ongoing and completed pictures in each of the conditions. This data corresponds to the participants' judgment task, in which they had to click on the best-fitting picture to the sentences they heard. There was a sum of 360 observations in each aspectual condition.

In the imperfective condition, there was an almost unanimous preference for the Target picture, as 99% of observations chose the Ongoing Event. In the perfect condition, on the other hand, there was a preference of 86% for the Completed Event, which was the Target response. The values in (40) are the means of all responses given in each of the aspectual conditions, so they are represented by numbers from 0 to 1, showing the distribution of the answers. Averages show that the likelihood of the imperfective responses to be accurate is of 0.99, while the probability of perfective items to be answered accurately is of 0.86. Therefore, the preference for the Target picture was lower in the perfective condition than in the imperfective. Concerning the Standard Deviation (SD) in each condition, it was higher in the perfective condition. The bar plot in (41) shows the difference of accuracy between the two aspects.

(40) Means and SDs of accuracy of offline results.

	OE	CE	SD
Imperfective	0.9944	0.0055	0.0744
Perfective	0.1388	0.8611	0.3463

(41) Accuracy by aspectual condition in judgment task.



The significance of the accuracy in both conditions was confirmed by a mixed effects logistic regression model. This model did not only examine the main effect of aspect on accuracy, but also accounted for variables other than aspect. In fact, participant and item variables were integrated into the model. When converting log-odd estimates into probability values, the data revealed that the probability of accuracy was 0.998 in the imperfective and 0.963 in the perfective condition.

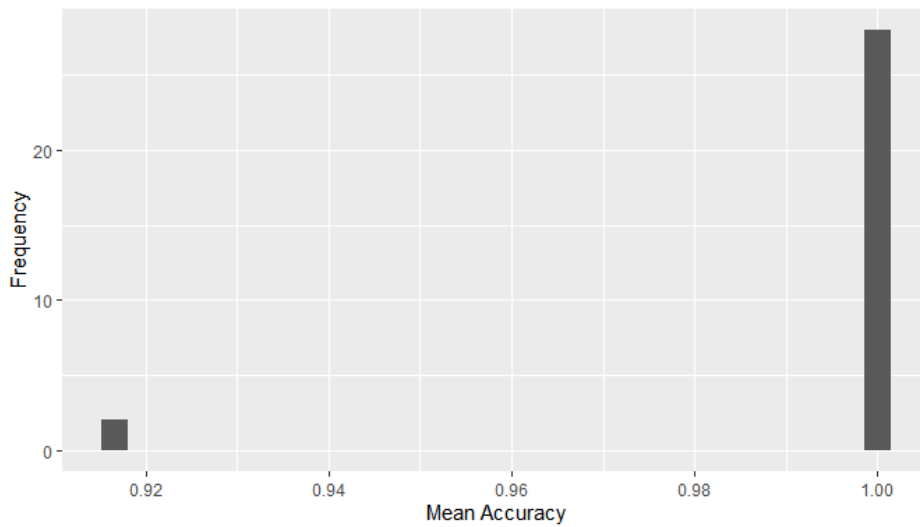
The offline mixed-effects logistic regression model results regarding the fixed effects are provided in (42). According to them, the preference for the OE in the imperfective condition ($B = 6.377$, $SE = 1.200$) and the preference for the CE in the perfective condition ($B = 3.2733$, $SE = 0.6351$) were both significantly above chance, as the p -values in both the imperfective ($p < 0.001$) and the perfective ($p < 0.001$) conditions were significantly low. Apart from that, even if the probability of accuracy was high in this model, there was still a significant difference of accuracy ($B = -3.104$, $SE = 1.184$, $Z = -2.622$, $p = 0.009$) related to the condition of aspect in the judgment task, based on the data presented in (42).

(42) Offline model results:

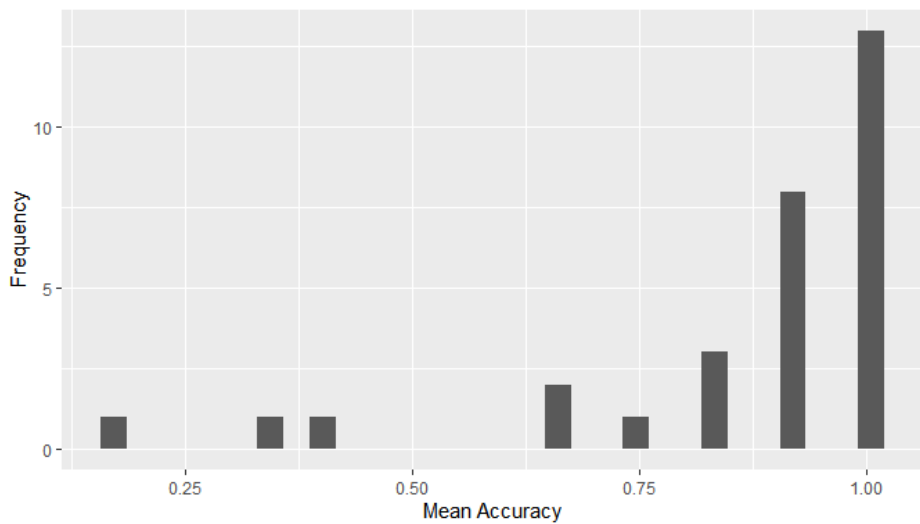
Fixed effects:				
	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	6.377	1.200	5.313	1.08e-07 ***
AspectPERF	-3.104	1.184	-2.622	0.00873 **

In order to explain the difference of accuracy values for the perfective condition in the experiment and in the mixed effects logistic regression model, it is interesting to know the distribution of accuracy rates across participants and items. On the one hand, the histograms in (43) and (44) visualize how the mean accuracy of the participants was distributed in imperfective and perfective conditions. When hearing the imperfect sentences (43), there were only two participants who did not choose the Target picture in all items, but each of them only selected the competitor picture in a couple of items.

(43) Distribution of accuracy scores among participants in the imperfective condition.

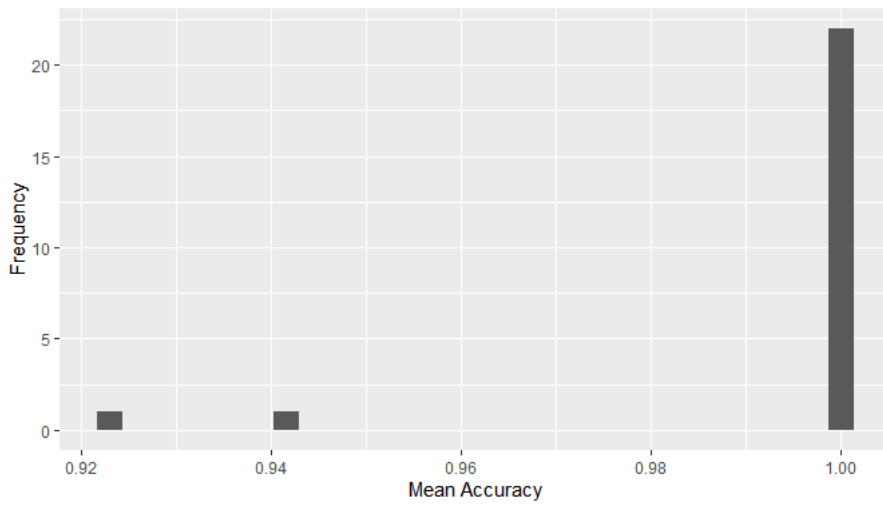


(44) Distribution of accuracy scores among participants in the perfective condition.

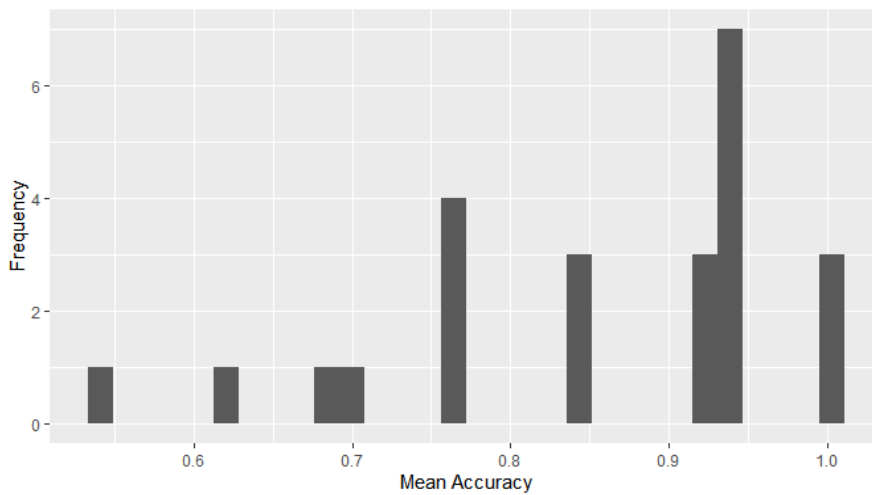


On the contrary, the distribution of accuracy scores among participants was more scattered in the perfective condition (44). Nevertheless, the majority of participants had an accuracy score higher than 0.65. There were only three particular participants who responded differently in the perfective condition. That could explain the average accuracy score obtained in the perfective condition in the experiment (0.861), which differs a bit from the probability of accuracy acquired for the perfective condition in the mixed effects logistic regression model (0.963).

(45) Distribution of accuracy scores among items in the imperfective condition.



(46) Distribution of accuracy scores among items in the perfective condition.



On the other hand, the histograms in (45) and (46) depict how the mean accuracy of the items was distributed in each of the conditions. In the imperfective condition (45), the item variable does not have an effect on the accuracy scores, as all items have a perfect or almost perfect accuracy score. As for the perfective condition (46), although the accuracy scores for the different items were not as perfect and there was some variation among them, most items achieved high accuracy, higher than 0.7. In conclusion, the participant variable appears to have a bigger impact in the distinctive mean accuracy results of the experiment.

In conclusion, offline results showed that participants exhibited a significant preference for Target pictures in both conditions, but there was also a significant difference in accuracy between the two. In the imperfective condition, participants overwhelmingly chose the OE in 99.44% of observations, with a low SD (0.0744), showing little difference in accuracy across imperfective results. In the perfective condition, participants also showed a significant preference for the Target picture, the CE. Nonetheless, the perfective condition had a higher SD (0.3463), suggesting more variability in accuracy scores. However, accuracy was significantly higher than chance in both conditions ($p < 0.001$).

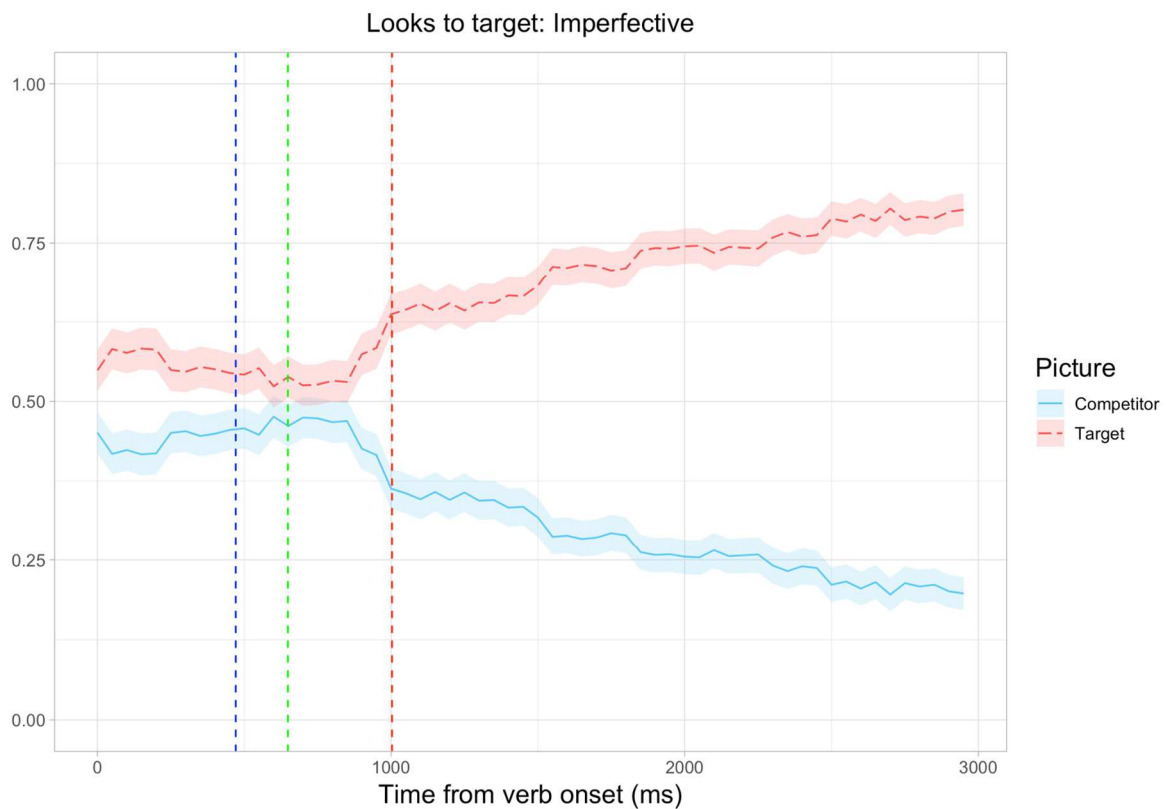
Apart from that, the mean accuracy score for the perfective condition was somehow affected by mainly participant variability, as the low accuracy of a few participants brought down the overall average. However, it is important to note that the age of the participants or their educational background did not particularly correlate with the participant variability. Besides, there was also some performance variability related to items in the perfective condition, but the mean accuracy score for all items was still mostly higher than 0.7. After accounting for participant and item effects in the logistic model, the difference of accuracy between the aspectual conditions was regardless significant ($p = 0.009$).

3.2.2 Online results

The online gaze data retrieved through WebGazer was represented in plots (47) and (48), which show the proportion of looks over time to the Target and Competitor pictures in each of the aspectual conditions. Only looks to the pictures were considered here, and all looks outside of the pictures were removed. The displayed data begins from the onset of the verb, and covers the following 3000 ms after that. Apart from visually inspecting the display of the gaze data, the significance of the Target preference will be considered. We will start analyzing the data corresponding to the imperfective condition, to later move on to the results for the perfective condition.

The plot in (47) exhibits the proportions of looks to the Target and Competitor pictures when participants heard the sentences in the Past Progressive tense. This verb tense, as previously described, consists of a participle containing the lexical verb and the imperfective suffix *-t(z)en*, the particle *ari* and an auxiliary verb in the past derived from *izan* (‘to be’). The three vertical lines in (47) represent the mean time points in which the different components of the verb tense begin and end. The 0 ms time point indicates the onset of the verb, and specifically the onset of the participle. Then, the vertical blue line represents the offset of the participle or the onset of *ari*. Next, the vertical green line represents the offset of *ari* or the onset of the auxiliary, whereas the red line indicates the offset of the auxiliary verb.

(47) Proportion of looks to the Target in the imperfective condition



If we examine the line that illustrates the proportions of looks to the Target picture in (47), we will see that it is slightly above chance from the beginning. That is because the Ongoing Event generally attracts more attention, because the representation of an ongoing action is more attractive to the human eye than a depiction of a completed action. This baseline preference was observed to be consistent in prior iterations of this experimental paradigm employing the same visual display (Minor et al., 2022a; Minor et al., 2022b). Following the course of the Target line, there is a noticeable shift of the direction of the line at a certain point

in between the onset and the offset of the auxiliary verb. That could be the moment in which the aspectual information begins to have an effect on the eye movements of the participants. Taking into account that the human brain needs a timespan of around 200 ms to react to any input, it makes sense to suggest that the sudden change of direction may be triggered by the linguistic cue introduced by the particle *ari*, or the *-t(z)en* suffix preceding it.

From that moment on, participants show an increasing determination for their choice, as the proportions of looks to the Target have an upward tendency until the end of the 3000 ms after the onset of the verb. At the same time, the proportions of looks to the Competitor picture notably decrease, mirroring the looks to the Target picture. A statistical analysis on the preference of the Target picture depending on the interaction of aspect and 300 ms time bins was conducted in a mixed-effects logistic regression model. The results of this model are provided in (49). The predicted marginal means calculated with emmeans proved the Target preference in the imperfective condition to be significant ($p < 0.001$).

(48) Proportion of looks to the Target in the perfective condition



As for the plot in (48), it showcases the proportions of looks to the Target and Competitor pictures when participants heard the sentences in the Perfective Past tense. As earlier described, the Perfective Past tense in Basque is formed by a participle containing the lexical verb and the perfective suffix *-tu/-du*, *-i*, or *-n*, and an auxiliary verb derived from the verb *edun* ('to have'). The graph in (48) also possess vertical lines marking the means of the onset and offset times of the components of the verb. The verb onset or the onset of the participle is at 0 ms. Then, the green vertical line marks the offset of the participle or the onset of the auxiliary verb, and after that, the red line indicates the offset of the auxiliary. As can be noticed by observing the offset time of the auxiliary, the verbs in the perfective condition are shorter on average than the verbs in the imperfective condition, which, in addition, include the particle *ari*.

Looking at the lines which represent the proportions of looks to the Target and Competitor pictures in the perfective condition in (48), here we can also notice a predetermined preference for the OE, which is the Competitor picture in this case. Before the participants have received any aspectual input, it is noticeable that participants preferably look at the ongoing action rather than the completed action. However, before the offset of the auxiliary verb, participants gradually start looking at the Target picture, until they show a bigger preference for the CE than for the OE. Then, around 1300 ms after the verb onset, the proportions of looks to the Target fluctuate around a proportion of 0.6 and 0.7, and they do not show an evident increase. The effect of the aspectual information does not seem as strong as in the imperfective condition, and appears more gradual in the perfective condition. Nevertheless, there is an unmistakable change of direction of participants' preference at a certain point after the offset of the participle, which causes an increase of the proportions of looks to the Target picture, namely the CE.

Above all, the mixed effects logistic regression model showed a steady increase of the proportions of looks at the Target picture in both conditions, as can be observed in the online model results in (49). However, the model revealed that there was no significant interaction between aspect and the 300 ms time bins in the ROI, showing that Target preference increased through time in a similar manner in both conditions. In any case, the predicted marginal means estimated using emmeans proved that the preference for the Target picture in the perfective condition was significant ($p < 0.001$).

(49) Online model results:

Fixed effects:				
	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	0.29421	0.15626	1.883	0.059726 .
AspectPERF	-0.28216	0.22009	-1.282	0.199837
TimeBin2	0.42136	0.17371	2.426	0.015284 *
TimeBin3	0.54790	0.17825	3.074	0.002114 **
TimeBin4	0.63003	0.17874	3.525	0.000424 ***
TimeBin5	0.69967	0.18080	3.870	0.000109 ***
AspectPERF:TimeBin2	-0.03211	0.24508	-0.131	0.895745
AspectPERF:TimeBin3	0.09036	0.25124	0.360	0.719100
AspectPERF:TimeBin4	0.07181	0.25189	0.285	0.775589
AspectPERF:TimeBin5	0.01134	0.25355	0.045	0.964328

In conclusion, the analysis of the online results consisted in the interpretation of plots representing the proportions of looks of the participants to the Target and Competitor pictures in each of the conditions, for 3000 ms after the onset of the verb. Furthermore, the statistical significance of Target preference was analyzed in both imperfective and perfective conditions. Participants looked slightly more to the OE from the beginning in the two conditions, probably due to the inherent appeal of Ongoing Events compared to Completed Events. However, in the imperfective condition, there was a key time point during the input of the auxiliary verb in which the looks to the Target visibly increased. That sudden tendency suggests that the aspectual information coded in the imperfective verb tense might be codified before the auxiliary, likely in the *ari* particle, and have a natural delayed effect in the participants' reactions a few milliseconds later. After the aspectual input is processed by the participants, the proportions of looks to the Target show a steady increase, while the looks towards the Competitor picture conversely decrease. Apart from that, the significance of Target preference in the imperfective condition was statistically proved.

As for the perfective condition, there was also a change of tendency in the proportions of looks towards the Target picture. Even if participants initially looked more to the Competitor OE due to natural preference, participants gradually started shifting their gaze towards the Target picture, the CE, before the offset of the auxiliary verb. Then, around 1300 ms after the verb began, proportions of looks toward the Target stabilized at around 0.6-0.7. That may imply that the effect of the aspect information was a bit less pronounced, apart from the fact that it occurred in a more gradual manner compared to the imperfective condition. Still, the preference for the Target picture was statistically proved to be significant in the perfective condition as well. Therefore, both conditions showed a clear preference for the Target picture, but no significant difference in the increase of Target preference through time between the perfective and the imperfective aspect.

4 Discussion

This study investigated how Basque tenses of distinct grammatical aspect influence native speakers' ability to link verbs to corresponding pictures. Particularly, a picture depicting an Ongoing Event was coded as Target in the imperfective condition with the Past Progressive tense, whereas a Completed Event picture was the Target in the perfective condition with the Perfective Past tense. The results showed a clear preference for Target pictures in both conditions, with accuracy significantly higher than chance.

In the offline results, the usage of the two contrasted verb tenses strongly influenced the picture selection in the judgment task. In other words, both the Perfective Past and the Past Progressive were processed and interpreted as conveying meanings of culmination and ongoingness, respectively. Those meanings coincide with the expected conditions for perfectivity and imperfectivity. Nevertheless, offline results suggested that the Perfective Past tense is not as effective conveying meanings of action completion, as Past Progressive is conveying meanings of ongoingness. Still, the analysis of the online results showed that the Target preference in both conditions evolved in a similar manner, becoming significant over time. In this chapter we will discuss these findings, delving into the matters of result state saliency of the two tested tenses, the encoding of aspect, as well as the characterization of the Past form in Basque, among others.

4.1 Result state saliency

In order to gain a more comprehensive understanding of the extent to which Basque Perfective Past and Past Progressive are effective at entailing culmination and ongoingness, it is convenient to revisit previous studies on different languages. By contrasting the Basque results to the results gathered in parallel experiments which were realized through the same procedure and with similar materials, we can contextualize the findings within a broader linguistic framework. Maintaining the same procedure and materials allows us to control the variables and focus on the effects specific to the grammatical aspect being investigated here. In this manner, we will specifically compare the results of this study with the findings reported by Minor, Mitrofanova, Guajardo, Vos, & Ramchand (2022) in their experiments investigating the processing of grammatical aspect in Russian, Spanish, and English.

First of all, within the study of Minor et al. (2022a), English results were the most surprising. On the one hand, offline results revealed that 95% of participants selected the ongoing Target image when presented with a progressive sentence. On the other hand, for the Simple Past sentence, participants showed no significant preference in the judgment task. In fact, only 54% chose the completed image, suggesting ambiguity. This lack of preference was further confirmed by the online data. Participants looked significantly more at the OE than the CE during the progressive sentence. For the Simple Past sentence, however, their eye movements showed no significant preference, with gazes shifting indiscriminately between the two pictures.

If we compare those results to the findings obtained in the Basque experiment, we can conclude they exhibit a notable difference. Basque participants showed a near-consensus preference of 99% for the Target picture with the Past Progressive tense. The preference for the ongoing picture was even greater with the Basque progressive tense than with the English progressive. Conversely, Basque participants chose the Target picture 86% of the time while hearing the Perfective Past tense, which demonstrates a great difference with the 54% preference rate for the Target picture with the Simple Past tense in English. More precisely, the preference for the CE in the perfective condition was much greater in Basque than in English. This suggests that English Simple Past is nothing like Basque Perfective Basque when it comes to entailing meanings of culmination, as the latter is relatively more effective.

Secondly, we shall focus on the results of the experiment on Russian aspect. Russian results demonstrated contrasting properties to those in the English experiment. The offline data, once again, revealed a strong preference for ongoing interpretations in response to the Russian Imperfective Past (98%). At the same time, the offline responses for the Perfective Past overwhelmingly favored completed interpretations (95%). Most importantly, there was no statistically significant difference in accuracy between the imperfective and the perfective aspects. These findings were mirrored in the gaze data. Participants were significantly more likely to look at the OE when presented with imperfective sentences, while the perfective sentences significantly increased the probability of looks directed towards the CE. The visual representations of the proportions of looks to the Target in both conditions exhibited a marked resemblance, displaying a similar tendency of preference in participants' eye-movements across the two conditions.

A comparison between Russian and Basque results shows a greater resemblance than the comparison between English and Basque results. Firstly, the offline results for the imperfective condition show a strikingly similar Target preference between the Russian Imperfective Past (98%) and the Basque Past Progressive (99%). As for the offline results for the perfective condition, Russian Perfective Past shows a higher level of accuracy (95%) compared to Basque Perfective Past (86%). The fact that the grammatical contrast is less categorical in Basque than in Russian might be the reason for a lower accuracy rate and participant and item variability in the perfective condition in the Basque experiment.

After accounting for the mixed effects, the accuracy rate in the perfect becomes higher (96%). However, there is still a rather statistically significant difference in accuracy between the aspectual conditions in Basque ($p = 0.009$), whereas the statistical difference in accuracy between aspects is less significant in Russian ($p = 0.26$). Concerning the online data, the proportions of looks significantly favored the Target picture across the two conditions and languages ($p < 0.001$). Overall, the results for Russian and Basque suggest that both Perfective Pasts give rise to interpretations of complete events. Nonetheless, the Russian Perfective Past is somewhat more effective than its Basque counterpart.

Thirdly, Spanish results had a substantial degree of similarity to Russian results. Regarding offline results in Spanish, participants revealed a strong preference for ongoing interpretations. Spanish speakers selected the OE 97% of the time when presented with imperfective sentences. Conversely, the preference for the CE with perfective sentences (83%) was less pronounced compared to Russian. In Spanish, the statistical analysis exhibited a significant difference of accuracy between the two conditions ($p < 0.001$). This pattern was reflected in the online gaze data. As a matter of fact, participants demonstrated a significantly above chance preference for the Target OE during Spanish Preterite sentences. As for the Target preference during Preterite sentences, there were two time windows where Spanish speakers showed a significantly above chance preference for the Target. Overall, the level of certainty that perfective sentences were associated with completed events was somewhat reduced in Spanish as compared to Russian, as it was reflected in their eye-movements.

Comparatively, Spanish and Basque experiments had interestingly similar results, especially in the offline judgment task. The Target preference in the imperfective condition was significantly high both in Spanish (97%) and in Basque (99%). Likewise, Spanish and Basque had a similar Target preference rate in the perfective condition (83% and 86%, respectively), which was lower than in the imperfective condition.

On top of that, a statistically significant difference in accuracy scores was observed between the two conditions, both in Spanish ($p < 0.001$), as well as in Basque ($p = 0.009$). In the online results, the visual representations of the proportions of looks in the perfective condition slightly differed from the imperfective condition in both languages. However, the difference between conditions was more notable in Spanish. A logistic regression model with the gaze data gathered in Basque proved that both conditions showed a comparable increase in Target preference over time. In conclusion, Basque Perfective Past seems to be equally or slightly more effective than Spanish Preterite at conveying meanings related to completed action.

To sum up, a cross linguistically comparative approach to the results of the Basque experiment provides strong support for our hypothesis. The proposed hypothesis was that accomplishments expressed in the Perfective Past in Basque would primarily trigger interpretations of completed actions, in a similar manner to the Spanish *Pretérito Indefinido*. The results showed that Basque Perfective Past does predominantly elicit interpretations that emphasize the completion of action, probably to a lesser extent than Russian Perfective Past

and to a somewhat higher extent than Spanish Preterite. According to that, the hierarchical classification of the four languages discussed here regarding their result state saliency would be the one presented in (50).

(50) Result state saliency hierarchy:

Russian > Basque > Spanish > English.

Anyway, it would be interesting to test the effects of grammatical aspect of Basque in a larger sample size for two main reasons: on the one hand, a bigger sample allows for more precise estimates of the overall effect of the aspect variable; on the other hand, that would grant a higher chance of detecting statistically significant mixed effects, such as the variables of participants and items which were discussed in the analysis of the results.

4.2 The encoding of aspect

The experiment in this study demonstrated how the contrasted verb forms in Basque, the Perfective Past and the Past Progressive do indeed produce culmination and ongoingness interpretations to a great extent. The fact that Basque possesses different verb forms dedicated to entailing meanings of action completion or ongoingness suggests that Basque has a systematic manner of encoding aspect within the grammar. This grammatical aspect system is therefore responsible for providing information to speakers about whether an action is finished or ongoing. Even if we know that Basque has grammatical perfectivity and imperfectivity, there is another question that arises: Which part of the linguistic representation actually provides this information?

The verb forms that were tested in the experiment involved distinct participial suffixes in each of the tenses. In the perfective tense, the suffix had the allomorphs *-tu/-du*, *-Ø*, *-i* and *-n*, while the imperfective suffix was *-t(z)en*. In addition, the imperfective tense included the particle *ari*. If we look at the contrasting participial suffixes, there is a possibility that these are aspectual markers which exclusively convey meanings of aspect. If that was true, the suffixes would mark perfectivity and imperfectivity in a consistent and direct manner. On the other hand, if the suffixes do not always determine aspectual status and differ in their meaning according to context, it could be that aspectual meaning is lexically contained, as it is the case with languages such as Russian.

As previously described, in Slavic languages like Russian, adding prefixes to verbs can create verbs of perfective aspect. That does not necessarily imply that the prefixes themselves are aspectual markers of perfectivity. Principally, prefixes add meaning and nuances to the base of the verb. Sometimes, the combinations of prefix and verb become lexicalized. In other words, they turn into fixed units with their particular meaning. The existence of that kind of prefix suggests that Slavic languages do not use a specific morphological marker to indicate grammatical perfective aspect. In fact, Filip (2017) argues that prefixes like *s-* in Slavic languages are certainly used to create derived verbs, but they do not directly mark PFV grammatical aspect. This perspective contradicts the widespread belief that Slavic languages rely exclusively on prefixes to mark PFV aspect.

According to Filip (2017), a maximization operator MAX_E identifies the maximal stages of eventualities in all PFV forms. In the case of Slavic languages, that operator is phonologically null, as PFV is not expressed through an overt aspectual marker. Instead, Filip (2017) argues that Slavic languages express PFV through lexicalization. Namely, it is the verb's inherent meaning that determines whether the verb form is perfective or imperfective. Prefixes on verbs can have influence on aspect, but they do not single-handedly determine the grammatical aspect of a verb. Actually, they can co-occur with imperfective suffixes or even form imperfective verbs themselves. Thus, these prefixes cannot be solely responsible for expressing perfective aspect. In languages with no grammatical aspect such as English, PFV is also not expressed through morphological markers, so the speaker has to rely on contextual information and world knowledge to interpret a verb phrase as perfective.

In a similar way, a theory proposed by Arregi (2000) suggests that grammatical aspect might also not be conveyed through morphological markers in Basque. According to the researcher, communicating grammatical aspect is not the exclusive function of the previously mentioned participial suffixes. That contrasts with Laka's (1990) view that all participial suffixes are aspectual markers. Laka (1990) claims that the absence of overt aspectual morphology is the factor that triggers syntactic head movement to create simple tenses, but all tenses, simple and compound, possess an Asp component. However, Arregi (2000) argues that there are some perfective compound verbs in Basque with a null aspectual marker which do not undergo such head movement. That inconsistency implies that an overt aspectual marking is not always needed to convey grammatical aspect.

Arregi (2000) defends the idea that grammatical aspect is determined by the presence of an Asp projection. Specifically, non-habitual imperfective forms lack the Asp projection, both in compound and simple tenses. In his view, the imperfective participial suffix *-t(z)en* in compound forms has two different aspectual meanings, habitual and non-habitual, depending on the presence or absence of an Asp projection. Thus, *-t(z)en* does not have an exclusive aspectual meaning, like an aspect marker usually has.

Arregi (2000) also provides arguments to support the idea that the participial suffix itself never actually materializes aspect. The evidence comes from the use of the perfective and imperfective suffixes and the manner in which they contribute to aspectual meaning. For instance, an argument in favor of that hypothesis is that, in focus constructions, the focused verb always carries the *-tu* suffix (or one of its allomorphs) regardless of the overall aspect of the sentence, whereas an auxiliary *egin* ('to do') carries the suffix that determines the final aspect. The examples of focus constructions in (11) and (12) have been repeated here for convenience:

(11) Verb focus construction in perfective aspect.

Zabal-du	egi-n	da	ate-a
open-TU	do-PFV	Aux.PRS	door-the.ABS
'The door has OPENED'			

(12) Verb focus construction in the imperfective aspect.

Ja-n	egi-ten	du	ume-a-k
eat-TU	do-IMPFV	Aux.PRS	child-the-ERG
'The child EATS'			

The fact that *-tu* does not always signal perfective aspect undermines the idea that it is a realization of aspect. Another example that challenges the traditional view of participial suffixes in direct relation with aspect is that imperfective suffix *-t(z)en* is really a combination of two morphemes: a derivational suffix *-t(z)e* and an inessive case marker *-n*. Derivational suffix *-t(z)e* is actually used in different constructions in combination with several case markers, even in an embedded clause, indicating completion of an action (*-t(z)en amaitu*, 'finish -ing'). That contradicts the belief that *-t(z)en* always conveys the same aspectual meaning.

The arguments that Arregi (2000) presents suggest that morphological marking might not be the only actual mechanism for expressing grammatical aspect within the Basque language. The fact that suffixes *-tu* and *-t(z)en* do not always determine aspect and their meaning varies depending on context implies that the inherent meaning of the verb could play a role, like in Slavic languages. Nevertheless, that does not necessarily imply full lexicalization like in Slavic languages. Apart from the inherent meaning of the lexical verb, Basque seems to utilize both the tense feature in the auxiliary verb and participial morphology in conveying aspect, making its aspectual encoding more similar to Spanish.

A syntactic approach can be adopted to explain aspectual encoding in Spanish, as well as in Basque. An Asp head dominating the verb phrase might take the aspectual meaning as a formal feature from the lexical verb, as well as other syntactic elements and contextual cues. While Russian prefixes categorically influence the setting in the Asp head, the lexical meaning of a verb does not solely determine aspectual interpretation in Basque. Further analysis is required to see how Basque Perfective Past is interpreted in combination with measure phrases and other modifiers which interact with aspectual marking when conveying perfectivity in the case of Spanish Preterite. This will provide a clearer understanding of the relative importance of lexical influence, syntactic cues, and surrounding context in Basque aspect encoding.

Coming back to the experiment, in the analysis of the gaze data the most important linguistic cues of the verb constructions were timed and represented in the plots with coloured vertical lines. Each line showed the average time in which a specific grammatical cue of one of the verb forms ended or started. Specifically, the offset of the participle containing the aspect suffix, the offset of *ari* (in the imperfective tense) and the offset of the auxiliary verb were marked. This was intended to generate an estimated visualization of the effect of the aspectual content on the processing and eye-movement behavior of the participants. However, it was rather vague to determine the exact point which triggered a significant proportion of looks towards one of the pictures. In order to reach a more accurate conclusion in that sense, a cluster-based permutation analysis would be more precise and helpful. Previous experiments employed that kind of analysis to highlight the specific time windows in which the proportions of looks became significant. Therefore, a cluster-based permutation analysis should be implemented in future research.

4.3 Characterization of the Basque Perfective Past

Now that the result state saliency of the Perfective Past and Past Progressive has been described and compared to that of corresponding verb forms in other languages, it is opportune to attempt to define Basque PFV in terms of its morphology and semantics. Regarding result state saliency, the Spanish Preterite form was probably the closest equivalent to the Basque Perfective Past. As we will discuss in this section, at first sight, the form that we are referring to as Perfective Past has the morphological properties of a typical ‘have’ Perfect in the past. In spite of that, in terms of translation choices, it is clearly nothing like a Past Perfect or the Pluperfect in Spanish, but more like *Pretérito Indefinido* or the Spanish Preterite.

First of all, the morphology of the Compound Perfective Past form in Basque aligns with the morphology of the Spanish *Pretérito Pluscuamperfecto*, as well as with any crosslinguistically equivalent Pluperfect form with ‘have’, such as the English Past Perfect, or French *Plus-que-parfait*. The Basque Perfective Past form for the verb *amaitu* (‘finish’) is *amaitu n(it)uen* in the first person singular (‘I finished’). Nevertheless, taking a closer look to the components of the tense form, *amaitu* is a participle derived from the lexical verb ‘finish’, whereas *n(it)uen* is an auxiliary derived from the verb *edun* ‘have’.

(51) a. Basque Perfective Past construction:

Iaz	ikasketa-k	amai-tu	n-it-u-en
Last year	study.the-PL.ABS	finish-PFV	1SG-PL-have-3SG.PST
‘Last year I finished my studies’			

b. Spanish *Pretérito Pluscuamperfecto* construction:

El	año	pasado	había	termina-do	mis	estudio-s.
the	year	last	have.1SG.PST	finish-PRF	my	study-PL
‘Last year I had finished my studies’						

In (51a) and (51b) we present instances of Basque Perfective Past and Spanish Pluperfect constructions. If we look at the Spanish *Pretérito Pluscuamperfecto* form of the same verb comparatively, *había terminado* (‘I had finished’) is very similar to *amaitu nuen* (‘I finished’): it consists of an auxiliary verb ‘have’ in the past (*había*) and a participle carrying the lexical verb (*terminado*). The Pluperfect forms in English (*had finished*) and French (*avais*

terminé) present a parallel composition to that of *Pretérito Pluscuamperfecto*. These Pluperfect forms only differ from the Perfective Past in Basque in that they are left-headed, while the Basque form is right-headed.

According to Van Der Klis et al. (2022) a Perfect tense sets up a past event with relevance at utterance time. That is the most distinctive characteristic in the core meaning of the Perfect, which separates it from Past tenses. Apart from that, Perfect is incompatible with past time adverbials and/or narrative use in languages such as English. For example, a Present Perfect form in English cannot be used in combination with a past adverbial phrase like “at six o’clock” or as the verb form in a narrative text to describe a succession of events. However, the interpretations of the Perfect vary among languages, some being more restrictive (e.g. English Present Perfect) and others more liberal (e.g. French *Passé Composé*) in the number of contexts in which it can exist (Van Der Klis et al., 2022).

Even though we might not have decisive data to assert that Basque Perfective Past is semantically closer to *Pretérito Indefinido* than to Russian Perfective, we can determine from general translation choices of Basque speakers that this form is generally not translated as a *Pretérito Pluscuamperfecto* or Pluperfect, but as a *Pretérito Indefinido*. We provide some comparative examples in Basque and Spanish in (52) to illustrate this fact. The Perfective Past form *irakurri nuen* (‘I read’) in (52a) is translated as *Pretérito Indefinido* form *leí* in Spanish, and a Simple Past form *read* in English. In the same manner, in example (52b), *afaldu zuen* (‘she had for dinner’) is interpreted as a *Pretérito Indefinido* form in Spanish, and not as a Pluperfect. It is worth noting that Basque does not possess a distinct Pluperfect form, so adverbs of time indicating anteriority such as *jada* (‘already’) or *ordurako* (‘by then’) are often used together with the Perfective Past to express a Pluperfect.

(52) a. Atzo	liburu-a	irakurr-i	n-u-en
Yesterday	book-the.ABS	read-PFV	1SG-have-3SG.PST
Ayer	leí	el	libro
Yesterday	read.1SG.PST	the	book
‘Yesterday I read the book’			

b. Bart	ama-k	arrain-a	afal-du	z-u-en
Last night	mum.the-ERG	fish-ABS	dine-PFV	3SG-have-3SG.PST

Anoche	mi	madre	cenó	pescado
Last night	my	mum	dine.3SG.PST	fish

‘Last night my mum had fish for dinner’

Apart from that, in both examples, the Perfective Past tense is employed with past time reference adverbials, which place the narrative in the past: *atzo* (‘yesterday’) and *bart* (‘yesterday night’). Aside from the fact that Perfective Past can occur together with these kinds of adverbials, it is also natural that it occurs in contexts of narrative progression in the past. For instance, in the example presented in (53), Perfective Past is employed in narrative discourse, presenting two consecutive events: one in the temporal adverbial clause (*entzun*, ‘hear’) and the other in the main clause (*irribarre egin*, ‘smile’). The fact that it can be used in a context like (53) encourages the hypothesis that it is semantically close to *Pretérito Indefinido*.

(53) Abesti-a	entzu-n	z-u-en -ean,
song-the.ABS	hear-PFV	3SG-have-3SG.PST-INE

irribarre	egi-n	z-u-en
smile	do-PFV	3SG-have-3SG.PST

Cuando	escuchó	la	canción,	sonrió
when	hear.3SG.PST	the	song	smile.3SG.PST

‘When he heard the song, he smiled’

Another question we should examine is the compatibility of the Basque Perfective Past with measured phrases such as ‘for three hours’. According to Janda & Fábregas (2019), one of the most common mismatches between perfectivity use in Russian and Spanish is that when a measured duration is mentioned, Spanish tends to use the perfective whereas Russian tends to use the imperfective. That is because while Spanish regards these measured events as a single bounded whole, Russian requires using the imperfective with events of an ongoing nature, even when they are limited within a timeframe. We can observe how Basque Perfective Past can coexist with measured phrases as well as *Pretérito Indefinido* can in the example in (54).

(54) Liburua **hiru ordu-z** irakurr-i z-u-en
 Book-the.ABS three hour-DUR read-PFV 3SG-have-3SG.PST

Leyó el libro **durante** **tres** **horas**
 read.3SG.PST the book for three hours

‘He read the book for three hours’

Interestingly, when we examine present tenses, Basque possesses a Present Perfect tense with ‘have’, which has the same structure as the Perfective Past, but with the auxiliary verb in the present. This form translates into a Perfect, and the contexts of its use can be compared to those of Spanish *Pretérito Perfecto Compuesto*. In fact, Basque Present Perfect also has a hodiernal nature, locates events in the recent time gone by, and past time event reference is hence not allowed with this tense form. In (55), we present a minimal pair of the same sentence in the Perfective Past and the Present Perfect in Basque, and their correspondent translations to Spanish *Pretérito Indefinido* and *Pretérito Perfecto Compuesto*. While the form with the auxiliary in the past is interpreted as *Pretérito Indefinido*, the present auxiliary form turns the translation into a *Pretérito Perfecto Compuesto*.

(55) a. Okindegi-a-n ogi-a **eros-i** **n-u-en**
 Bakery-the-INE bread-the.ABS buy-PFV 1SG-have-3SG.PST

Compré pan en la panadería
 buy.1SG.PST bread in the bakery

‘I bought bread in the bakery’

b. Okindegi-a-n ogi-a **eros-i** **d-u-t**
 Bakery-the-INE bread-the.ABS buy-PFV 1SG-have-3SG.PRS

He **compra-do** pan en la panadería
 have.1SG.PRS buy-PRF bread in the bakery

‘I have bought bread in the bakery’

In light of this, we are compelled to ask how it is possible that a morphologically Past Perfect form is interpreted like a Perfective Past. It is not unusual to find meaning shifts in Present Perfect forms, as their use becomes more extended and liberal in typical Past tense

environments. That is the case of French and Italian perfects, for example (Van Der Klis et al., 2022). In contrast, a meaning shift in a Past Perfect form would be unexpected. Anyway, we have observed that *Pretérito Indefinido* is a close equivalent in terms of meaning and distribution of labor to the Basque Perfective Past, even if the Basque form is morphologically more similar to a Pluperfect.

In any case, there is no particular need to label the tense form we are dealing with. We can describe Basque Perfective Past tense in terms of its morphologic and semantic features, for example, by testing its ability to give rise to the salience of the result state, like we did in this experiment. Comparing verb forms crosslinguistically also sheds light into the characterization of specific tenses. Along these lines, it would be interesting to compare Basque Perfective Past's and Present Perfect's ability to trigger result state interpretations and see if they coincide or differ when it comes to that.

4.4 Directions for future research

This research had some limitations and could be expanded in many directions. First of all, an experiment of a larger sample size could provide a more precise estimate of the effect of grammatical aspect in the interpretation of Perfective Past and Past Progressive verb forms in Basque. It might also allow us to detect significant mixed effects related to the behavior of different items and participants. Apart from that, building on the hypothesis that Basque participial suffixes do not solely determine aspect, future research could delve deeper into the interaction between morphology, lexical semantics and various syntactic elements in encoding aspectual information. In addition to that, in future experiments, a cluster-based permutation analysis could mark the exact moments when participants look significantly more at one of the pictures as a response to the audio stimuli. That would provide more accurate insights about grammatical aspect processing. Finally, a follow-up experiment to this one could compare Perfective Past and Present Perfect forms in Basque regarding their ability to emphasize the completion of an action when applied to accomplishments.

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Appendix A: Preamble sentences

Item Number	Preamble	ENG
1	Eskola orduan, neskatoa ikasgelan zegoen.	At schooltime, the girl was in the classroom.
2	Gau ilun batean, mutikoa kalean zegoen.	On a dark night, the boy was outside.
3	Egun euritsu batean, neskatoa supermerkatuan zegoen.	On a rainy day, the girl was in the supermarket.
4	Egun eguzkitsu batean, aitona kalean zegoen.	On a sunny day, grandpa was outside.
5	Mutikoak atsegin zuen etxeko lanak egitea.	The boy liked doing chores.
6	Eskola orduan, mutikoa ikasgelan zegoen.	At schooltime, the boy was in the classroom.
7	Bazkalorduan, amona sukaldean zegoen.	At lunchtime, grandma was in the kitchen.
8	Neguko goiz hotz batean, aitona lanpetuta zegoen.	On a crisp winter morning, grandpa was busy.
9	Plastika zen neskatoaren ikasgai gustokoena.	Art was the girl's favorite subject.
10	Bazkalorduan, neskatoa sukaldean zegoen.	At lunchtime, the girl was in the kitchen.
11	Neskatoa jatun ona zen.	The girl had a good appetite.
12	Aitona konpontzaile bikaina zen.	Grandpa was a great repairman.
13	Egun euritsu batean, amona etxean zegoen.	On a rainy day, grandma was home.
14	Neguko goiz hotz batean, neskatoa baserrian zegoen.	On a crisp winter morning, the girl was in the farm.
15	Egun eguzkitsu batean, neskatoa etxean zegoen.	On a sunny day, the girl was home.
16	Egun euritsu batean, neskatoa etxean zegoen.	On a rainy day, the girl was home.
17	Bazkalorduan, emakumea sukaldean zegoen.	At lunchtime, the woman was in the kitchen.
18	Egun eguzkitsu batean, amona lorategian zegoen.	On a sunny day, grandma was in the garden.

19	Neguko goiz hotz batean, aitona etxean zegoen.	On a crisp winter morning, grandpa was home.
20	Neguko goiz hotz batean, amona etxean zegoen.	On a crisp winter morning, grandma was home.
21	Eskola orduan, mutikoa ikasgelan zegoen.	At schooltime, the boy was in the classroom.
22	Bazkalorduan, amona etxean zegoen.	At lunchtime, grandma was at home.
23	Egun eguzkitsu batean, amona pozik zegoen.	On a sunny day, grandma was happy.
24	Mutilak gauza asko zuen lagunari esateko.	The boy had a lot to say to his friend.
25	Egun euritsu batean, aitona etxean zegoen.	On a rainy day, grandpa was home.
26	Egun euritsu batean, mutikoa etxean zegoen.	On a rainy day, the boy was home.
27	Egun eguzkitsu batean, aitona kalean zegoen.	On a sunny day, grandpa was outside.
28	Egun euritsu batean, neskatoa etxean zegoen.	On a rainy day, the girl was home.
29	Egun euritsu batean, mutikoa lanpetuta zegoen.	On a rainy day, the boy was busy.
30	Egun eguzkitsu batean, amona etxean zegoen.	On a sunny day, grandma was home.
31	Eskola orduan, mutikoa ikasgelan zegoen.	At schooltime, the boy was in the classroom.
32	Neguko goiz hotz batean, aitona etxean zegoen.	On a crisp winter morning, grandpa was home.
33	Egun eguzkitsu batean, amona etxean zegoen.	On a sunny day, grandma was home.
34	Egun eguzkitsu batean, mutikoa mendian zegoen.	On a sunny day, the boy was hiking.
35	Eskola orduan, neskatoa ikasgelan zegoen.	At schooltime, the girl was in the classroom.
36	Neguko goiz hotz batean, aitona etxean zegoen.	On a crisp winter morning, grandpa was home.
37	Egun eguzkitsu batean, neskatoa kalean zegoen.	On a sunny day, the girl was outside.
38	Egun euritsu batean, amona etxean zegoen.	On a rainy day, grandma was home.

	zegoen.	
39	Egun berezia zen neskatoarentzat.	It was a special day for the girl.
40	Neguko goiz hotz batean, mutikoa kalean zegoen.	On a crisp winter morning, the boy was outside.
41	Egun eguzkitsu batean, neskatoa lanpetuta zegoen.	On a sunny day, the girl was busy.
42	Neguko goiz hotz batean, aitona kalean zegoen.	On a crisp winter morning, grandpa was outside.
43	Gau ilun batean, aitona etxean zegoen.	On a dark night, grandpa was home.
44	Egun eguzkitsu batean, amona etxean zegoen.	On a sunny day, grandma was home.
45	Egun eguzkitsu batean, neskatoa kalean zegoen.	On a sunny day, the girl was outside.
46	Egun euritsu batean, mutikoa lanpetuta zegoen.	On a rainy day, the boy was busy.
47	Egun euritsu batean, amona etxean zegoen.	On a rainy day, grandma was home.
48	Neguko goiz hotz batean, aitona kalean zegoen.	On a crisp winter morning, grandpa was outside.

Appendix B: Experimental sentences

Item Number	Target	ENG
1	Puxika puztu zuen/puzten ari zen , irudian ikus dezakezunez	She blew up/was blowing up the balloon, as you can see in the picture.
2	Kutxa lurperatu zuen/lurperatzen ari zen , irudian ikus dezakezunez	He buried/was burying the chest, as you can see in the picture.
3	Mugikorra erosi zuen/erosten ari zen , irudian ikus dezakezunez	She bought/was buying a phone, as you can see in the picture.
4	Zuhaitza moztu zuen/mozten ari zen , irudian ikus dezakezunez	He chopped/was chopping down the tree, as you can see in the picture.
5	Gela garbitu zuen/garbitzen ari zen , irudian ikus dezakezunez	He cleaned/was cleaning the room, as you can see in the picture.
6	Dorrea eraiki zuen/eraikitzen ari zen , irudian ikus dezakezunez	He constructed/was constructing a tower, as you can see in the picture.
7	Intxaurra hautsi zuen/hausten ari zen , irudian ikus dezakezunez	She cracked/was cracking the nut open, as you can see in the picture.
8	Etxea eraitsi zuen/eraisten ari zen , irudian ikus dezakezunez	He demolished/was demolishing the house, as you can see in the picture.
9	Loreontzia marraztu zuen/marrazten ari zen , irudian ikus dezakezunez	She drew/was drawing a vase, as you can see in the picture.
10	Esnea edan zuen/edaten ari zen , irudian ikus dezakezunez	She drank/was drinking the milk, as you can see in the picture.
11	Arraina jan zuen/jaten ari zen , irudian ikus dezakezunez	She ate/was eating the fish, as you can see in the picture.
12	Hozkailua konpondu zuen/konpontzen ari zen , irudian ikus dezakezunez	He fixed/was fixing the fridge, as you can see in the picture.
13	Margolana eskegi zuen/eskegitzen ari zen horman, irudian ikus dezakezunez	She hung/was hanging the painting, as you can see in the picture.
14	Behia jetzi zuen/jezten ari zen , irudian ikus dezakezunez	She milked/was milking the cow, as you can see in the picture.
15	Leioa ireki zuen/irekitzen ari zen , irudian ikus dezakezunez	She opened/was opening the window, as you can see in the picture.
16	Horma margotu zuen/margotzen	She painted/was painting the wall, as you

	ari zen , irudian ikus dezakezunez	can see in the picture.
17	Laranja zuritu zuen/zuritzen ari zen , irudian ikus dezakezunez	She peeled/was peeling the orange, as you can see in the picture.
18	Lorea landatu zuen/landatzen ari zen , irudian ikus dezakezunez	She planted/was planting a flower, as you can see in the picture.
19	Liburua irakurri zuen/irakurtzen ari zen , irudian ikus dezakezunez	He read/was reading the book, as you can see in the picture.
20	Jantzia josi zuen/josten ari zen josteko makinaz, irudian ikus dezakezunez	She sewed/was sewing a dress with a sewing machine, as you can see in the picture.
21	Arkatza zorrotu zuen/zorrotzen ari zen , irudian ikus dezakezunez	He sharpened/was sharpening the pencil, as you can see in the picture.
22	Angurria zatitu zuen/zatitzen ari zen , irudian ikus dezakezunez	She sliced/was slicing the watermelon, as you can see in the picture.
23	Zuhaixka ureztatu zuen/ureztatzen ari zen , irudian ikus dezakezunez	She watered/was watering the bush, as you can see in the picture.
24	Gutuna idatzi zuen/idazten ari zen , irudian ikus dezakezunez	He wrote/was writing a letter, as you can see in the picture.

Appendix C: Filler sentences

Item Number	Target	ENG
25	Sua piztu berri zuen, irudian ikus dezakezunez.	He had just lit the fire, as you can see in the picture.
26	Iltzea mailukatzeari ekin zion, irudian ikus dezakezunez.	He started hammering in the nail, as you can see in the picture.
27	Lurrean zuloa egitea erabaki zuen, irudian ikus dezakezunez.	He decided to dig a pit in the ground, as you can see in the picture.
28	Gaztelua osatzea lortu zuen, irudian ikus dezakezunez.	She managed to put the castle together, as you can see in the picture.
29	Aulkia desmuntatzen ahalegindu zen, irudian ikus dezakezunez.	He tried to take apart the stool, as you can see in the picture.
30	Tarta labean egin berri zuen, irudian ikus dezakezunez.	She had just baked a cake, as you can see in the picture.
31	Irudia koloreztatzen amaitu zuen, irudian ikus dezakezunez.	He finished coloring the drawing, as you can see in the picture.
32	Postrea prestatzea lortu zuen, irudian ikus dezakezunez.	He managed to prepare the dessert, as you can see in the picture.
33	Atea giltzaz itxi berri zuen, irudian ikus dezakezunez.	She had just locked the door, as you can see in the picture.
34	Mendiari argazkiak ateratzeari ekin zion, irudian ikus dezakezunez.	He started photographing the mountain, as you can see in the picture.
35	Lorea ebakitzen ahalegindu zen, irudian ikus dezakezunez.	She tried to cut out the flower, as you can see in the picture.
36	Bonbila askatzea lortu zuen, irudian ikus dezakezunez.	He managed to unscrew the light bulb, as you can see in the picture.
37	Koadernoaren erretzen amaitu zuen, irudian ikus dezakezunez.	She finished burning the notebook, as you can see in the picture.
38	Puntuzko jertsea egiten ahalegindu zen, irudian ikus dezakezunez.	She started knitting a jumper, as you can see in the picture.
39	Oparia zabaldu berri zuen, irudian ikus dezakezunez.	She had just unwrapped the present, as you can see in the picture.
40	Enborra zerratzen amaitu zuen, irudian ikus dezakezunez.	He finished sawing the log, as you can see in the picture.
41	Maleta egitea erabaki zuen, irudian ikus dezakezunez.	She decided to pack the suitcase, as you can see in the picture.

42	Elur panpina egiten amaitu zuen, irudian ikus dezakezunez.	He finished building a snowman, as you can see in the picture.
43	Kandela itzaltzen ahalegindu zen, irudian ikus dezakezunez.	He tried to blow out the candle, as you can see in the picture.
44	Telebista itzaltzea erabaki zuen, irudian ikus dezakezunez.	She decided to switch off the TV, as you can see in the picture.
45	Ibaian zehar igeri egiteari ekin zion, irudian ikus dezakezunez.	She started swimming across the river, as you can see in the picture.
46	Harrikoa egitea erabaki zuen, irudian ikus dezakezunez.	He decided to wash the dishes, as you can see in the picture.
47	Alkandorari mahuka ebakitzea lortu zuen, irudian ikus dezakezunez.	She managed to cut the sleeve off the shirt, as you can see in the picture.
48	Zubia dinamitatzen ahalegindu zen, irudian ikus dezakezunez.	He tried to dynamite the bridge, as you can see in the picture.

Appendix D: Participant background questions and results

1. Zein adin-tartetan zaude? / *Which age group are you in?*

- 18-30
- 31-43
- 44-56
- 57-69
- 70+

2. Ikusmen zuzendua duzu? / *Do you have corrected vision?*

- Bai, betaurrekoak erabiltzen ditut. / *Yes: I wear glasses.*
- Bai, lentillak erabiltzen ditut. / *Yes: I wear contact lenses.*
- Ez, ez dut ikusmen zuzendurik. / *No: I have normal, uncorrected vision.*
- Ez; ikusmen arazoak izan arren, ez dut betaurreko edo lentillarik erabiltzen. / *No: I have problems with my eyes/vision that are uncorrected by glasses or contacts.*

3. Zein da zure lehen hizkuntza edo ama-hizkuntza? / *What is your L1 or mother tongue?*

- Euskara / *Basque*
- Erdara (euskara ez den beste edozein hizkuntza) / *Any language other than Basque*
- Euskara eta erdara / *Basque and another language*

4. Zein hizkuntzatan egin zenituen oinarrizko ikasketak? / *In which language did you do your basic studies?*

- Euskaraz / D ereduan / *In Basque / In Model D*
- Erdaraz (euskara ez den beste hizkuntza baten) / A ereduan / *In any language other than Basque.*
- Euskaraz eta erdaraz / B ereduan / *In Basque and another language / In Model B*

Participant	Age	Vision	L1	Language of studies
1	18-30	Bai, betaurrekoak erabiltzen ditut.	Euskara eta erdara	Euskaraz / D eremuan
2	18-30	Bai, betaurrekoak erabiltzen ditut.	Euskara eta erdara	Euskaraz / D eremuan
3	18-30	Bai, betaurrekoak erabiltzen ditut.	Euskara eta erdara	Euskaraz / D eremuan
4	57-69	Bai, betaurrekoak erabiltzen ditut.	Euskara	Erdaraz (euskara ez den beste hizkuntza baten) / A eremuan
5	44-56	Bai, betaurrekoak erabiltzen ditut.	Euskara	Euskaraz / D eremuan
6	57-69	Bai, betaurrekoak erabiltzen ditut.	Euskara	Erdaraz (euskara ez den beste hizkuntza baten) / A eremuan
7	18-30	Ez, ez dut ikusmen zuzendurik.	Euskara	Euskaraz / D eremuan
8	18-30	Ez, ez dut ikusmen zuzendurik.	Euskara	Euskaraz / D eremuan
9	18-30	Bai, lentillak erabiltzen ditut.	Euskara eta erdara	Euskaraz / D eremuan
10	44-56	Ez, ez dut ikusmen zuzendurik.	Euskara	Euskaraz eta erdaraz / B eremuan
11	44-56	Bai, betaurrekoak erabiltzen ditut.	Euskara	Euskaraz eta erdaraz / B eremuan
12	18-30	Ez, ez dut ikusmen zuzendurik.	Euskara	Euskaraz / D eremuan
13	44-56	Ez, ez dut ikusmen zuzendurik.	Euskara	Euskaraz / D eremuan
14	18-30	Bai, lentillak erabiltzen ditut.	Euskara	Euskaraz / D eremuan
15	44-56	Ez, ez dut ikusmen zuzendurik.	Euskara	Euskaraz / D eremuan
16	18-30	Ez; ikusmen arazoak izan arren, ez dut betaurreko edo lentillarik erabiltzen.	Euskara eta erdara	Euskaraz / D eremuan
17	18-30	Bai, lentillak erabiltzen ditut.	Euskara	Euskaraz / D eremuan
18	44-56	Bai, betaurrekoak erabiltzen	Euskara	Erdaraz (euskara ez den

		ditut.		beste hizkuntza baten) / A ereduan
19	18-30	Bai, betaurrekoak erabiltzen ditut.	Euskara	Euskaraz / D ereduan
20	57-69	Bai, betaurrekoak erabiltzen ditut.	Euskara eta erdara	Erdaraz (euskara ez den beste hizkuntza baten) / A ereduan
21	18-30	Ez, ez dut ikusmen zuzendurik.	Euskara	Euskaraz / D ereduan
22	44-56	Ez, ez dut ikusmen zuzendurik.	Euskara	Euskaraz / D ereduan
23	18-30	Bai, betaurrekoak erabiltzen ditut.	Euskara	Euskaraz / D ereduan
24	18-30	Ez; ikusmen arazoak izan arren, ez dut betaurreko edo lentillarik erabiltzen.	Euskara eta erdara	Euskaraz / D ereduan
25	18-30	Bai, betaurrekoak erabiltzen ditut.	Euskara	Euskaraz / D ereduan
26	44-56	Ez; ikusmen arazoak izan arren, ez dut betaurreko edo lentillarik erabiltzen.	Euskara	Euskaraz eta erdaraz / B ereduan
27	44-56	Bai, betaurrekoak erabiltzen ditut.	Euskara eta erdara	Erdaraz (euskara ez den beste hizkuntza baten) / A ereduan
28	44-56	Ez, ez dut ikusmen zuzendurik.	Euskara	Euskaraz / D ereduan
29	18-30	Ez, ez dut ikusmen zuzendurik.	Euskara	Euskaraz / D ereduan
30	57-69	Ez; ikusmen arazoak izan arren, ez dut betaurreko edo lentillarik erabiltzen.	Euskara	Euskaraz / D ereduan