

At the boundary between lexical and grammatical  
aspect: an eye tracking study

Na rozhraní lexikální a gramatické povahy vidu:  
studie očních pohybů



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## Declaration

I declare that this thesis has been composed solely by myself and that it has not been submitted, in whole or in part, in any previous application for a degree. Except where states otherwise by reference or acknowledgment, the work presented is entirely my own.

Prohlašuji, že jsem diplomovou práci vypracoval samostatně, že jsem řádně citoval všechny použité prameny a literaturu a že práce nebyla využita v rámci jiného vysokoškolského studia či k získání jiného nebo stejného titulu.

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## Abstract

Even subtle changes in linguistic cues can lead to changes in mental representation. Among the grammatical markers and lexical categories from which linguistic cues arise have shared influence on the spatiotemporal representation. By means of those categories, we create mental concepts which are used to refer to the spatiotemporal observations on the world around us. The present study investigates the interaction of lexical and grammatical aspect and how it is reflected in eye movements. Twenty Dutch native speakers were measured as they listened to sets of Dutch sentences that differed in terms of lexical and grammatical aspect, while looking at a blank white screen. As such, the proposed experimental paradigm mirrors real-world passive listening circumstances. This study provides evidence that grammatical and lexical aspect can diversely influence spontaneous eye movements in a situation without an explicit visual task. These results, obtained using an understudied language, contribute to an ongoing discussion in linguistics about whether linguistic components as abstract as grammar are able to modulate sensorimotor representations. Additionally, the data from this study can lead to subsequent research on the extent to which brain circuits devoted to language are tightly connected with perceptual areas of the brain.

Key words: language, cognition, interaction, lexical aspect, grammatical aspect, eye tracking, conceptualisation, blank screen paradigm, sensorimotor system, Dutch

## Abstrakt

I malé změny v jazykové realizaci mohou vést k rozdílné mentální reprezentaci. Gramatický a lexikální aspekt jsou dva příklady kategorií, které se na této mentální reprezentaci podílí. Pomocí těchto kategorií vytváříme mentální koncepty, pomocí kterých uchopujeme naše prožívání místa a času. Tato studie zkoumá interakci lexikálního a gramatického vidu a jak se tato interakce odráží na charakteru očních pohybů u mluvčích nizozemštiny. Bylo užito *paradigmatu bílé obrazovky* (blank screen paradigm) (Altmann, 2004). Byly měřeny oční pohyby 20 rodilých mluvčích nizozemštiny, během toho, co sledovali bílou obrazovku bez jakýchkoliv explicitních obrazových stimulů a poslouchali věty vytvořené s ohledem na různé kombinace lexikálního a gramatického vidu. Užitá paradigma simuluje případy z běžného života, kdy lidé pasivně poslouchají mluvenou řeč bez doprovodné vizuální složky. Tato studie nabízí důkazy, že gramatický a lexikální aspekt ovlivňují celou řadu očních pohybů. Tato práce je hodnotným rozšířením naší znalosti o psycholingvistické realitě vidu v nizozemštině, jazyce, kterému nebyla v tomto ohledu věnována dostatečná pozornost. Výsledky tohoto výzkumu vnášejí nové světlo do probíhající diskuse o tom, zda i tak abstraktní jazykový element, jakým je gramatika, zanechává měřitelné stopy v našem senzomotorickém systému, a zda je schopný ho ovlivňovat. Navíc tato studie otevírá dveře dalšímu výzkumu zaměřenému na spojení mezi jazykem a mozgovými drahami, které se podílí na zpracování vjemových stimulů.

klíčová slova: jazyk, kognice, interakce, lexikální vid, gramatický vid, oční kamera, konceptualizace, blank screen paradigma, senzomotorický systém, nizozemština

## List of contents

1. Introduction	10
1.1 The current study	12
1.2 Tense and grammatical and lexical aspect	14
1.2.1 Tense	15
1.2.2 Grammatical aspect	18
1.2.3 Lexical aspect	19
1.2.4 Definition of the aspectual terminology for the current study	25
1.3 Temporal properties in the Dutch language	29
1.3.1 Tense and grammatical aspect in Dutch	29
1.4 Interplay of lexical and grammatical aspect in Dutch	41
1.5 Psycholinguistic approach	43
1.5.1 Psycholinguistics of aspect	44
1.5.2 Psycholinguistics of lexical and grammatical aspect in Dutch	46
1.5.3 Blank screen paradigm: rationale	53
1.6 Summary	55
1.7 Research question and hypotheses	56
2. Experiment	60
2.1 Method	61
2.1.1 Participants	61
2.1.2 Technical equipment	63
2.1.3 Materials	63
2.1.4 Experimental design: implemented changes	66
2.1.5 Procedure	69
4. Results	73
5. Discussion and conclusion	78
5.6 Conclusion	87
6. Bibliography	89
Appendices	97
Appendix I – Stimuli	97
Appendix II – Form in Dutch	98
Appendix III – Form in English	99
Appendix IV – Event detailed statistics	100

## Glossary and abbreviations

Acc.	Accusative
ANS	Algemene Nederlandse Spraakkuns (Haeseryn et al., 1997)
Aux.	Auxiliary
concept	If not specified: various combinations of tense, lexical and grammatical aspect capturing the temporal flow of the situation
conceptualisation	If not specified: creation of mental concepts about the temporality by means of the various combinations of tense, lexical and grammatical aspect to capture the temporal flow of the situation
e.g.	exempli gratia, for example
H1-3	hypothesis 1-3
i.e.	id est, this means
ibid.	ibidem, reference for a source that was cited in the previous endnote
imperfective	<sup>1</sup> If not specified by the noun <i>aspect</i> , it is used as a synonym for <i>preterit</i> . <sup>2</sup> In parts about Dutch this term refers to v.t.t.
Kořenář (2016)	In a footnote, this marks a paragraph/sentence, which has been already presented in my earlier article. See the bibliography for more information about this article.
matching conditions	Following combinations of lexical and grammatical aspect: <i>telic-perfective</i> and <i>atelic-imperfective</i>

mental representation	If not specified: combination of various cognitive concepts to mentally capture the experienced temporality of the reality
mismatching condition	Following combinations of lexical and grammatical aspect: <i>atelic-perfective</i> and <i>telic-imperfective</i>
MK	Michal Kořenář
NP	nominal phrase
p.	page
past.part.	past participle
perf.	Perfective aspect
perfective	<sup>1</sup> If not specified by the noun <i>aspect</i> , it is used as a synonym for <i>present perfect</i> . <sup>2</sup> In parts about Dutch this term refers to v.t.t.
pers.	Person (grammatical category)
preterit	synonymously used with <i>imperfective</i> , in parts about Dutch this term refers to o.v.t
pret.	Preterit
prs.	Present tense
o.t.t.	onvoltooid tegenwoordige tijd (incompleted present tense)
o.t.t.t.	onvoltooid tegenwoordige toekomstige tijd (incompleted present future tense)
o.v.t.	ovoltooid verleden tijd (incompleted past tense)
o.v.t.t.	onvoltooid verleden toekomstige tijd (incompleted past future tense)
v.t.t.	voltooid tegenwoordige tijd (completed present tense)



- v.v.t. voltooid verleden tijd (completed past tense)
- v.v.t.t. voltooid verleden toekomstige tijd (completed past future tense)
- v.t.t.t. voltooid tegenwoordige toekomstige tijd (completed present future tense)

*Parts of this work have been presented earlier in my article “Sensorimotor Behaviour Reflects Lexical and Grammatical Aspect in Czech: An Eye Tracking Study”, published in Poljarnyj vestnik, the Norwegian Journal for Slavic Studies in 2016. The concerned parts are marked and referred to in the footnotes as “Kořenář (2016)”*

## **1. Introduction**

The first Czechoslovakian president, Tomas Garrigue Masaryk, once said: „The number of languages you know is the amount of times you are a human being“<sup>1</sup> (Masaryk, 1903). This quote does not refer only to the ability to speak different languages, but also to the way language facilitates cultural immersion, which in turn shapes our identities. If we approached the notion of being a different human being when using a different language ad absurdum, it would also suggest a sci-fi implication that languages could be powerful tools which enable us to change our identity and see the world through different eyes.

This view makes one think of a linguistic hypothesis derived from the American anthropological tradition, formulated by Benjamin Lee Whorf as the “linguistic relativity principle”, also popularly known as the Sapir-Whorf hypothesis. At the heart of this hypothesis lies the idea that different language speakers think differently, because language determines thoughts and analogically, according to Whorf, linguistic categories determine cognitive ones. Moreover, Whorf assumes that the use of different grammars causes different observations and evaluations of the external world in language users (Whorf, 1940/1956, p.221).

Some linguists speak about a dichotomy between the strong and the weak version of the linguistic relativity principle. However, such a dichotomy has never been set up by Whorf or his teacher Sapir (Hill & Mannheim, 1992). The strong version sees language

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<sup>1</sup> Translation MK

as the determiner of cognition, whereas the weak version assumes that language and linguistic categories just influence the way we see the world (Ahearn, 2006).

Indeed, various empirical studies have shown results supporting the notion that language has an attention-directing power for the purposes of categorization. A great deal of the empirical studies concerned domains of colours (e.g. Davidoff, Davies, & Roberson, 1999; Heider, 1972; Regier & Kay, 2009), space (e.g. Haviland, 1993; Levinson, 1996) or time (e.g. Schultz, 1990; Whorf, 1939). In the latest cited study, Whorf argues that the continuous, cyclic abstract notion of time in English arises from the fact that English frames the cyclic time experiences (such as a day, a week...) in the same way as concrete object nouns (*ibid.*).

Even though Whorf compared categorization of time in English with a typologically different language, Hopi, the concept that language influences the way we perceive and experience temporal reality is relevantly applicable on the study of just one language. From Whorf's research arises that language components can change the way we conceptualize the world. Can some language components change the way we perceive and cognitively experience time? How do language users capture the temporal properties of events they are experiencing? In other words: how can language capture the mental representation of temporal properties of events we encounter?

This study aims to enrich our knowledge about the influence of language on conceptualisation. Conceptualisation is a process employed to capture our experiences of the world by the means of cognitive concepts. The concepts arise from the cognitive ability to create mental notions about the reality. The process of combination of such concepts and its subsequent application is called mental representation. To sum up what's been said so far: we create cognitive concepts to capture the observations about the world, such a process is called conceptualisation. To be able to cognitively adequately refer to the word observations, we combine the cognitive concepts with each other, which results in mental representation of how we experience the world. In this work, if not specified, conceptualisation concerns the process, when temporal concepts are created to capture the temporality of the world by the means of language.

Psycholinguistic research has shown that upon hearing a story we construct a mental representation of the communicated event (e.g. Givón, 1992). Some studies show that this construction already evolves during online processing, thanks to instantly accessible language processing cues (Altman & Kamide, 1999; Ferretti, McRae & Hatherell, 2001; McRae, Ferretti & Amyote, 1997). These cues are also employed to capture the intricate temporal structure of the story. They arise from the interplay of the three basic linguistic components (form, meaning and function) and as such are consistent with a constructional view of language (e.g. Fillmore, 1988). Two examples of grammatical markers and lexical categories from which these linguistic cues arise are grammatical and lexical aspect.<sup>2</sup>

### **1.1 The current study**

In the linguistic field, a lot of attention has been paid to analyses of how the sources of temporal cues function within a language system. The most important ones will be described in the subchapter *Grammatical and lexical aspect*. However, there is a lack of empirical data on how grammatical and lexical aspect interact, and what the effects of such an interaction are. The present study aims to investigate the link between the complex system of temporal cues and sensorimotor representation in Dutch speakers, with specific focus on grammatical verb aspect and so called event telicity, i.e. lexical aspect, all of which will be further described in later chapters.

The proposed study investigates the interplay of lexical and grammatical verb aspect in Dutch during mental conceptualisation, by means of an eye tracking experiment using a ‘blank screen paradigm’ (Altmann, 2004). This paradigm has been traditionally used in experiments on visual memory. To my knowledge, this method was used for purely linguistic purposes only twice (Huettenlocher et al. 2014; Korenár, 2016), hence this study adds to these studies’ enrichment of the psycholinguistic methodological repertoire. The advantages and rigours of the used paradigm based on the existing literature will be

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<sup>2</sup> Kořenář (2016)

discussed in the chapter *Methodology*, and its eventual application will be reflected upon in the chapter *Discussion*.

The experimental design of the present study follows from the theoretical, influential and among Dutch linguists largely accepted work of Henk Verkuyl on temporal verb properties (1972, 1973, 1993, 2005, 2008). This framework has to date not yet been revised by means of empirical psycholinguistic methods. This study aims to offer a cognitively relevant attestation of the used aspectual theoretical framework.

Since the terminology on grammatical aspect and other temporal verb properties is volatile, I will provide an overview of relevant studies and will unify them regarding the used terminology.

The overall objective is to test an emergent view in cognitive linguistics that language components as seemingly abstract as grammar bear substantial and measurable influence on our cognition as a whole. The identification and elucidation of this novel aspect of the interrelatedness of language and our conceptualisation of the world, contribute to an integrated understanding of the human mind at the confluence of the fields of linguistics, psychology, and neuroscience.

Concretely, the proposed study will reveal whether mental conceptualisation, as reflected in eye movements, is different when subjects are exposed to Dutch sentences that differ in terms of lexical and grammatical aspect. There are four different aspectual groups, based on grammatical (perfective vs. imperfective) and lexical (telic vs. atelic) aspect (see also the Methodology section) whose interaction will be studied.

This study is novel because it focuses on Dutch, a language which has not been largely empirically investigated regarding its aspectual system yet. Most studies on this topic with comparable methodology were done on English or on Slavic languages. Slavicists have traditionally paid a lot of attention to the research of grammatical aspect. The privileged position of aspect in literature about Slavic languages can be ascribed to the unique way these languages code this linguistic category. Not surprisingly, e.g. Russian or Czech aspectual systems differs substantially from the Dutch one. Even though both English and Dutch belong to the same branch of Indo-European genealogical language family, the way they conceptualise temporality by means of

language is also different. The differences between English, Dutch and traditionally exhaustively studied Slavic aspect will be described.

Importantly, this means that the current study offers new insight on the psycholinguistic reality of grammatical and lexical aspect in Dutch and can be used for valuable cross-linguistic comparisons. At the same time, it is important to note that the degree to which the hypothesized effects rely on grammatical or lexical aspectual differences may not agree with what studies on English would suggest.

In summary, the results of this study may indicate a concrete embodiment of cognition on a lexico-semantic and morpho-syntactic level, in that different constructions of the same reality can be "acted out" by eye movements differently. If confirmed, it would fit with theories of cognitive linguistics and support the idea that grammar, as every part of the language, has detectable mappings from form to meaning and vice versa. It would support the idea that language and all its parts consist of three basic components (structure, meaning and function) which influence each other and reflect our cognition. Specifically, the way in which morpho-syntactic and lexico-semantic properties of verbs in Dutch influence mental representation in a measurable way, will contribute to an interdisciplinary, international pursuit of an integrative understanding of human cognition, facilitating a cross-lingual perspective in the process.

## **1.2 Tense and grammatical and lexical aspect**

Thinking and speaking about events is a process tightly connected with time perception. We can express when an event has occurred with respect to other events; whether it was a durative or a one-time event; whether it was an ongoing or already finished event, etc. Every human language has its own way and extent to which this complex temporal structure of experienced events is expressed. Linguists have defined

many linguistic concepts which help them to describe and compare ways to signify temporal properties of events across languages.<sup>3</sup>

Unfortunately, the terminology regarding temporality is not unified. There are several possible reasons for the terminological variability. One is that, since there are many diverse ways in which concrete languages encode temporal event information, linguists studying concrete languages have often defined their own concepts of linguistic categories and named them differently; take for instance the analogous concepts of *Aktionsart*, *event telicity*, *lexical aspect*, and *manner of verbal action*. Additionally, along with the emergent notion that language should not be considered a discrete module of cognition (e.g. Janda, 2015), the temporality in language has caught the attention of many non-linguists. Those scientist, who conduct their research mostly on English, use a more liberal linguistic classification of temporality. This often leads to situations where two similar but still different categories are lumped together, or where studies based on just one language conclude that our cognition behaves in one or another way, not taking into account that the specific structure of the studied language may have influenced the outcomes the most.

In this paper, three aspectual terms are particularly important: *grammatical aspect*, *lexical aspect* and *tense*. Note that those terms are linguistic categories, i.e. constructs defined by linguists to make the description of languages easier. There are numerous cases when straightforward classification of a language cue into one of the named categories is not possible. Especially challenging is to compare those categories across languages. Given this difficulty, it is important to review the use of these terms in literature and to establish clear definitions for these terms before we move on.

### **1.2.1 Tense**

The category of tense is often referred to as a deictic or grounding category, because it *grounds* an event on the time axis and it *denotes* the position of the event with respect

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<sup>3</sup> Kořenář (2016)

to the time of speech or to other events, enabling the framing of an event as taking place in past, present or future (e.g. Fauconnier, 1994: 22; Reichenbach, 1947: 805-806). Defining the basic function of this category as locating a verbal event in *time* is very traditional and is enhanced by the terminology of many languages in which the same word for *time* and the category of tense is used, e.g. Bahasa Indonesia (*kala*), Czech (*čas*), Dutch (*tijd*), Finnish (*aika*), German (*Zeit*), and Spanish (*tiempo*). One of the biggest disadvantages of this notion is its inability to account for cases where a verb's tense and non-verbal reality mismatch (see examples below).

Within the field of the cognitive linguistics, a new approach to the definition of tense has been employed where the relation between tense and time is considered to be epiphenomenal. Scientists supporting this notion hold that distinction between past and present relates to the amount of mental accessibility of the event analogical to the proximal/distal dichotomy as described in demonstratives (Brisard, 2002; James, 1982; Langacker, 1978). Janssen (1989, 2002) has a very similar conception of the presence/past distinction. In his rendition, he assumes a vantage point in the mental conceptualization of the event from which the language user observes the situation. The category of tense divides the mental field of vision, as he calls it, into two contexts: *verb-in-this-context-situation* (signalled by present-tense verbs) and *verb-of-that-context-situation* (signalled by past-tense verbs).

Not grounding an event to a concrete place on the time axis allows one to account for seemingly controversial instances in authentic linguistic material, such as spontaneous speech. Consider the following instances when the past tense does not refer to the past (1) or the present tense does not refer to the present (2), or the past tense shows opposite deictics even in just a single sentence (3):

(1) Nou, maar ik vertrok morgen!

Well, but I left<sub>preterite</sub> tomorrow!

Well, but I was supposed to leave tomorrow! (Boogaart & Janssen, 2007)



(2) Fred, iemand vraagt naar jou. Kom je even?

Fred, someone asks<sub>prs</sub> for you. Come you just?

Fred, someone is asking for you. Will you come for a minute? (Leech, 2004)

(3) Gisteravond vertrok je morgen en nu vertrek je overmorgen!

last.night left<sub>preterit</sub> you tomorrow and now leave<sub>prs</sub> you the.day.after.tomorrow

‘Last night you were leaving tomorrow and now you are leaving the day after tomorrow! (Janssen, 1994a: 122; Huddleston, 1969: 787)

As is clear from (1), the past tense form does not overlap with anything on the time axis to the left of either the moment of speech or of the adverbial marker *morgen* (tomorrow), i.e. we do not have any satisfactory explanation for the use of the past tense by means of deixis with respect to time. However, the explanation that the Dutch preterit (also called imperfective) was used to express the speaker’s distance from the referred event seems to be plausible (Janssen 1994b). In (2), one can argue that the present tense was used, because the past event referred to by the verb has an ongoing effect on the situation at the time of speaking (Leech, 1987:11; Verkuyl, 2000). It is noteworthy, that according to the time-based traditional Reichenbachian approach, the logical effect of a past event on the present should not change the fact that it should be grounded to the past. On the other hand, it nicely corresponds with the non-time-based alternative rendition: the situation of “asking” is still very current to the speaker, hence the present tense. Note that this stands for cases when we know that the person who is asking for Fred is still there. Imagine a situation when someone asks for Fred and then leaves. Most likely, we would tell Fred that someone *was asking* for him rather than someone *is asking* for him, even when the same time had elapsed after the question. This example strikingly shows a switch from present to past tense that occurs irrespective of time.

This novel analysis of tense can be interpreted in terms of the actuality of information in the speaker's cognition, which we will discuss further using language processing and discourse studies in subchapter 1.5, *Psycholinguistic approach*. Besides through differences in tense, the actuality of information may also be denoted by aspectual differences. For instance, in (1), the use of perfective past tense would be completely inadequate in Dutch, arguably because it would denote more actuality than would the imperfective past tense. This aspectual modulation of actuality will be discussed in subchapter 1.3, *Grammatical and lexical aspect in Dutch*. This analysis of tense and aspect is especially relevant to the current study, as it highlights their interrelation with cognition.

### 1.2.2 Grammatical aspect

Grammatical aspect, in contrast tense, does not carry out a deictic or grounding function to the time axis. It does not link the described event to any discourse grounding, but rather captures the internal temporal structure of the situation (e.g. Comrie, 1976). Arguably, the function of grammatical aspect is to denote the internal temporal properties of a situation and determine to which extent language speakers access the internal temporal flow of the described event. The dichotomy of imperfective and perfective verbs has been observed to occur in many languages and is widely used by many influential aspectual theories (e.g. Binnick, 1991; Comrie, 1976; Dowty, 1986). To describe the effects of aspect, some researchers have proposed a cinematic metaphor, comparing the imperfective aspect to a movie (Kruisinga & Erades, 1955)<sup>4</sup>.

The imperfective aspect allows language users to verbalize the intermediate phase. As such it provides a within-event perspective. In other words, the structure of the various stages of the event is available to the speaker. (e.g. Athansopoulou & Bylund, 2013; Langacker, 1982; Madden & Zwaan, 2003). Using the movie metaphor, if we listen to a sentence in imperfective aspect, the play button is pressed in our brain and we can review the situation with the possibility to concentrate on all stages of the event. Thus,

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<sup>4</sup> Kořenář (2016)

sentences in past continuous in English which express the imperfective aspect such as *Peter was eating a sandwich*, allow the listener<sup>5</sup> to imagine a boy going through the process of eating his snack, from the moment he grabs the sandwich, to the moment he is still chewing his last mouthful. Without adding any additional information, all those stages of the process of eating a sandwich are accessible for mental representation.

By contrast, the perfective aspect refers to an event as bounded and projected to an indivisible unit without emphasizing its internal properties. Thus, the perfective aspect focuses only on the static endpoint of the event as a whole. This distinction is hugely accepted among researchers and supported by various studies on aspect (e.g. Comrie, 1976; Dowty, 1977; Langacker, 1982; Schoorlemmer, 1995; Borik, 2002; Filip, 2000). This does not necessarily mean that the situations which are referred to with perfective aspect do not have any duration or stages. Perfective aspect denies the access to the internal structure of the situation. As a result, there is not a movie playing the different phases of the event, rather just a picture of the situation that represents the event as a whole. One example of how to represent a situation in perfective aspect is past tense in English. In the perfective sentence *Peter ate a sandwich*, the listener mentally reconstructs the event of eating a sandwich as a whole.

### 1.2.3 Lexical aspect

Traditional aspectual literature often draws an imaginary line between two ways in which to refer to the internal and temporal structure of an event. The previous section described *grammatical aspect*, which is expressed by morpho-syntactic grammatical markers that are unique to language. However, the lexico-semantic character of language items can also modulate how the internal and temporal structure of events is conveyed. When a semantic category expresses temporal characteristics of verbal

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<sup>5</sup> The proposed view of the situation is not the only possible one, depending on the cultural and individual experiences regarding the process of eating. For example, for some people the situation starts with the moment the sandwich is brought by the waitress to the table. Nevertheless, the point of this paragraph is to show that various stages of the event are accessible.

predicates by means of their lexical content, this is referred to in literature as *Aktionsart*, *telicity*, or *lexical aspect*.

As mentioned at the start of this subchapter, the meanings of these terms are highly dependent on the philological framework in which they are used. A good example of the distinctive power of context is the usage of the term *Aktionsart*. Because German is traditionally considered not to have grammatical markers to express aspect, the term *Aktionsart* refers to the whole scale of aspectual properties, including properties that in e.g. the Slavonic literature would be ascribed to *grammatical aspect*. By contrast, in Czech literature, *Aktionsart* refers to a linguistic category also referred to as *manner of the verbal action* (for an overview, see Lehečková, 2011). This is just one example of the terminological diversity within research on aspectuality.

We can trace back the first attempts to understand telicity to ancient times. In four of his works<sup>6</sup>, Aristotle describes his philosophical view on action, mind and language. He makes aspectual distinction between *energia*, i.e. “actuality” or “activeness”, and *kinesis*, i.e. “change” or “motion” (Aristotle & Hope, 1968). The translation of *energia* as *actuality* or *actualization* aligns with the Aristotelian notion that *energia*-actions have ends, but they are *actualized* immediately when they begin (Filip, 2012: 721-722). Taking this view, verbs like *singing*, *thinking*, and *playing* can fit the *energia*-group by virtue of being ends in themselves. There is a clear Aristotelian heritage in the work of several linguists (e.g. Dowty, 1979; Bach, 1986) who use the term *Aristotelian classification* in cases where they try to list categories of lexical verbal classes. Besides that, “Aristotelian” in this context usually implies the existence of certain linguistic tests to make the stratification of verbs into several classes as objective as possible, not just based on the introspective decisions of linguists.

In the least specific sense of the term, the category of lexical aspect concerns whether a situation described through verbs reaches some endpoint, or at least has some limit anchored in the verb’s lexical structure. Whether a certain eventuality has or does not

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<sup>6</sup> *Physics*, *Metaphysics*, *Nicomachean Ethics* and *De Anima*

have an endpoint is well known as the telic/atelic distinction. Bach (1981) approaches this bilateral character by proposing an analogy between the semantics of so-called *eventuality types*, and the quality of countability of nouns. Atelic eventualities, which do not have an endpoint, can be compared to mass nouns: if we *daydream*, it does not matter whether we daydream 2 or 200 hours, a single continuous action is described. Similarly, if we add some more water to *water*, we still end up having *water*. Now imagine a scenario in which we *eat up an apple*. This is akin to a count noun: it does matter whether we eat up one apple or a hundred apples, as each instance signifies a discrete process in which an apple is eaten up. In this sense, telic eventualities are akin to count nouns.

The semantic notion of telicity is also a topic of discussion between researchers. This controversy rises from the various definitions of *reaching an endpoint*. For some linguists, the explicit endpoint needs to be present in the predicate to consider the concerned situation as telic (e.g. Dowty, 1979; Filip, 2012; Verkuyl<sup>7</sup>, 2000).

An influential classification of lexical aspect has been proposed by Vendler (1967), who contributed to the study of lexical aspect with his four schemata which imply time by means of English verbs (*idem*: 104). He divided English verbs into four binary classes based on the following three properties: (i) durativity; (ii) whether the situation reaches an endpoint, i.e. telicity; and (iii) whether the situation is dynamic, i.e. undergoing change. These are states (e.g. *know, love*), activities (e.g. *run, walk*), accomplishments (e.g. *break, write a letter*) and achievements (e.g. *reach, recognize*). Table 1 shows how all the verb types are distinguished with respect to their temporal properties. Some

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<sup>7</sup> Verkuyl does not use the terms *telic* and *atelic* to address this phenomenon. Instead, he speaks about the dichotomy *durative* or *terminative*, but he mentions himself, that his definitions of terminativity and durativity are interchangeable with the more common *telicity*. He sticks to his proposed terms in his later works (e.g. Borik, Gonzales & Verkuyl, 2004; Gonzales & Verkuyl, 2017; Verkuyl, 2005, 2008), which he rationalizes by his objections against Aristotelian notion of the word *telos*. This word is translated as ‘goal’. In one of Aristotle’s works, an example is given to account for the distinction between situations with or without a natural endpoint: *oikodomein*. Translations of this term differ crucially, with some using “to build a house”, which is telic, and others using “to build houses”, which is atelic. He argues that ancient Greek is not the right point of departure for terminology dealing with aspectuality in languages where the determiners are crucial in the decision whether a situation is telic or atelic (for the whole argumentation, see Verkuyl, 2015: 142-146).

researchers (e.g. Comrie, 1976; Smith, 1991) also include a fifth verb type, namely semelfactive verbs (e.g. *sneeze, fall*).<sup>8</sup>

TABLE 1	Dynamic	Durative	Telic
State	-	+	-
Activity	+	+	-
Accomplishment	+	+	+
Achievement	+	-	+

As follows from Table 1, the property of telicity<sup>9</sup> is the only one that separates the two classes of activities and accomplishments, which are identical in other respects. Activities can involve various changes of state but do not entail an intrinsic endpoint. For example, the activity *reading Russian literature* does not reasonably imply a natural endpoint. In contrast, *reading two chapters of Ana Karenina* may take some time to finish, but entails a natural endpoint to be reached, making it an accomplishment. Verbs express situations, but one given verb can express more than one. We can see that even though Vendler's classification refers to the *verb classes*, it is not sufficient to examine verbs in isolation to determine the lexical aspect, but that the phrases they are used in must be considered as well.

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<sup>8</sup> Kořenář (2016)

<sup>9</sup> Note, that the distinction between telic and atelic is often considered to be the most prominent regarding the category of lexical aspect (Filip, 2012: 722) and sometimes even the only distinction made regarding the temporal properties expressed by the lexical language units (e.g. Garey, 1957: 106). In the current study, the distinction between telic and atelic will be the most important. That is why I am going to dedicate the attention to the quality of telicity in this paper and how to test it. For the diagnostic tests to distinguish between *states* and *activities*, and *accomplishments* and *achievements* (pairs of semantic verb properties which do not differ from each other in the terms of telicity), see Dowty (1979), Filip (1999) or Lehečková (2012).

As mentioned above, within the Aristotelian tradition telicity is usually determined by means of certain “diagnostic” tests. For English, three tests are very commonly used and their reliability can be supported by the extent to which they are employed for both theoretical (e.g. Comrie, 1976; Dowty, 1979; Boogaart & Janssen, 2007; Filip, 2012, Lehečková, 2011) and experimental linguistic research (e.g. Becker et al., 2013; Kořenář, 2016; Yap et al., 2009).

The first of these tests is based on the observed interaction of the category of telicity with temporal adverbial modifiers. *In NP* and *for NP* modifiers differ in the way they reveal quantitative information about a situation. Witness a telic example (4a) and an atelic example (4b) from Filip (2012: 722):

- (4) a. John recovered in an hour/ \*for an hour.
- b. John swam for an hour/ \*in an hour.

The *in NP* in (4a) expresses the period within which recovery completes. After the moment expressed by the *in NP* elapses, the situation is over. In (4b), the *for NP* cuts out a part of the ongoing situation of swimming and sets the temporal boundaries around this continuous situation. In principle, one cannot see differences between the manner of the described situation at the beginning of swimming and at the end.

The second test uses quantifiers. Vague, imprecise quantifiers go with atelic predicates, whereas quantifiers containing cardinal numbers are compatible with telic situations. See the following examples (5a-b) and (6a-b) from Filip (2012: 723):

- (5) a. Vesuvius erupted three times. TELIC
- b. John slept (\*) three times last night. ATELIC

- (6) a. Vesuvius erupted (\*) a lot. TELIC
- b. John slept a lot last night. ATELIC

It supports the notion that situations expressed by means of telic predicates can be “counted”. This nicely corresponds with the above-mentioned notion of Bach (1981) and it offers evidence for the view that verbs, like nouns, can be sorted into two groups based on whether they are *mass* or *countable*.

The third test arises from the observation of interaction between lexical aspect and progressiveness described by a phenomenon called the *imperfective paradox*. This can be schematized within the framework of propositional calculus:

P: progressive predicate

Q: non-progressive predicate

+/-: telic/atelic

Premise 1:  $P^+ \rightarrow \neg Q^+$

Premise 2:  $P^- \rightarrow Q^-$

Or as Filip (2012) describes it:

*“A progressive sentence with a base telic predicate is true at a given time even if the corresponding non-progressive sentence is false and never can be true.”*

In other words, a telic verb in non-progressive does not logically follow from the same sentence in progressive, which was true. Take the example of a telic verb predicate in (7):

(7) a. John is recovering. ( $P^+$ )

b. John has recovered. ( $Q^+$ )

If it is true that John is in the process of recovering after an injury, it cannot simultaneously be true that he already *has recovered*. That is why the premise  $P^+ \rightarrow \neg Q^+$  is in accordance with the actual situation. Logically, one cannot be recovering from an injury that is also already healed. A different situation arises when an atelic predicate is tested, as shown in (8):

(8) a. John is swimming. ( $P^-$ )

b. John has swum. ( $Q^-$ )

Take Premise 2 ( $P^- \rightarrow Q^-$ ): If it holds that John is swimming, we can conclude that he has swum too. As an end in itself, swimming fulfils its purpose continuously, both now and as soon as it began. Empirically, we know that if we see someone doing something,



she must have started doing it at some point in the past. Hence, both sentences in (8) are true, and Premise 2 applies: the situation is atelic.

Notably, the name *imperfective paradox* addresses a terminological issue often seen within aspectual research. Dowty (1977, 1979) labelled this observation using the established term *imperfective* from the domain of grammatical aspect. This label works for English, in which the *imperfective aspect* is built by the means of formal progressive marking *be<sub>past</sub> + -ing*. However, when applying this test to other languages, where *imperfective* can also have non-progressive interpretations, this term is inaccurate.

As we can see, drawing the line between these three crucial categories (tense, grammatical aspect, lexical aspect) is not easy, and a careful definition of these terms should be established. I do so in the following section.

#### **1.2.4 Definition of aspectual terminology for the current study**

In last three subchapters, we reviewed the concepts of tense, grammatical aspect and lexical aspect as described in influential aspectual studies. In cognitive linguistics, the terms lexical and grammatical aspect often merge together without any explicit attempt to distinguish between them. One can argue that this can be perfectly reasonable (Langacker, 1987, 1999; Croft, 1989). For instance, Langacker only makes a distinction between *perfective* and *imperfective*, arguing that “*English verbs divide into two broad aspectual classes, my terms for which are perfective and imperfective*” (1999: 223). He bases the adequacy of this distinction on cognition, arguing that “[t]he distinction is of a ‘*primal character*,’ since it is related to the basic cognitive capacity of perceiving change (*perfective*) or the lack thereof (*imperfective*)” (Langacker, 1987: 258, as cited in Boogaart & Janssen, 2007).

Nevertheless, while a more simplistic framework like that used by Langacker may sufficiently make aspectual distinction from a cognitive perspective, there are good reasons to maintain a more comprehensive framework. First and foremost, in experimental studies, the variables of interest should be carefully isolated and manipulated across conditions. Loose definitions underlying experimental

manipulations can hamper the interpretation of results, as they are more prone to reflect multiple conflated linguistic properties. One reason this is especially true in the case of grammatical and lexical aspect is the fact that they address distinct components of linguistic analysis, which is also pertinent outside the experimental realm (e.g. Klein, 1994:30; Schmidtová & Flecken, 2008). This becomes most readily apparent when considering cross-linguistic perspectives.

Every human language has its own way to grasp the internal temporal flow of a situation and may differ in the extent to which this complex temporal structure of experienced events is expressed. Whereas some languages give relative prominence to the morpho-syntactic structure and are considered to have a highly complex system of grammatical aspectuality (e.g. Czech, Arabic), others have reserved a leaner repertoire of grammatical means to convey aspectual contrast (e.g. Dutch and German).

For example, in Czech, aspect is marked by aspectual affixes (often prefixes, sometimes suffixes), resulting in overtly marked verb pairs<sup>10</sup> that denote grammatical aspect. Telicity on the other hand can be expressed by many means in Czech, such as pragmatics, argument of the predicate, temporal adverb, etc. These different components of linguistic analysis are apparent from the following examples (9a) in Czech and (9b) in English, where morpheme-by-morpheme glosses are used:

- (9) a. (ona) U-my-l-a sklenic-i.  
(She) Perf-wash-Past-3sg glass-Acc.  
'She washed a glass.'
- b. She wash-ed a glass.  
She wash-past a glass.

In (9a), the Czech verb is overtly marked by a prefix *u-* as perfective, and the telic nature of the predicate can be inferred from the countable indefinite object *glass*. Here, grammatical and lexical aspect are readily identified through two different components

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<sup>10</sup> Aspectual triplets

of linguistic analysis. By contrast, in the English example in (9b), while telicity is similarly indicated by the indefinite object, perfectivity is not marked overtly. Arguably, both of the sentences express reaching an endpoint, in this case *a clean glass*, yet both categories involve two different operations. If we do not mark the perfectivity in Czech, as is shown in example (10), then an ongoing, rather than a bounded, situation results:

- (10) (ona) Myla-a sklenic-i.  
 (She) wash-Past-3sg glass-Acc.  
 ‘She was washing a glass.’

Thus, in Czech, grammatical aspect is overtly marked on the verb and telicity is, as in English, marked with the argument of the predicate. In Czech, this happens independent of tense, which enables a Czech speaker to express the aspectual boundedness in the present using the present tense without changing the ongoing temporal flow of the situation. See the following example<sup>11</sup>:

- (11) (ona) Myj-e sklenic-i.  
 (She) wash-Present-3sg glass-Acc.  
 ‘She is washing a glass’

By contrast, in English, the switch in tense from past to present becomes a bit problematic as the meaning of the sentence changes:

- (12) She washed a glass. PAST SIMPLE  
 She washes a glass. PRESENT SIMPLE

In the past simple, the predicate expresses a perfective situation which reaches its endpoint (i.e. is telic). By contrast, the present simple tense usually reflects a habitual activity, which requires a further contextual placing that would explain the habitual

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<sup>11</sup> In Slavic languages, the present perfect is interpreted as a future situation (Umyje nádobí – She will wash the dishes) (Bybee & Dahl, 1989; Isačenko, 1982; Petr, 1986). However, the recent psycholinguistic research shows, that verbs in present tense marked as perfective can express *hic et nunc* meaning too (Schmiedtová, 2004).

character (e.g. *What does your mother do when she wants to calm down after a horrible fight?*). If an English speaker would like to move the static, perfective, telic situation across the time axis from past to present, she is forced to switch the aspect as well, which in English is marked by the progressive form of the continuous tense:

(13) She is washing a glass.

It follows that, in English, the change in tense goes hand in hand with a change in grammatical aspect. On the other hand, the value of telicity, or lexical aspect, remains intact across the tenses. This example illustrates that the borders between categories are not readily transferable across languages, and that attempts at one-to-one mapping can be very misleading.

For the reasons outlined above, clear definitions distinguishing between grammatical and lexical aspect are necessary for this study, especially if its results are to be compared with existing studies on English (Huettenlocher et al., 2014) and Czech (Kořenář, 2016) that use the same methodology and experimental paradigm.

To sum up what has been written so far:

1. The distinction between lexical and grammatical aspect is favourable because those two categories require different treatments regarding linguistic analysis.
2. The distinction based on structural differences is favourable for the experimental design and subsequent cross-linguistic analysis.

Therefore, I adhere to a structural distinction between lexical and grammatical aspect, that is based on the form they realize to change the way a situation is viewed: morphological and syntactic markers are ascribed to grammatical aspect and lexical and semantic ones to lexical aspect.

I hope I succeeded in explaining that in the broadest sense, aspectual categories express the temporal properties of a situation and code the way we view described situations. I have also mentioned in what sense the category of tense influences the way we view a situation and I have proposed the largely accepted definition of tense as a “grounding” category, making explicit that the grounding does not need to refer to the

time axis but to a distance between the situation and the speaker, respectively between the situation and the addressee. As I will further explain in chapter 1.3, *Grammatical and lexical aspect in Dutch*, the category of tense is closely related to that of grammatical aspect in the Dutch language. Because tense is morphologically marked, it corresponds with the distinction between lexical and grammatical aspect used in this work. As a result of this, the category of tense will be treated and referred to as grammatical aspect. More elaborate support for this will be presented in the next section.

### 1.3 Temporal properties in the Dutch language

In the previous section, I outlined influential literature on aspectual categories and established the terminological apparatus for the current study. As the Dutch language lies at the heart of this thesis' research focus, we will now examine the concepts of tense, and grammatical and lexical aspect in the context of Dutch linguistics. In so doing, the tools used in the Dutch language to code temporal properties and this study's approach toward them will be discussed.

#### 1.3.1 Tense and grammatical aspect in Dutch

It is hardly possible to discuss verb systems in Dutch without mentioning Te Winkel, as the model he proposed in 1866 underlies the conventional view in Dutch grammar (Janssen, 1987). His classification is based on a triplet of binary oppositions:

- i. Present X Past
- ii. Imperfect X perfect
- iii. Future X non-future

The combinations of these binaries yield a verbal system of eight possible tenses:

TABLE 2 (te Winkel, 1866)		PRESENT	PAST
NON-FUTURE	IMPERFECTIVE	<i>Present simple (o.t.t.)</i>	<i>Past simple (o.v.t.)</i>
	PERFECTIVE	<i>Present perfect (v.t.t.)</i>	<i>Past perfect (v.v.t.)</i>

FUTURE	IMPERFECTIVE	<i>Future (o.t.t.t.)</i>	<i>Future in the past (o.v.t.t.)</i>
	PERFECTIVE	<i>Future perfect (v.t.t.t.)</i>	<i>Future perfect in the past (v.v.t.t.)</i>

In Table 2, the bracketed abbreviations denote Dutch tenses for each combination of the binary triplet. Not just to please Dutch readers of this thesis, who may be familiar with the traditional Dutch terminology, but to explore some interesting issues regarding the Dutch verb system, let us consider the literal translations of the full Dutch terms in the following list, marked as examples (14a-h):

(14)	<i>Dutch/English name of the tense</i>	<i>Dutch/English example</i>
a.	onvoltooid tegenwoordige tijd (o.t.t.) uncompleted present tense	ik werk I work
b.	voltooid tegenwoordige tijd (v.t.t.) completed present tense	ik heb gewerkt I have worked
c.	onvoltooid verleden tijd (o.v.t.) uncompleted past tense	ik werkte I worked
d.	voltooid verleden tijd (v.v.t.) completed past tense	ik had gewerkt I had worked
e.	onvoltooid tegenwoordige toekomstige tijd (o.t.t.t.) uncompleted present future tense	ik zal werken I will work
f.	voltooid tegenwoordige toekomstige tijd (v.t.t.t.) completed present future tense	ik zal gewerkt hebben I will have worked

g. onvoltooid verleden toekomstige tijd (o.v.t.t.) uncompleted past future tense	ik zou werken I would work
h. voltooid verleden toekomstige tijd (v.v.t.t.) completed past future tense	ik zou gewerkt hebben I would have worked

As you can see, the name of each verb form contains explicit information about whether or not the verb expresses a completed situation, whether it refers to a situation in the past or the present, and whether or not reference to the future is made (although this last property is omitted absent reference to the future). Regarding the terminology in Dutch and what it reveals about the Dutch verb system, I would like to address two observations occurring in linguistic literature.

First, rather than a grammatically marked future tense, Dutch uses a pragmatic one. This has led to the seemingly controversial statement that the Dutch language has no future tense. Even though most Dutch speakers would intuitively disagree, as they feel quite capable referring to situations which are set to happen in the future, linguists across different traditions seem to have reached a consensus regarding this topic (Boogaart, 2013; Harmsen, 2006; Janssen, 1987; Verkuyl & Broekhuis, 2013a). The main argument of research using the traditional, implicitly based methods, is that the auxiliary verb *zullen*<sup>12</sup> merely expresses the speaker's estimation that the described situation has a very high probability of happening. This arguably confirms the non-temporal character of the concerned grammatical construction, as per the following examples (15a-b) from Boogaart (2013):

(15)a. Marie zal een afspraak met hem maken

Marie will<sub>3, person, present</sub> a meeting with him make<sub>infinitive</sub>

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<sup>12</sup> Translated as and compared to the English verb *shall* or the German modal verb *sollen*. (e.g. Harmsen, 2006)

Marie will (shall) make a meeting with him.

- b. Marie maakt een afspraak met hem.

Marie makes<sub>3.person.present</sub> a meeting with him.

Marie will make a meeting with him.

According to Verkuyl (2012), the absence of the auxiliary verb *zullen* has nothing to do with the temporal location of the meeting. The difference is just in modality; in (15a), the certainty of the meeting being made is moderated by the verb *zullen*.

Notably, there are some studies struggling whether it is cognitively adequate to completely discard the temporal function of *zullen*, resulting in the more moderate position that the modal function of *zullen* is dominant, but that there are situations where the temporal interpretation of *zullen* is also possible (Janssen, 1989; Kirsner, 1969). They argue, that both the temporal and epistemic interpretation of *zullen* are connected on a gradual scale and we can find examples of both more temporal and more epistemic uses of *zullen*. The reasoning for such a notion is based on embodiment, connecting distance in space and time with epistemic distance.

A *Construction grammar*-based approach offers empirical data from corpus analysis, which support this notion by presenting numerous cases where the absence of *zullen* disables the future interpretation of the sentence, as in (16) (Kroezen, 2016):

- (16) De Graafschap zal de ruimtes klein maken en opportunistisch spel laten zien.

De Graafschap<sup>13</sup> will make the places small and show an opportunistic play.

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<sup>13</sup> *De Graafschap* is a Dutch football club based in Doetinchem.



One can argue that there is a very nicely illustrated modal, epistemic character of the word *zal* in (16). However, if we delete the word *zal*, there is nothing that indicates the future occurrence of the situation. The sentence without *zal* just expresses the general character and strategies of De Graafschap, rather than future plans (for the discussion on this topic see Boogaart, 2013; Verkuyl & Broekhuis, 2013b; for review see Kroezen, 2016).

While I will not use the future/non-future-binary using *zullen* in my experimental design, the previous discussion does carry relevance to this thesis. First, the debate on the existence of a Dutch future tense has drawn considerable academic attention to the aspectual system in Dutch, providing a fruitful substrate for discussion across various linguistic schools. Among other things, this has led to the notion that the interpretation of the verbal forms in Dutch is highly dependent on the whole predicate. Furthermore, the modality-temporality opposition highlights the notion that distance in time and various manners of time flow as expressed by linguistic elements may correspond with cognitive processing and the perceived distance to the speaker in terms of space and relevance. The aim of the current study is built on an idea that builds on this possibility: that a connection can be found between temporal properties conveyed in sentences through aspect and tense, and eye movements.

A second point I would like to discuss regarding the Dutch names for verbal forms concerns the voltooid/onvoltooid part. Like in English, every name of a *tense* includes information about whether the verb action is *completed* (voltooid in Dutch, perfect in English) or not. In Czech or Russian, we can distinguish between verbs which stand for completed or not completed situations (further outlined in subchapter 1.2.4), the so-called *dokonavý* (completed) or *nedokonavý* (incompleted) *vid*<sup>14</sup>. But we do not mention the type of the *vid* in the name of a verbal tense, simply because the aspectual marker is not contingent on the tense of the verb. The fact that Dutch tenses do include this

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<sup>14</sup> The term *vid* comes from the Latin verb *videre* – *to see*, which denotes the *viewpoint* of the situation.

information is the first sign, that in Dutch the tense not only changes the deictic position of the situation on the time axis, but also the inner temporal flow of the situation.

One of my research objectives is to draw cross-linguistic comparisons of the influence of aspect on conceptualisation. Existing experimental work on aspect uses verbs in the past tense (e.g. Huette et al. 2014; Kořenář, 2016; Mattlock, 2010; Yap et al., 2009; for further studies see the chapter 1.4 *Psycholinguistic approach* of this thesis). To facilitate comparison with this research, the incorporation of past tense conditions in the current study is an obvious decision. In this thesis, two tenses will be compared with respect to the ocular behaviour they instigate, *voltooid tegenwoordige tijd* (completed present tense; 13b) and *onvoltooid verleden tijd* (uncompleted past tense; 14c). Both arguably express past situations while differing in terms of grammatical aspects, i.e. the former is perfective, and the latter imperfective. Dutch grammar and language books for foreigners usually mention two ways to express the past: preteritum (14c) or perfectum (14b) (e.g. Fontein & Pescher-Ter Meer, 2000; Ham et al., 2007; Trnka & Krijtová, 1990), Let us examine these two tenses more closely.

### **Voltooid tegenwoordige tijd (v.t.t.)**

The Dutch present perfect (14b) consists of a form of the auxiliary verbs *hebben* (to have) or *zijn* (to be) and a past participle. It is easy to get thrown off by the word *tegenwoordig* (*present*) and the absence of an explicit reference to the past in the term. The name connects two pieces of seemingly contradicting information as it says that the situation is *completed*, but also *present*. *Algemene Nederlandse Spraakkunst*<sup>15</sup> (ANS) (Haeseryn et al., 1997) describes the v.t.t. as referring to a situation which has occurred in the past but still has an influence in the present. Literally, ANS states that v.t.t. is used when “the past and present merge”. Verkuyl (2001) describes the usage of this verb form as an invitation for someone to see a very brief scene that shows what happened in the past. By using v.t.t., the person who is showing us the picture expresses that he wants us

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<sup>15</sup> General Art of Dutch Language (translated by MK); available online via <http://ans.ruhosting.nl/e-ans/index.html>, retrieved 12 July, 2017

to look at what happened in the picture from the perspective of the moment when the picture is showed, from the perspective of the moment of speaking. Verkuyl also ascribes to the v.t.t. a *terminative* character, a quality akin to *telicity* (his preference for the terms *terminative-durative* over the more commonly used *telic-atelic* is described in footnote 4 of this thesis).

Henriëtte de Swart (2007) too agrees that v.t.t. facilitates looking at a situation in the past from the present perspective. She distinguishes between the time of speech and the time to which reference is made, arguing that the two are closely connected in the case of v.t.t.. Moreover, she states that the perfective only offers limited access to the phases of the situation, arguing that it refers to a situation as a whole with boundaries from the right side as the default meaning of perfective in Dutch, French and English. However, she points out the need to analyse the compositional context of the sentence in order to be able to decide whether the situation is finished. Finally, De Swart (2007) shows that besides describing the situation, Dutch v.t.t. also introduces the listener to its result, which follows immediately after the presented situation.

Thus, the v.t.t. has two distinct features as (i) it presents a situation retrospectively and (ii), relevant to the current study, v.t.t. shows the situation as a complete whole along with its result.

We don't have to rely on the introspective interpretation of functions of v.t.t. based on synchronic research. Identification of those two features is also supported by diachronic studies on grammaticalization processes which has led to the emergence and establishment of this verbal form (De Haan, 1991; Duinhoven, 1988). Those features can be detected in the semantic structure of the Old Germanic language. There, the verbal adjective was transformed into the past participle which makes the lexical core of the v.t.t. construction. At that time, the predicative complement of the direct object was the verbal adjective. The connection between the verbal adjective and the direct object was broken in favour of the attachment of the verbal adjective to the verb *hebben*. *Hebben* became the auxiliary of the past participle, resulting into the full grammaticalization as we observe nowadays, as the v.t.t. construction can be used without any constraints with

every Dutch verb<sup>16</sup>. On the one hand, the auxiliary stayed in its present tense form, representing in this analysis the retrospective point of view from the moment of speaking. On the other, the past participle captures the situation as a whole (De Haan, 1991, Duinhoven, 1988; Overdiep, 1923).

### **Onvoltooid verleden tijd (o.v.t.)**

The Dutch past simple is also referred to as preterit or imperfect. As both the English and Dutch names suggest, this tense allows access to the unbounded situation. This verb form is made morphologically by means of the suffix *-te* or *-de* added after the root, or by an irregular preterit form. No auxiliaries are used. ANS proposes a clear definition of use for this verb form, stating that o.v.t. is used to refer to situations which happened before the moment of speaking (Haeseryn, 1997: 128-129). As I have thoroughly described the possible interpretations of v.t.t., we will explore the function of o.v.t. contrastively by comparing the two verb forms with each other.

### **Comparison of v.t.t. and o.v.t.**

A very practical definition to give an overall idea when these two verb forms can be used was given by Clement (1997). She says that preterit (o.v.t.) is used to tell a story, to lively describe a situation we have experienced, whereas perfect (v.t.t.) is used to give a brief overview, a conclusion, to give facts or results, which can be captured in one 'shot'. She also explains these terms somewhat metaphorically using the concept of *reality*. When a speaker uses the perfect, he refers to a past moment of *a reality* in which he has participated; this past can only be seen as a past preceding the moment of speaking on the same timeline. By contrast, preterit refers to the past more as if to *another reality*, another timeline, separate from the one the speaker is located on (Clement, 1997: 98).

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<sup>16</sup> This is defined as the last step of a grammaticalization process in Bybee et al. (1994).

I do not share the idea that speakers use imperfective just to refer to realities outside their own *hic et nunc*. Consider the following example (17):

(17) Ik ging naar mijn moeder en heb daar groenten gegeten.

I went<sub>preterit</sub> to my mother and have<sub>e<sub>3,pers.aux</sub></sub> there vegetables eaten<sub>past.pasrt.</sub>

I went to my mother's and ate vegetables there.

It is unlikely that the speaker identifies himself in the sentence (17) as simultaneously making part and not making part of the described reality. Nevertheless, while the notion of preterit referring to a past in an alternative reality may be too strong, I think it does share similarities with the description of epistemic deixis as proposed by Janssen (1989; the principles of this approach have been described in subchapter 1.2.1 *Tense* of this work). Because the v.t.t. consists in part of a finite verb in the present tense, the semantic information contained in the predicate is much closer to the language user, or as Janssen calls it, much more *actual*, than the preterit. In Janssen (1989), the difference between those two forms is based on the level of focus. V.t.t. describes situations which are still actual for the speaker, which puts them in the foreground of the listener's attention.

ANS also speaks about the differences between v.t.t. and o.v.t., providing the following overview:

TABLE 3

Voltooid tegenwoordige tijd – present perfect	Onvoltooid verleden tijd – past simple
Referring to the situation which (has) happened before the moment of speaking	
a. Incidental happening	Indefinite duration or a habit
b. the effect of the situation lasts till the moment of speaking	the effect of the situation does not last till the moment of speaking
c. Not connecting the situation to a specific point in the past	Connecting the situation to a specific point in the past

The first difference mentioned in Table 3 concerns the duration of the situation and as such is in line with the aspectual property which those verb forms inherently imply. Let me illustrate the differences in implied duration for both tenses with an example (18) from Haeseryn et al (1997):

- (18) a. Vorig jaar heeft opa nog gefietst.  
 Last year has<sub>aux.3.pers.present</sub> grandfather still biked<sub>past.part.</sub>  
 Last year, grandfather still biked.
- b. Vorig jaar fietste opa nog.  
 Last year biked<sub>preterit</sub> grandfather still.  
 Last year, grandfather was still biking.

The sentence in (17a) means, that last year the grandfather went biking on one or perhaps a few particular occasions. The second sentence (17b) means that, last year, the grandfather was still biking on a regular basis.

Regarding distinction (b) in Table 3, I have already mentioned that v.t.t. expresses a situation from the past which has an effect on the moment of speaking. To show that this does not hold for o.v.t., consider the following example (19) given by ANS:

- (19) a. Het heeft vannacht geregend: de straat is nat.  
It has tonight rained<sub>past.part.</sub>: the street is wet.  
It has rained tonight: the street is wet.
- b. \*Het regende vannacht: de straat is nat.  
It rained tonight: the street is wet.  
It was raining tonight: the street is wet.

In ANS it is stated, that the example in (19b) is impossible. However, I would argue that given a certain context, (19b) can be a correct sentence. Imagine a situation when you lie in your bed in a room with the curtains closed. You hear some indistinct sounds. You start an argument with your partner, disagreeing on whether or not it is raining. The next morning you open the window and see that the streets are wet. You jump back to bed satisfied and tell your partner you were right, using the sentence in (19b). Nevertheless, even though we can find some contexts where the preterit can be used, seemingly having an effect on the moment of speaking, it does not discard the primary function of this verb form. Furthermore, one can argue that the use of imperfect in the scenario just described has nothing to do with a remaining effect on the moment of speaking. By reframing the situation in terms of pragmatical circumstances, we root the situation to a concrete point in the past, or as Clement (1997) would say, to a different reality. From this we naturally proceed to point (c) of the table 3.

The third comparison mentioned in ANS is whether or not a situation is connected to a concrete moment. In ANS, the following example is given:

- (20) a. Zij heeft nog op krukken gelopen.  
 She has still on crutches walked.  
 She still walked on crutches.
- b. Zij liep nog op krukken.  
 She walked still on crutches.  
 She was still walking on crutches.

In (20a), the person has walked on crutches in a not specified past, which can be proven by the possibility to add a non-specific deictic temporal adverb *ooit* (*at some point*) to the sentence, resulting in: *Zij heeft ooit op krukken gelopen* (*At some point, she has walked on crutches*). If we use the o.v.t. as in (20b), we root the sentence to a concrete time in the past, which can be proven by the possible addition of the concrete deictic temporal adverb *toen* (*at that time*).

Another good example of this distinctive feature of imperfective is given by Koefoed (1984: 146), who argues, that we cannot open a conversation with the sentence *Ik ging naar Rotterdam* (*I was going to Rotterdam*). According to him, the interpretation of such a sentence would not go smoothly, because the speaker did not offer to the listener the reference framework of a reality to which he could tie this situation. A Dutch speaker would in this case probably interpret such a sentence modally, relying on another function of Dutch imperfective than a temporal one. For more discussion on the modal function of o.v.t., Haeseryn et al., (1997) and Bouwmans (2015) provide overviews.

In summary, both v.t.t. and o.v.t. concern past tenses, but show different grammatical aspects, i.e. perfective and imperfective, respectively. The most notable additional qualities imparted through grammatical aspect that are characteristic to the Dutch language are the boundedness of the described situation, the effect to the moment of speaking and the presentation of the endpoint. The imperfective is used for not bounded situations, enabling to access all the stages of the ongoing event. It requires a temporal reference framework to account for.



## 1.4 Interplay of lexical and grammatical aspect in Dutch

If a language user decides to tell a story, he uses a whole palette of linguistic elements, which are unwittingly chosen to match the mental concept of the situation that is being described. On the basis of these elements, the speaker also creates a “temporal package” of the situation. With the grammatical elements in Dutch being discussed above, I will now address the lexical elements that help build this “temporal package”. It has been mentioned before, that it is not enough to determine telicity by looking just at the verb, but that the whole clause needs to be taken into consideration (Mourelatos 1978; Dowty 1979). For instance, *to read* is atelic whereas the entire predicate *to read a book* is telic.

For the purposes of experimental design, it is necessary to have a set of rules which allows for a mechanical and explicit way to determine of the category of telicity. In Dutch linguistics, an elaborate proposal in this direction has been made by Verkuyl (1933), and its basic principle will be used for this study. His notion of the temporal system proceeds from that of te Winkel (1866), based on the triplet of binary oppositions, but he does not include the opposition *future-non future*, which results in the quadrant shown in Table 4, where the grammatical opposition *perfective* and *imperfective* is crossed with the lexical opposition *telic – atelic*<sup>17</sup> as you can see in the examples (21-24) :

TABLE 4 (Verkuyl,2000)	<b>Imperfective (o.v.t.)</b>	<b>Perfective (v.t.t.)</b>
<b>Durative (atelic)</b>	(21) a. Zij at. She was eating.  b. Ik liep. I was walking.	(22) a. Zij heeft gegeten. She ate.  b. Ik heb gelopen. I walked.

<sup>17</sup> Verkuyl uses terms *durative* and *terminative*.

<b>Terminative (telic)</b>	(23) a. Zij at drie appels. She was eating three apples.  b. Ik liep een halve km. I was walking 0,5 km.	(24) a. Zij heeft drie appels gegeten. She ate three apples.  b. Ik heb een halve km gelopen. I walked 0,5 km.
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As you can see in Table 4, Verkuyl (2000) includes seemingly conflicting perfective durative instances in (22), as well as imperfective terminative instances in (23). That is, even when imperfective (*onvoltooid*) is used, a telic character can be achieved through a clever choice of nominal argument; in the case of (23a), this is the direct object “three apples”. Similarly, the perfective (*voltooid*) tense is used in (22), but by skipping the argument we can get a durative, atelic predicate. Verkuyl’s proposed system accommodates for these seeming inconsistencies.

In fact, when using Dutch imperfective, the related properties discussed in subchapter 1.3 still hold even in the telic example in (23). We still get access to the various stages of the event. Putting a natural, logical endpoint to this predicate in the form of one or more bounded objects like three apples does not deny the speaker the access to the film-like processing of the sequences of the situation. We can imagine a person eating three apples through all the stages of the situation – eating the first apple, the second one, half of the third etc.

Similarly, the telic difference between (22a) and (24a) does not change the fact that both of those situations are bounded by the perfective. That the listener has extra information about what was eaten in (24a) does not change the fact that the listener does not have the access to the different stages of the situation (*idem*). Instead, whereas in the atelic sentence (22a), the woman may still be eating as she has done before, in (24a) we know that the eating of the three apples was completed.

Thus, the perfective and imperfective sentences prime the listener to access the situation in what was previously explained as a picture or a movie, respectively, even

when telicity mismatches in terms of completeness of the situation, as in (22) and (23). Similarly, the telic and atelic sentences denote or omit an endpoint, irrespective of whether the situation is bounded through grammatical aspect.

There is general agreement among Dutch linguists on how other temporal elements in a sentence can be approached. Differences can be found regarding the extent to which they propose rules and methods for adding or removing endpoints. Dowty (1986) proposes a set of *compositional semantic rules* which have been further worked out by Krifka (1992) and exhaustively described by Verkuyl (1993). In his dissertation, Verkuyl uses various sentence constituents that can seemingly influence the temporal character of sentences regarding both lexical and grammatical aspect. The fact that he used generative grammar as his point of departure raises the concern whether this approach, despite its exhaustive and rigorous character, can account for cases when the interpretation of lexical aspect is highly dependent on the context, or even on knowledge about the world, rather than exclusively on grammar (Boogaart, 1999).

I have taken into a consideration those concerns, as well as the fact that Verkuyl (1993) provides invaluable work in the field of aspectology in Dutch, in spite of its purely grammar-based character. I would argue it is highly relevant to use the rules mentioned in Verkuyl (1993, 2000) for the purposes of my experimental design, and will use them as a blueprint for the different conditions in my experimental design, as further described in chapter 2.2.3 *Materials*.

## **1.5 Psycholinguistic approach**

One of the basic premises of cognitive linguistics is that language is an intrinsic part of our cognition, and that all the cognitive functions share a degree of neural capacities. Under this assumption, grammar and its processing bears an influence on our conceptualisation. Ideally, this influence should be measurable at all levels of higher cognitive behaviour. Since the term *psycholinguistics* has been used for the first time in 1936 by Jacob Robert Kantor (Levelt, 2013), the field has come a long way, being an established and respected discipline with its own rich methodological apparatus. Using

a wide range of behavioural methods adapted from psychology, sensorimotor measurements which were inspired by cognitive science, and neural imaging methods used in neuroscience, this integrative discipline has a great potential to broaden our knowledge in cognitive aspects of language structure and usage (*idem*).

As apparent from the work discussed so far, the study of aspectuality in language has been thoroughly studied by many linguists regardless of the language they studied or the theoretical background they came from. In this section, three subchapters will present (i) an overview of the psycholinguistic literature on aspect in other languages than Dutch; (ii) psycholinguistic literature on aspect in Dutch; and (iii) two earlier studies using a blank screen paradigm, which will be similarly employed in the present study. This part of my work aims to provide evidence connecting lexical and grammatical aspect to conceptualisation, as reflected in sensorimotor behaviour.

### **1.5.1 Psycholinguistics of aspect<sup>18</sup>**

Psycholinguistic evidence shows that grammatical aspect influences the conceptualisation of encountered event (Carreiras, Carriedo, Alonso, & Fernandez, 1997; Coll-Florit & Gennari, 2011; Ferretti, Rohde, Kehler & Crutchley, 2009; Ferretti et al., 2007; Madden & Therriault, 2009; Madden & Zwaan, 2003; Magliano & Schleich, 2000; Matlock 2010; Matlock, 2011; Matlock, 2012; Matlock et al. 2012). One experiment by Madden & Zwaan (2003) uses a visual word paradigm, in which users of language were asked to look at a screen with pictures showing finished or unfinished events, whilst hearing an event description employing either perfective or imperfective aspect. If the event was described in perfective aspect, subjects preferred looking at pictures with finished events, whereas they showed no specific preference in the imperfective condition. Given that the imperfective aspect allows for focus to be placed on different phases of an ongoing event, a more detailed mental representation is constructed. Consistent with this idea, information about place (Ferretti et al. 2007) and characters (Carreiras et al. 1997) is more accessible while using the imperfective aspect rather than

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<sup>18</sup> Kořenář (2016)

the perfective one. This is also supported by Matlock (2011), who found in her offline processing studies on grammatical aspect, that when asked to complete an imperfective sentence, participants consistently mentioned more details of the action they were referring to than in the case of a perfective sentence.

This work aims to investigate how the category of telicity and the morpho-syntactic category of aspect interact with our mental representation, and how this interaction is grounded in our sensorimotor experiences. Unfortunately, most of the empirical studies on grammatical and lexical aspect investigated only one of those verb properties. That is why it remains unclear how lexical aspect interacts with grammatical aspect to constrain representations. Only a few studies have addressed this issue (Gennari & Coll-Florit, 2011; Pinango, Winnick, Ullah, & Zurif, 2006; Piñango, Zurif, & Jackendoff, 1999; Yap et al., 2009).

In a study on Cantonese, a language rich in aspectual marking, Yap et al. (2009) demonstrated facilitated processing of events when the inherent telicity of accomplishments is matched with the perfective markers and its boundedness and completedness features. They also show that imperfective markers facilitate the durative character of activity verbs which are characterized by ongoingness. In other words, imperfective sentences were processed faster and with higher accuracy if they were expressed by activity verbs, whereas this was the case for perfective sentences when accomplishment verbs were used.

In another study, Becker et al. (2013) go beyond the Yap et al. (2009) findings by investigating grammatical aspect manipulation in short stories using accomplishment and activity verbs. They explored how resistant the effects of lexical and grammatical aspect are to a third basic source of temporal information, so-called time shifts proceeded by short (e.g. *She picked a tomato; She sneezed*) and long intervening events (*She weeded the garden; She painted a picture*). The presumptions of the Becker et al. study are based on the finding that concepts preceding short temporal events are more available later on in the discourse than those preceding long ones (Anderson, Garrod, & Sanford, 1983; Bestgen & Vonk, 1995; Ditman, Holcomb, & Kuperberg, 2008; Kelter, Kaup, & Claus, 2004; Zwaan, 1996). Based on research investigating discourse availability

measured by EEG (Ditman, Holcomb, & Kuperberg, 2008), Becker and colleagues assumed that in the case of the most accessible combination of temporal features of events, the N400 effect would be reduced. However, their own EEG data suggests that matching grammatical and lexical aspect does not make constructing mental representations of activities any easier. Still, there was a discourse availability advantage for imperfective accomplishments over perfective ones. In all, this study does not offer convincing support to the Yap et al. (2009) study. This line of research thus remains to be continued to be able to identify which temporal-semantic features of events are critical for constraining the way aspect is represented.

### **1.5.2 Psycholinguistics of lexical and grammatical aspect in Dutch**

#### **Progressive**

There are several psycholinguistic studies on the Dutch temporal language system which are concerned with the progressive construction *aan het + infinitive*. These studies share a careful distinction between progressive and imperfective as has been discussed here in chapter 1.3. Note that this construction is not fully grammaticalized. This is manifested by the fact that not all the verbs can be “progressivized” by this construction. As Bybee et al. (1994) state in their work, the process of grammaticalization is defined by the expanding character of the sum of contexts in which a construction can be applied. The decision to include sentences with the progressive construction in the experimental design for the current study is motivated by two reasons: (i) comparison can be drawn with existing studies employing the progressive construction (Schmidtová & Flecken, 2008; Flecken & Gerwien, 2013); and (ii) the eye movements yielded by the progressive construction may provide insight on whether the imperfective construction more closely reflects the progressive or the perfective construction in terms of cognitive processing.

Note that there is evidence suggesting that *aan het + infinitive* has not been fully grammaticalized, and consequently not fully morphological in nature, but rather periphrastic (for the discussion on grammaticalization of the progressive construction in Dutch see Schmidtová & Flecken, 2008: 19).

By means of an acceptability judgment task using 5-point scale, Schmidtová & Flecken (2008) obtained data showing that, according to native Dutch speakers, the progressive construction can only be applied to semantically adequate verbs. Such verbs are in logical agreement with the ongoingness expressed by the progressive construction *aan het + infinitive*; the study's results show that this construction is used very often with Vendler's *activity verbs* (1957). They refer to these activities as not having boundaries, i.e. not having a clear start or end of the event. See the following example (25) with the verb swim which was judged by native Dutch speakers as entirely acceptable in combination with the progressive construction *aan het + infinitive*:

(25) Ik was aan het zwemmen.

I was<sub>preterit</sub> on the swim<sub>infinitive</sub>.

I was swimming.

Arguably, the activity of swimming can be placed anywhere on the time axis under the one condition that the *swimming* has been finished before the moment of speaking. This may seem like a boundary, but as the constraint is of a deictic character, it is the tense, and not the aspect, that sets it. In fact, it is absolutely acceptable for a Dutch speaker to use the same construction *aan het zwemmen* with both present and future-like tense<sup>19</sup>, without changing the ongoing unbounded character of the activity. Witness (26) for example:

(26) a. Ik ben aan het zwemmen.

I am<sub>present</sub> on the swim<sub>infinitive</sub>.

I am swimming.

b. Ik zal aan het zwemmen zijn.

I will<sub>aux. future-like</sub> on the swim<sub>infinitive</sub> be<sub>infinitive</sub>.

I will be swimming.

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<sup>19</sup> Dutch is considered not to express future tense grammatically.

This acceptability judgment task investigates the progressive in Dutch and does not directly address other ways in which Dutch aspect influences conceptualization. On the other hand, it shows clearly that grammatical markers, although not yet fully grammaticalized, are introspectively perceived in a consistent way by native speakers. This supports the idea that different temporal properties of verbs in Dutch can bear measurable differences on sensorimotor experience.

Another study on the Dutch progressive offers convincing support for the notion that language can co-modulate the way we perceive the world (Flecken & Gerwin, 2013). The majority of existing studies mentioned in chapter 1.4.1 *Psycholinguistic approach to lexical and grammatical aspect*, treat time rather like a non-absolute entity which is differently cut and sequenced according to the temporal properties of one or another grammatical or lexical marker. In other words, they do not address the topic of time perception but, rather, the topic of *event perception*. In general, these studies aim to show how temporal properties of verbs influence the way we conceptualize the world as a whole. In contrast, the study on the Dutch progressive by Flecken and Gerwien (2013) investigated how the temporal properties of verbs influence the way the Dutch perceive psychological time under the influence of sentences with or without progressive construction.<sup>20</sup> First they used an acceptability judgment task to evaluate non-finite situations for experimental use, to ensure that all sentences in their design sounded familiar and natural in Dutch. All the situations were modified into progressive or non-progressive forms (*Jan zwemt* vs. *Jan is aan het zwemmen*). The participants were exposed to one of both conditions, and were subsequently asked to estimate the event duration on a 3-grade scale (long, medium, short). The results show significant

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<sup>20</sup> In their study, the authors use the term grammatical aspect when referring to the progressive construction *aan het + infinitive*. Later in the article the specification *progressive aspect* is used. This terminological approach has the following reasoning: their theoretical grasp of this phenomenon proceeds from Klein (1994), where aspect is defined by the various differences between the actual time when a situation happened and the specific time that is being talked about by verbal means. This notion turns out also to be very useful for experimental research because it precisely defines which situation falls in one category or another, even though the categories are not directly connected to a grammatical form. However, for the current study, which aims to investigate how different *grammatical* forms can change our conceptualisation, it is necessary to employ a theoretical background defined by the sharper boundaries between semantics, pragmatics and grammar.



differences in estimated length of the situations. Sentences in the progressive were judged to refer to significantly longer lasting situations than their non-progressive counterparts. The presented results imply that the perceived duration of described events is shared among speakers of Dutch, and that the progressive is a language tool which has the power to modulate this property.

### **First language acquisition**

To understand the way language is stored in our brain and which cognitive functions interact with each other or which are prominent, research on language acquisition can provide useful information. For this reason, researchers around the world try to understand the way children learn and store such complex knowledge as that entailed by language.

We mostly do not realize how many cognitive processes need to be employed when referring to a past event: We need to remember an event; we need to be capable of so-called *mental time travelling* to conceptualise past time in our minds; we need to understand which knowledge the listener has about the world, which requires active *theory of mind*; we need to master the language system we are using to communicate, and so on. The natural ease with which we can tell someone what we did last morning makes it easy to overlook how complex this process truly is. When studying the way language beginners deal with the complex set of cognitive challenges while sharing with us what they did this morning can tell us which processes are more demanding, or what factors the performance of certain language phenomena are dependent on. For this reason, first and second language acquisition has a strong position in psycholinguistics.

Research on acquisition of lexical and grammatical aspect in Dutch, Polish and Italian shows from a cross-linguistic perspective that lexical and grammatical aspect are acquired at different stages of development (van Hout, 2008). Similarly, perfective and imperfective aspect differ in the onset of acquisition observed in children across the investigated languages. This contradicts the *Morphological Salience Hypothesis* (van Hout, 2005), which pegs morphology as the leading factor in language acquisition. After all, the particular way grammatical aspect is encoded by linguistic markers affects the

discovery of form-to-meaning mapping, which would suggest that Polish children should acquire both aspectual forms, regardless of their function. In Polish, as in Czech and Russian, imperfective and perfective aspect are both made by affixes, resulting in all verbs having aspectual pairs or triplets. See example (27):

- (27)      Ø-jeść                                  imperfective  
                  null.prefix-eat  
                  to eat
- Z<sub>perf.</sub> prefix-jeść                                  perfective  
                  perf.prefix.z-eat  
                  to eat up

The meaning of the affixes interacts heavily with the meaning and manner of the described situation. Some of the aspectual forms are more morphologically complex in perfective, like the verb *to eat* in (27), whereas others are more complex in the imperfective aspect, such as example (28):

- (28)                      dać- Ø                                  perfective  
                  give-null.suffix  
                  to give
- da-wać<sub>imperf. prefix</sub>                                  imperfective  
                  give-wa.imperf.suffix  
                  to give

Proceeding from the Morphological Salience Hypotheses, one would expect that Polish children would acquire the morphologically simpler form earlier than their affixed counterparts, regardless of meaning or function. Van Hout (2008) supposes, that the semantics of the imperfective aspect puts even more cognitive load on the children's cognition than the morphological complexity, which results in earlier onset of acquisition of perfectives in Polish and Dutch children. Those empirical data suggest

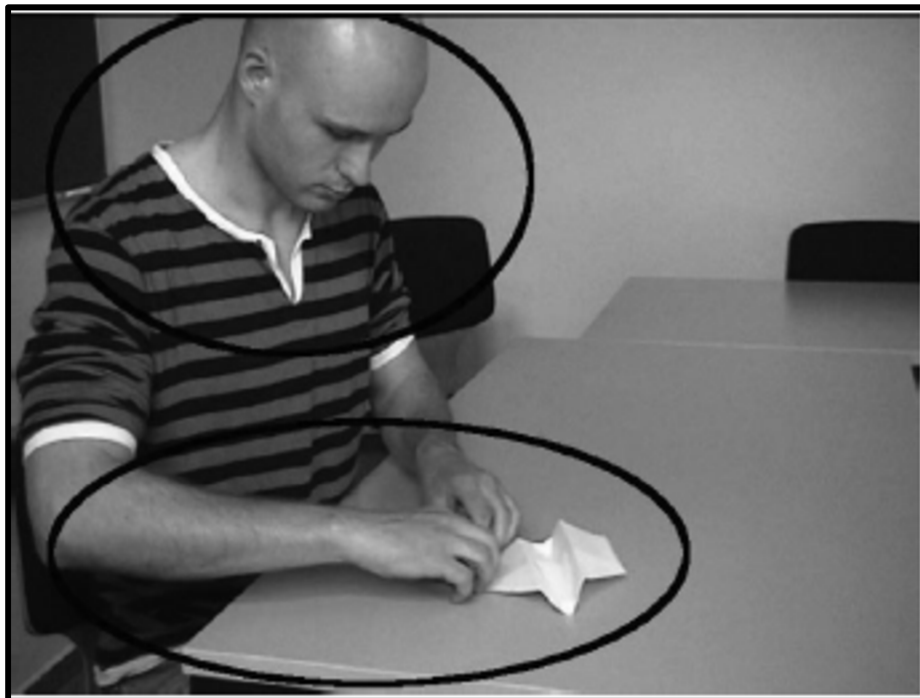
differences in complexity across the various aspectual forms in Dutch which should be mirrored also in the ease with which those forms are processed. As eye movements mirror cognitive processing, including language processing, the findings presented in van Hout support the core notion of this thesis that differences between grammatical forms of the same verbs should be measurable in eye movements.

### **Bilingualism and cultural determination**

Flecken (2011) shows that early mono- and bilinguals of Dutch and German conceptualize the world in different ways depending on the culture(s) and language(s) they have been exposed to. Monolingual Dutchmen or Germans, and bilinguals of Dutch and German, all pupils at grammar school, were asked to retell what happened in short videos of everyday situations. Afterwards, she analysed the data from this production task regarding the frequency of use of progressive and non-progressive forms. When comparing the monolingual groups, statistical analysis confirmed her hypothesis that the Dutchmen use more progressive constructions than Germans. Dutch speaking bilingual individuals used the most progressive forms out of all groups. Data from the production task were used in order to predict ocular behaviour in a subsequent eye tracking experiment.

It is argued that different types of constructions draw our attention to different stages of an event. Concepts that are often used by language users and have manifested by means of grammar arguably play a significant role in establishing preferences in the segmentation and construal of events through language. Those concepts are both language-specific and culture-specific. (Von Stutterheim & Nüsse, 2003). Flecken's study is exceptionally valuable for the current thesis, because she uses eye tracking in order to investigate the role of language in the conceptualisation of the world. In the experiment, she showed that participants prefer to look at different parts of a presented video (activities such as *moulding a vase* or *knitting a scarf* were presented). The progressive unbinds an event and moves focus across its various stages, with eye movements

reflecting this process, while perfective aspect<sup>21</sup> places focus on the end-phase of the action, not enabling access to the various stages of the situation. Interests for concrete parts of the visual stimuli expressed through eye movements were consistent with the semantics of preferred constructions used by the different groups when describing an event. Dutch and bilingual participants focused on more the parts of the video showing the activity in progress, whereas Germans looked more often at the agent (see Figure 1 from Flecken (2010) for illustration). According to the author, this shows that different grammatical forms influence mental representation of the world. Languages offer tools that enable us to put focus on the most important parts of described events, and that are probably shaped by culture.



**Figure 1.** Example of a video clip used as a stimulus in Flecken (2010) showing the two areas of interests which were measured by the eye tracker.

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<sup>21</sup> Past simple tense in the case of the discussed research.

## **Designing an eye tracking experiment**

Crucial to the current study, Flecken shows that eye movements mirror aspectual processing with an explicit visual task. More precisely, aspectual forms in Dutch differ in meaning, which influences the subsequent conceptual mapping of the actual situation presented in a video clip. The concern remains whether different eye movements would also result from different grammatical forms without any encouragement by visual stimuli. This concern can be addressed by means of an uncommon method, called the *blank screen paradigm*, which will be explained in detail in the following subchapter.

### **1.5.3 Blank screen paradigm: rationale**

The blank screen paradigm was used under this name for the first time by Altmann (2004). Despite its name, the design of his study was not without any visual stimuli. Pictures of situations were presented to disappear immediately after the auditory description of the situations was played. The eye movements were measured after the disappearance of the visual stimuli occurred. Only a blank screen was displayed. In contrast to the current study, Altmann was interested in areas where the objects described in the situations were presented before they disappeared. For example, there was a drawn picture with a man eating a cake. This picture disappeared to reveal the blank screen. Eye movements were measured while the participants listened to the sentence “*The man will eat cake.*” This means that the objective of that research was more memory driven as it studied whether the eye fixations were made to places where the described objects were depicted earlier.

Still, this research is relevant to the current study, because it supports the idea that ocular behaviour can reflect mental representation of situations even in absence of explicit visual stimuli. Spivey and Geng (2001) presented similar results, when they asked participants to look at a blank screen and listen to verbal auditory stimuli presenting objects and events. When the participants heard about vertically oriented objects (e.g. a skyscraper) their eye movements mirrored the prototypical orientation of the reported objects (for a review, see Fischer & Zwaan, 2008).

Methodologically, investigating more or less spontaneous eye movements to study the way in which grammatical and lexical aspect influence the semantic representation of space and time is quite novel.

Arguably, by avoiding the often highly goal-oriented and constrained experimental setting that is characteristic of cognitive research, this experiment simulates a more natural situation, reminiscent of normal conversation, where people frequently listen to references to absent objects.

The absence of an explicit visual task and task constraints in this experiment enables the investigation of eye movements that are not influenced or changed by any visual scene. This is supported by research on spatial biases (Hartmann et al., 2015), which argues that absent a spatially biased frame of reference, participants use those spatial associations that are deeply grounded in their cognition.

Furthermore, research on mirror neurons offers neurological evidence that suggests that explicit pictures of an action can relate to a strong language bias. Mirror neurons fire not only at the moment of performing an action, but also at the moment of seeing someone performing an action. This raises a concern about the possible bias of an explicit visual task. Studies in humans using the MRI method suggest that, in humans, mirror neurons are found very close to Broca's area (e.g. Kilner et al., 2009) which has led to the suggestion that language has evolved from gesture learning, and as such can be tightly connected with stimulation of the motor cortex. There is a theory regarding the connection between mirror neurons and language which states that the meaning of action-related words is rooted in brain areas devoted to the execution of those actions (e.g. Hauk, Johnsrude, Pulvermüller, 2004; Hickok, 2010). One experiment using TMS (transcranial magnetic stimulation)<sup>22</sup> showed that stimulation of motor cortex also affects performance of lexical decision tasks (Pulvermüller et al., 2005). The theory of

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<sup>22</sup> TMS is a non-invasive method used for both, medical treatment on the neural level, and neurocognitive experiments. A small coil with a magnetic generator is placed near the target area of the head where the brain should be stimulated. While producing magnetic field in the strength of fMRI, it dissociates the electromagnetic pulse characteristic for the neural activity, resulting in short-term abnormalities of production of concerned cognitive processes (George et al., 2003).

mirror neurons connects language not only to actual action, but also to the observation of action, as in the case of explicit visual task.

## 1.6 Summary

The temporal qualities of the world are conceptualised by linguistic components, among which grammatical and lexical markers. Those markers create temporal concepts which are used by language speakers to refer to reality by means of language. Among others, these concepts differ in the terms of the position of a situation on the time axis, the way the various phases of a situation can be accessed, and whether or not a situation reaches an endpoint. In linguistics, these three temporal features are conventionally referred to as tense, grammatical aspect and lexical aspect (respectively). Evidently, various combinations of these features create different temporal concepts. Note, that in this work the word *concepts* is meant to signify *the various combinations of tense, lexical and grammatical aspect capturing the temporal flow of the situation*". Analogically, the term *conceptualisation* is here elliptically used as *an application of the various combinations of tense, lexical and grammatical aspect to capture the temporal flow of the situation*. Across languages, those concepts are expressed by various means and the preference for one concept over another is also influenced by culture. The Dutch language has received a lot of attention from linguists who introspectively describe how these concepts can be achieved linguistically and what their function is. However, in contrast to English and the Slavic languages, Dutch has been understudied regarding the empirical evidence for a link between these three linguistic categories and the concepts applied by language users when capturing the temporality. The current study aims to investigate differences in the conceptualisation of temporality by measuring eye-movements, using native Dutch speakers as participants. In so doing, this work uniquely addresses the notion that language shapes cognition from the viewpoint of an understudied language.

## 1.7 Research question & hypotheses

Informed by the rich body of linguistic research on lexical and grammatical aspect and psycholinguistic experiments reviewed in the previous sections, the question that lies central to the current study is formulated as follows:

**Research question:** How are different combinations of lexical and grammatical aspect of Dutch verbs reflected in eye movements?

In order to answer this question, I will run an eye tracking experiment using a blank screen paradigm (Altmann, 2004). The rationale for this paradigm can be found in subchapter 1.5.3, *Blank screen paradigm: rationale*. Eye movements of participants will be measured while they look at a white screen, and listen to five sets of five similar spoken sentences, differing in terms of lexical and grammatical aspect. The five different conditions are: (i) atelic imperfective, (ii) atelic perfective, (iii) telic imperfective (iv) telic perfective and (v) atelic progressive. Previous research shows how described events with detailed spatiotemporal parameters involve sensorimotor systems of the brain. Thus, there is reason to believe that grammatical and lexical aspect affect numerous properties of eye movements in a situation with no explicit visual task. As such, the proposed experimental paradigm mirrors real-world passive listening circumstances. In respect to my research question, proceeding from the overview of the literature discussed above, I propose the following hypotheses:

### **Null hypothesis:**




- **H<sub>0</sub>:** The five conditions yield eye movement measurements that do not differ from each other.

### **Alternative Hypotheses:**

- **H<sub>1</sub>:** The telic perfective condition entails smaller eye movements with fewer fixations than the other conditions.
- **H<sub>2</sub>:** The atelic imperfective condition entails more widely spread eye movements with more fixations than conditions with perfective and/or telic aspect.
- **H<sub>3</sub>:** The progressive condition entails more widely spread eye movements with more fixations than the other conditions.



These alternative hypotheses all follow from one underlying notion: I expect that ocular behavior will show a gradual, linear reflection of visual processing along the experimental conditions as they occur on the overarching spectrum of *completedness*. That is, in the perfective telic case, the condition conveying completedness most definitively, eye movements will be most widely spread, showing the least points of fixation. Further down the spectrum (moving toward *non-completedness*), less dispersion of eye movements and more points of fixation are hypothesized to occur in the ambiguous cases of telic imperfective and atelic perfective. The gradual decrease in dispersion and increase in number of fixations continues with the atelic imperfective condition, and culminates in the progressive condition. Thus, the hypothesized dynamic between the different conditions, visual processing, and eye movements, can be schematized as shown in Table 5. Moving down the rows, the experimental conditions, through the outcome measures of the eye-tracking experiment, are thus linked to the level of visual processing assumed to result from differences in grammatical and lexical aspect.

<b>Table 5.</b> Hypothesized dynamic between experimental conditions and outcome measures.					
<b>Conditions</b>	1: Perfective telic	2: Imperfective telic	3: Perfective atelic	4: imperfective atelic	5: Progressive (atelic)
<b>Eye movement dispersion</b>	Less  More				
<b>Number of fixations</b>	Fewer  More				
<b>Visual processing</b>	Less  More				

This hypothesized dynamic is based on studies that have shown a connection between the use of imperfective aspect and mere focus on dynamics, details of events and intensive mental simulation (e.g. Anderson et al. 2008; Bergen and Wheeler, 2010; Matlock et al., 2012; for overview see Huette et al. 2014). Moreover, the study of Flecken (2010) showed that there are measurable differences in the estimation of psychological time duration when the progressive construction *aan het + verb* is used, compared to non-progressive conditions, suggesting differences in processing. Other studies show

that differences in processing are mirrored in eye movements. Studies on English have presented results supporting the expectation that progressive conditions are mirrored by widely dispersed and vivid eye movements (e.g. Anderson et al. 2008; Huette et al. 2014). This observation holds for both paradigms with and without a visual task. Taking into consideration that perfective aspect in English constraints mental conceptualisation to the endpoint of an event (Madden and Zwaan, 2003), we can predict that the eye movements revealed by situations with an intrinsic endpoint (i.e. telic sentences) would be like those revealed by perfective aspect.

Data on Dutch suggest, that v.t.t. (perfective) allows for the description of a situation as a bounded whole, implying an intrinsic endpoint. O.v.t. (imperfective) allows for the description of a situation and while enabling access to its various phases, implying the ongoing character of the situation. However, the culmination of a situation in an endpoint depends on the whole sentence (sometimes even on the broad context and pragmatics). This telicity can be controlled by means of countable direct objects or their absence. Nevertheless, the suggested differences in the ways that v.t.t. or o.v.t. capture situations support the view that different grammatical constructions are used to account for differences in the temporal flow of a situation. Consequently, there is reason to believe that there are going to be measurable differences in eye movements in conditions where v.t.t. and o.v.t. is used.

It is argued, that Dutch tenses do not only express the position of a situation on the time axis, but also the level of engagement of the speaker with the described situation. This level of engagement, or the extent to which a situation is actual for the language user, changes the way the information is processed. Since it has been showed that language processing influences ocular behaviour, I expect that grammatical processing of various temporal properties of situations can be linked to various patterns in eye movements.

Backer et al. (2013) show in their experiment that sentences describing situations with an endpoint (telic), using a perfective verb, make processing easier than combination of telic situation and imperfective verbs. Yap et al. (2009) present findings in line with Backer et al. (2013) and add similar ones about easier processing of atelic

events expressed by imperfective verbs. Kořenář (2016) suggests an existence of a scale regarding the features of telicity and perfectivity and how those are mirrored in eye movements. However, the position of perfective atelic and imperfective telic conditions in respect to each other remains unclear, as Kořenář (2016) included just one of the mismatching conditions, and also lacked a progressive condition.

### 3. Experiment

The measurement of eye movements has provided an important basis for theories of language processing in various situations. Tannenhaus et al. (1995) found that the processing of syntactic dependencies involves visual processing as well. Altman & Kamide (1999) found that eye movements differ based on the semantics of processed sentences. We can measure a wide range of ocular behaviour by means of eye-tracking, such as the path of eye movements, and number or duration of fixations on the screen. Given the previous findings on sensorimotor movements revealed by grammatical and semantical processing (e.g. Huette et al. 2014; Kořenář, 2016; Madden & Zwaan, 2003; Mattlock 2010), there is reason to believe that language processing of grammatical aspect, lexical aspect and their possible combinations in Dutch could be mirrored in eye movements in different ways.

Designing an eye tracking experiment is challenging, because crucial decisions on both visual and linguistic stimuli are required. It has been proven that the explicit visual stimuli can have such a strong bias on the participants that comprehension is compromised. (Hauk et al., 2004; Pulvermüller, 2005; Zwaan and Taylor, 2006; Bergen and Wheeler, 2010). Thus, because there is no direct need for it, and to avoid the introduction of unwanted biases, the experimental design used here does not include an explicit visual task. In other words, I will have participants simply look at a blank screen, to investigate the effects of language processing on eye movements revealed by auditory linguistic stimuli only. In the following chapter, the used method and its advantages will be described, as well as the changes in the experimental design made in comparison with existing studies.<sup>23</sup>

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<sup>23</sup> Kořenář (2016)

## 2.2 Method

### 2.2.1 Participants

Twenty right-handed native speakers of Dutch were measured and their eye movements were recorded. Handedness is one of the most distinctively lateralized cerebral functions, together with language (e.g Jung et al., 2003; Hervé et al., 2013). Moreover, handedness is also considered to be indicative for hemispheric language dominance. Numerous recent studies on English have demonstrated that right-handed individuals exhibit a contralateral dominance of language capacities toward their handedness, while left-handed people are believed to have bilateral or right-hemispheric language dominance (Knecht et al., 2000; Somers et al., 2015; for an overview see Gao et al., 2015). Important for an eye-tracking study where language processing is a central research interest, studies investigating the *effective connectivity networks during language processing* offer support to create a unified sample of participants regarding handedness. This approach has shifted the attention of neuroscientists from the areas in the brain to the circuits, so called connectivity networks, which are employed during brain activity and can inter alia account for the inconsistencies and differences in production in individuals with comparable brain damages (for a review see Friston, 2011). This growing emphasis on the interaction of neural circuits in performing certain cognitive functions also includes language processing. Studies on language and the neural systems used during various language tasks have offered support for existence of brain connectivity dynamics during language use (e.g. Bedo, 2014; Xu, 2015). Studies using a semantic decision task (Seghier et al., 2010), word production task (Abel et al., 2011) or visual word recognition task (Schurz, 2014), suggest an interaction on a neural level between handedness and language processing, resulting in significant differences in performance between left- and right-handers. Because right-handedness is much more common (Hardyck & Petrinovich, 1977) than left-handedness, right-handed participants were used.

The participants attended the experiment voluntarily, knowing in advance that they would be offered just a small refreshment in the form of a piece of cake and coffee after the experiment to compensate for the time spent on the experiment. Both women and

men participated. All participants reported having normal or corrected-to-normal vision and no hearing problems or language deficiencies.

Because cognitive functions can be underdeveloped in early age or become compromised by aging (Glisky, 2007), there was a need to have an age-consistent group of participants. The age of the participants was between 21 and 28, (mean age: 23 years and 4 months) which is in line with the research of Glisky who suggests all cognitive capacities are well established by the age of 18 years.

All participants reported to be studying or to have a university diploma. This condition was used to minimize the effects of differences in social background (Bernstein, 2003). Students of linguistics or cognitive psychology were excluded, because of the risk that they would anticipate the purposes of the experiment. One of the students stated that he studied a bachelor of linguistics for one semester before switching to his current study. I decided to include this participant, assuming the introductory courses taught in the first semester likely had not equipped the student with a sufficient background in experimental research to see through the goal of the current experimental design.

Experimental research on lexical accessibility in bilingual individuals regarding the phonetic effectuation of verbal auditory stimuli (e.g. Canseco-Gonzales et al., 2010; Ju & Luce, 2004) showed differences in monolingual and bilingual individuals. Consistent with those findings, I decided to include only monolingual participants.

All the afore-mentioned information was collected by means of an anonymous survey among the students of Erasmus University in Rotterdam, who were present in the library of the university or who were invited by the schedule-making programme used by the lab for behavioural studies. The form used for those purposes is part of this thesis as an appendix. The participants were informed that the information provided by them will be treated in accordance with the Data Protection Directive <sup>24</sup>.

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<sup>24</sup> Officially Directive 95/46/EC on the protection of individuals with regard to the processing of personal data and on the free movement of such data. It is a European Union directive adopted in 1995 which regulates the processing of personal data within the European Union (European Parliament and Council,

### 2.2.2 Technical equipment

The data were recorded with an *SMI RED 500 system* at a sampling rate of 250Hz, which means that there were 250 measurements of the ocular behaviour in one second. The eye tracker allowed for head movement in a 40x20 cm plane, given that participants were seated at a distance of 70 cm. Eye gaze was registered with a spatial resolution of 0.03° and a gaze position accuracy of 0.4°. The experiment was presented on a 22-inch screen (1920 x 1080 pixels) using *Experiment Center Software*, and eye data were recorded with *I-View X Software*<sup>25</sup>. Fixations were identified in the data by the means of *Be-Gaze* software, and determined as fixations that lasted for at least 50 ms. I also employed a maximal dispersion of 100 on subsequent frames using the *Distance Dispersion Algorithm* (Salvucci & Goldberg, 2000). Even though this measure is not so popular because of its complexity in comparison to other measures (e.g. Centroid-Distance Method) (Shic & Chawarska, 2007), it needed to be employed in this research, as no clear area of interest was defined.

### 2.2.3 Materials

Given the experimental character of this thesis, the notion that lexical aspect can be analysed will be applied only to create a well-constrained experimental design. That is why I decided to keep the rules according to which I am going to do my experimental design as simple as possible. The choice for the simplicity of stimuli is enhanced by the fact that I am going to look at eye movements motivated by offline spontaneous grammatical processing. By this I mean that the onset of the measurements will be after the participants are exposed to the auditory stimuli (see the chapter 2.2.5 *Procedure*). In

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1995). Actually, the stricter principles of the *General Data Protection Regulations* were applied, however, this new regulation is planned to be enforceable starting 25 May 2018 (European Parliament and Council, 2016).

<sup>25</sup> Developer of all the used software: SensoMotoric Instruments, Germany

these cases, it is not possible to ascribe a specific ocular behaviour to a concrete linguistic element. For those reasons, the complexity of the stimuli should be held at a minimum to avoid concerns that patterns in eye movements are caused by different parts of the sentence than the predicate, which is the area of focus in this thesis.

I decided to use the quadrant as proposed by Verkuyl (2000) and illustrated in Table 4. By means of grammar trees, well-motivated compositional rules are proposed in Verkuyl (1993: 46-49; 100-109). I have synthesised the following ones and minimalized them in the way relevant for the purposes of my experimental design:

1. To make a telic condition, countable nouns with quantifiers not higher than 3 will be used and will be placed in the syntactic role of direct object.
2. Only transitive verbs will be used. This rule proceeds from the rule 1.
3. To make an atelic condition, no argument will be used.

As I have written elsewhere, the Dutch v.t.t. consists of an auxiliary verb *zijn* (to be) or *hebben* (to have). From the diachronic point of view, both of those auxiliaries were grammaticalized at a different point (De Haan, 1991). It is argued, that there has been a difference in meaning between those two auxiliaries, where *hebben* is used in dynamic perfective situations in which the subject of the sentence has an agentive interpretation and *zijn* a non-agentive (Overdiep, 1949: 336). This fact is elaborated by the etymological study, where the meaning of Latin predecessor *capere* with a clear resultative use is connected with the Dutch *hebben*. *Hebben* automatically indicates a situation of an “action-kind” and the past participle specifies about which kind of action is spoken (Duinhoven, 1988: 22).

In the v.t.t. in Dutch, the meaning of the auxiliaries has significantly weakened, resulting in a less firm distinction between *zijn* and *hebben* regarding the agentive character. As evidence for this, the fact is mentioned that some verbs have undergone a shift from *hebben* to *zijn* and vice versa (De Vooy, 1967). However, psycholinguistic evidence showing the marginality of the meaning of the auxiliaries in v.t.t. is missing. That is why I decided to include the rule 4:



4. Only verbs with the auxiliary verb *hebben* will be used.

Based on the psycholinguistic aspectual studies which have been conducted on Dutch so far, I decided to add a not fully grammaticalized progressive construction as the fifth investigated condition, the *aan het + verb* construction (see the subchapter 1.5.2 *Psycholinguistics of lexical and grammatical aspect in Dutch* where the issue of grammaticalization of the progressive construction is discussed). Usage of this construction in the current experimental design is desirable because it enables us to compare the data from English, where progressive (present or past continuous) is used for imperfective aspect. Furthermore, I can subsequently compare the conditions with preterit with the conditions with progressive to see how these two different realisations of imperfective aspect in Dutch differ. This approach has to my knowledge never been applied. To allow for incorporation of progressive condition into the experimental design, further constraints for the choice of the verbs needs to be applied. The not fully grammaticalized character of the progressive denies the usage of other verbs than those referring to *activities* as defined by Vendler (1967). More precisely, given the right context, other semantic types of situations can also be used with the progressive construction, but this usage stands out from the other conditions (Schmidtová & Flecken, 2008). Based on this result, a fifth rule was implemented:

5. Only situations describing activities as defined by Vendler (1967) will be used for the progressive condition.

To make sure I have not compromised the core content of the *compositional rules* by my simplifications, Henk Verkuyl checked the stimuli of my experimental design. He was told that I intended to make well-designed sentences with respect to lexical and grammatical aspect, following his quadrant proposal and using the extracted rules 1.-3. based on his work (Verkuyl, 1993).

The above-mentioned reasoning and feedback provided by Henk Verkuyl resulted in an experimental design consisting of 5 conditions for each trial, counting 5 trials. This was ideal also with respect to the experimental procedure, making the randomisation of the conditions within one trial easier, as the *Latin square design* was intended to be used (see the following subchapter *Procedure*). The conditions were (a) telic perfective, (b)

telic imperfective, (c) atelic perfective (d) atelic imperfective and (e) progressive. See examples of these conditions in (14a-e). You can find the full experimental design in *Appendices*:

(14) a. Ik heb 3 broodjes gegeten.

I ate 3 sandwiches.

b. Ik at 3 broodjes.

I was eating 3 sandwiches.

c. Ik heb gegeten.

I ate.

d. Ik at.

I was eating.

e. Ik was aan het eten.

I was eating

### 3.2.4 Experimental design: implemented changes

Huette et al. (2014) used the blank screen paradigm method to see how eye movements revealed by spontaneous grammatical processing of aspect differ. In their study, sixty-three native speakers of English listened to short stories which were manipulated in terms of grammatical aspect, using the past progressive (e.g. was walking) and past simple (e.g. walked). These two tenses in English are the voluntary markers of grammatical aspect (Langacker, 1982). The researchers used only auditory stimuli. They found remarkable differences in the processing of past progressive (imperfective) and past simple (perfective) stories indeed. They argued their results were in line with other experimental studies on grammatical aspect: processing of past progressive conditions produced eye movements that were more dispersed across the screen, had many areas of fixation and longer saccade paths; the processing of past

simple conditions was accompanied by eye movements that covered a smaller screen area, had fewer areas of fixation with longer fixations and with shorter saccade paths.

Huette et al. provided valuable results with respect to the present study, including the methodology used. However, some adjustments were made for this study.

First, the experiment was designed exclusively with verbs of movement. More precisely, authors gave examples of stories where only various verbs of movement were used:

*“John was on a bike ride yesterday. After he sped / was speeding across the valley, he climbed / was climbing a mountain range. Then he pedaled / was pedaling along a river and finally, he coasted / was coasting into a campground.”*

Unfortunately, the link mentioned in the article where the supplementary materials could be found did not show anything more than was present in the article itself. I tried to contact the corresponding author of the paper, Stephanie Huette, via her correspondence email address stated in the article, but I did not get any answer yet<sup>26</sup>.

Using movement verbs has a specific effect on our sensorimotor movements. The series of experiments on motion verbs showed their privileged position regarding the influence on our sensorimotor movements. (e.g. Matlock & Richardson, 2004; Matlock, 2010, Richardson & Matlock, 2007; Spivey et al., 2000). In one of those studies, Matlock (2010) claims that the motion verb influences our conceptualisation to the extent that we simulate in our cognition the movement the language refers to. Evidence for the simulated motion are according to Matlock the eye movements which arguably go in the direction of the actual movement.

In another study, Richardson and Matlock (2007) show that it is not even necessary to use a verb of movement in the meaning expressing actual movement. Also the so-called fictive motion verbs (e.g. The road goes along the beach.; see also Langacker, 1986, 2000 where this phenomenon is called abstract motion and Matsumoto, 1996, where the term subjective motion is used) affect our conceptualisation and are probably simulated in our cognition. In the Richardson &

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<sup>26</sup> Written 23 Jul. 17

Matlock (2007) study, the researchers showed participants pictures with a road lined with palms. They described to the participants what they see using either a fictive motion verb (The road goes through the desert.) or a neutral verb (The road is in the desert.) If the fictive motion verb was used, the participants scanned the path on the picture, arguably simulating the movement primed by the motion verb. If the researchers also added characteristics which made the path seem difficult to walk (e.g. hilly, rocky) the eye movements of the participants in the fictive motion verb condition were slower than when adjectives which make the path seem easy to walk on (e.g. plain, sandy) were used. In the case of the control condition with the neutral verb to be the researchers did not observe any significant differences in the speed of eye movements while using adjectives, suggesting how easy or difficult the path is to walk on.

Those findings clearly suggest that motion verbs have a specific way of being processed and that the eye movements caused by motion verbs apply to visual rather than grammatical processing. That is why one could see the exclusive use of motion verbs as a shortcoming of the Huette et al. design, because motion verbs may have played a crucial role in revealing eye movements in participants.

Second, authors employed a picture-viewing task between the actual auditory stimuli, to confuse the participants about the aim of the research. In one of two pictures, there have been presented a street with cars and clock tower. Consistent with the findings on the mirror neurons, picture with driving cars may have elicited a motion-like cognitive processing. Such a visual evocation of a movement can arguably activate the early visual cortex, which has been proven by a fMRI study during visual mental stimulation (Kosslyn & Thompson, 2003). This can have an unwanted residual effect on the subsequent measurements during the actual linguistic task.

Kořenář (2016) is another study where the blank screen paradigm has been used. The study aimed to measure the spontaneous grammatical processing of Czech lexical and grammatical aspect revealed by eye movements. In this pilot study, eye movements of 8 Czechs have been measured during listening to the set of sentences properly designed with respect to the lexical and grammatical aspect. Similarly to the current work, the interaction of the lexical and grammatical aspects was in the centre of the research interests of this study.

A mock visual task has been inserted in each of the experimental trials. Even though the visual stimuli did not contain any paths or objects which are usually associated with movements<sup>27</sup>, the presence of the visual stimuli preceding the passive listening can possibly influence the results. As research on the visual attention shows, the visual attention can be easily mediated by some appealing visual stimuli such as colourful pictures, resulting in facilitation of eye fixations of the visually attractive areas (Treisman, 1969). In the studies where visual stimuli were shown prior the blank screen was displayed, the effects of the short-term visual memory were observed. The results show that the participants tend to re-fixate the areas of the screen without any visual content, where previously some objects were displayed (e.g. Altmann, 2004; Weber et al., 2007). This implies that eye movements are not contingent upon an online visual content necessary. Those findings are of a high importance for the current experimental design, raising concerns that the measured eye movements can be mediated or at least co-mediated by the previous visual stimuli.

Thus, compared to the previously discussed studies with a similar experimental paradigm, the following changes will be implemented:

1. No movement verbs are going to be used.
2. No picture-viewing task will be inserted.

### **2.2.5 Procedure**

The eye tracking experiment was conducted in a quiet room, a special lab for behavioural experiments at the Erasmus University in Rotterdam. The examiner of the experiment was in a different room, communicating with the participant after the onset of the actual experiment only if necessary through speakers in the testing room, via microphone.

After calibration of the eye-tracking equipment, participants were told to sit and read instructions on the screen, sitting at an operating distance between 60-80cm from

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<sup>27</sup> The stimuli were four pictures of landscapes.

the screen. They were told to press the “proceed” button when they are explicitly asked to do so, otherwise the experiment proceeded by itself, lasting no more than 15 minutes in total.

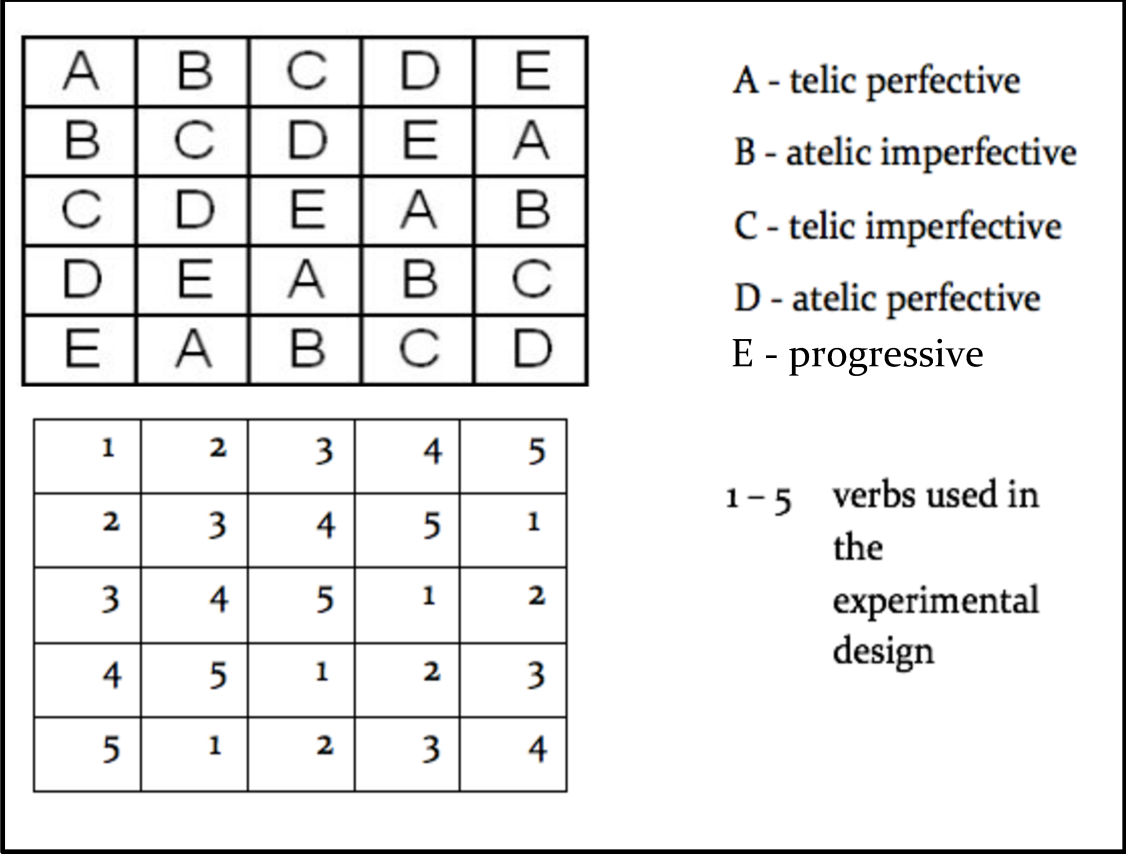
The participants weren't told they were going to be subjected to a linguistic experiment. Moreover, in order to confuse the participants about the purpose of the experiment and to avoid possible strategic or metalinguistic responses caused by an awareness of the purposes of the experiment, a mock auditory task was added to the experiment. The participants were encouraged to believe that the mock task was the most important part of the experiment, by (i) putting this task at the start of the experiment; and (ii) explicitly stating after the mock auditory task, that a series of sentences would be played only to help participants to reset their experience of the listening task where they need to distinguish between high and low pitches.

During the mock auditory task, participants listened to a random sequence of low or high pitched beeps, and were asked to press a button when a beep has a distinctly high pitch. No measurements were made during this phase, as it was inserted to keep the participants concentrated (Holmqvist et al. 2011), and to confuse them regarding the goal of the experiment.

Subsequently, the actual passive listening task followed. The task for the participants was to listen carefully to the spoken sentences, in order to forget the previous visual task. They were asked to keep looking at the screen to avoid recalibration. By this the illusion that the experiment was not a linguistic experiment was enhanced. Participants were warned that after finishing the experiment, a series of questions about the auditory stimuli would follow, to ensure their engagement with the stimuli. This was particularly important for an experiment where no corresponding picture was presented which would enhance the comprehension of the verbal stimuli.

During the passive listening task participants were subjected to 25 spoken sentences with different lexical and grammatical aspect. The order of the auditory stimuli was randomized by the experimental software for the SMI red 500 eye tracker. This software was programmed to randomize the sentences according to the principles of a concatenated Latin square design. See figure 2 for the two Latin squares which have been

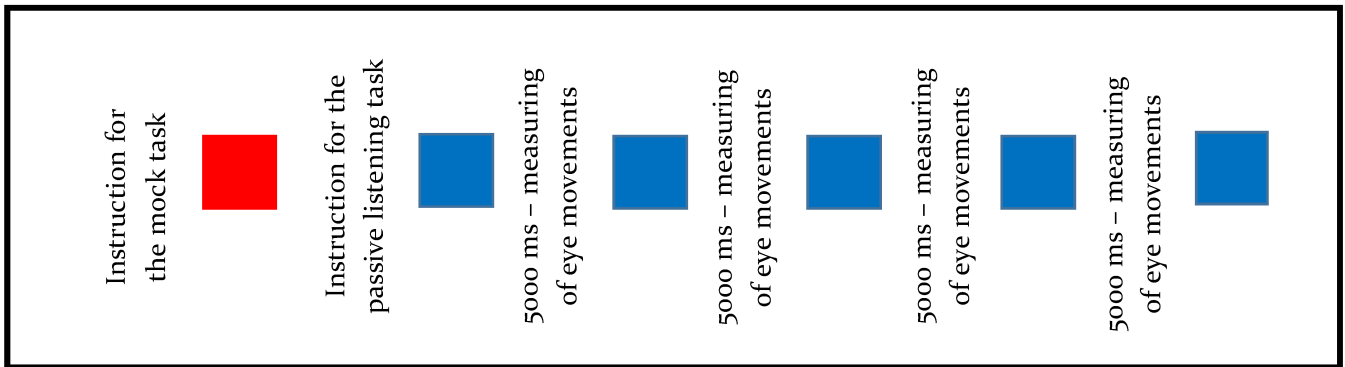
concatenated by the *Experiment Centre Software*, with the combination of telicity and perfectivity as one blocking factor and the verb used in the sentences as the second one.



**Figure 2.** Two Latin squares which were subsequently concatenated by the experimental software so that every participant hears all the five conditions A-E in every trial and those conditions are designed from five different verbs within each trial.

Every participant went through these steps for each of the 25 unique sentences, receiving just one of the five possible aspectual conditions per repetition. Thus, the resulting dataset contained five samples for each of the five conditions per participant.

Note that the components of each trial always had the same order of appearance. After each recorded sentence, 10 seconds of silence was present. It was also the only time the eye movements relevant for present study were measured. Because the sentences were of different length, only the spontaneous offline processing was measured in the 10 seconds of silence following immediately after the end of each auditory stimulus. See figure 3 for an illustration of one complete trial with all its components.



**Figure 3.** Schematic illustration of the order of the components which were displayed in each trial. This process has been repeated 5 times. At the very beginning of the experiment, the overall instructions described elsewhere were presented. At the very end of the experiment a screen with expressed gratefulness for the participation was displayed.



## 4. Results

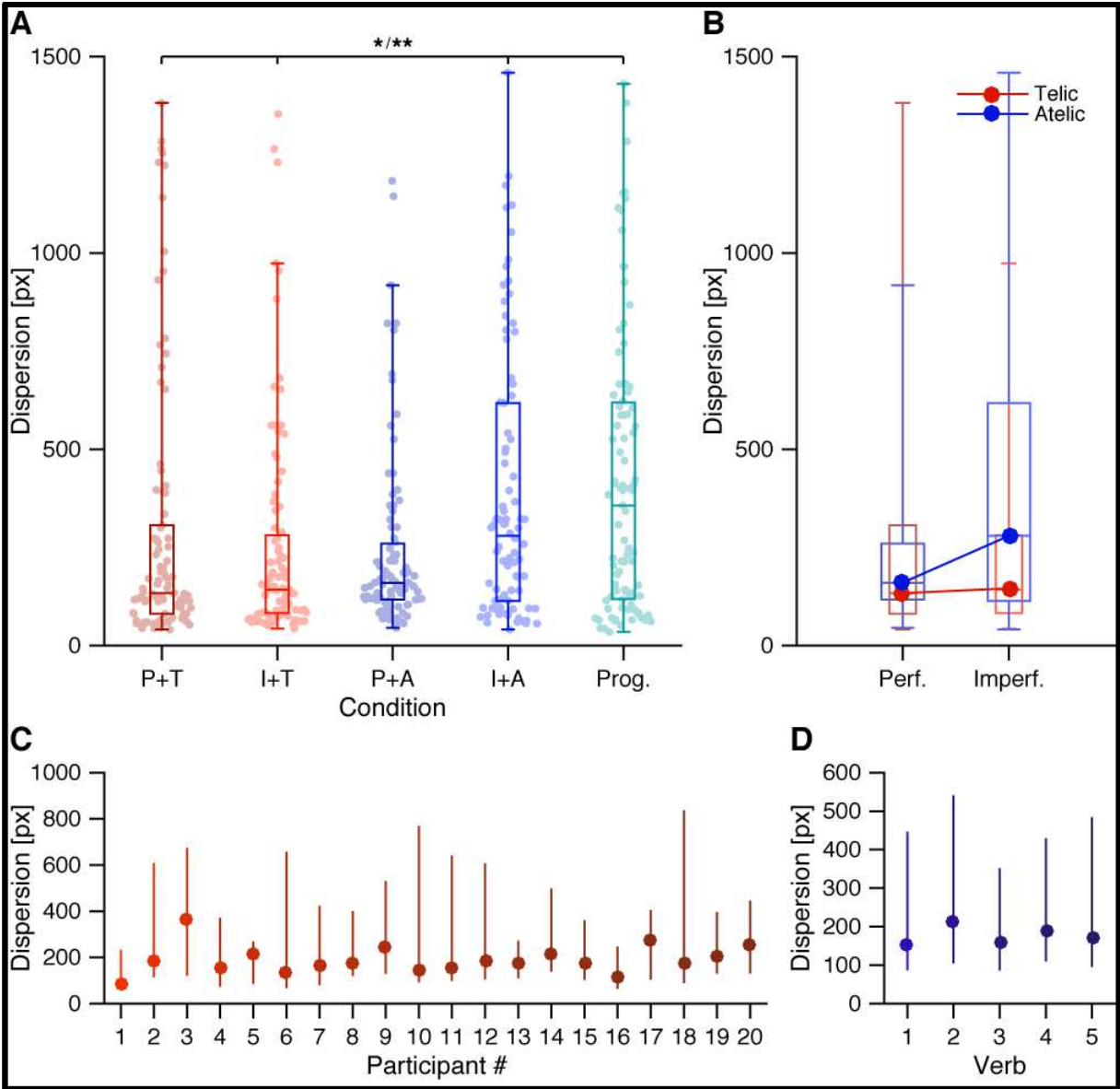
Two relevant outcome measures were derived from the data obtained from 20 participants in the eye-tracking experiments: (i) dispersion of eye movements, expressed as distance in pixels, which relates to the resolution of the computer screen on which the blank screen was shown; (ii) the number of fixations, which are moments in which the eyes were fixated on a point on the screen for at least 50 ms. Each of these variables will be explored with relation to the hypothesized outcomes, which are based on assumed differences between the five different experimental conditions, which are: (i) Perfective telic; (ii) Imperfective telic; (iii) Perfective atelic; (iv) Imperfective atelic; and (v) Progressive atelic. Note that these categories are roughly ordered based on whether they are assumed to convey “completedness”, from higher (i) to lower degrees (v). Two other variables concern participants and verbs, for which no differences in outcome measures were expected. For each outcome measure, this assumption was tested to make sure the analysis of the experimental conditions would not be hindered by significant differences across participants or the verbs that were used. The verb variable is coded with numbers, which denote the following verbs: 1 = *lezen* (to read); 2 = *eten* (to read); 3 = *zingen* (to sing); 4 = *spelen* (to play); 5 = *wassen* (to wash).

### Eye movement dispersion

To link the different grammatical and lexical aspectual conditions to increased visual processing, the existing relation between the latter and eye movement is exploited. If indeed atelic and imperfective sentences lead to more visual processing than telic and perfective sentences, one of the expected outcomes is that they will have elicited more dispersion of eye movements across the blank screen.

Figure 1 provides an overview of how eye movement dispersion is manifested across the dataset. Given a computer screen resolution 1920 x 1080 pixels, trial averages were considered to be unreasonably excessive if they exceeded 1500 pixels. A total of 49 trials (out of 500, i.e. 9.8%) were excluded based on this criterion. Figure 4A shows average dispersion across individual trials, with boxplots summarizing the data, for each

condition. Box edges denote the 25<sup>th</sup> and 75<sup>th</sup> percentile of each group, the line in the box denotes the median, and the whiskers show the overall range of the data (datapoints outside the whisker range concern outliers, but were not excluded as they are not outlying data with respect to the full dataset). Overall, there is a nice progression from perfective telic (133.5 [81.2 306.6] px; median [interquartile range]), through the mismatched conditions of imperfective telic (146 [83.3 333] px) and perfective atelic (160.6 [117.3 280.4]), to the conditions showing the least completedness, i.e. atelic imperfective (279.7 [114.1 618] px) and atelic progressive (356.9 [118.8 619.5] px).



**Figure 4.** Dispersion of eye movements.

A non-parametric Kruskal-Wallis test confirms that there are significant differences among these groups ( $\chi^2(4) = 20.4$ ,  $p = 0.0004$ ). Subsequently, post-hoc comparisons between groups were made using non-parametric Dunn-Sidak tests. The resultant p-values are summarized in Table 5, and establish significant differences between on the one hand the first two conditions, perfective telic and imperfective telic, and on the other the last two conditions, imperfective atelic and progressive atelic. Interestingly, in the progression from low to high completedness, the overlay of the first four conditions in Figure 4B also show that both mismatched conditions are closer to the condition conveying the most completedness, i.e. perfective telic, than to the other matched condition, imperfective atelic, conveying no completedness. Additionally, it is interesting to note that among mismatched conditions, whereas imperfective telic did show significance, perfective atelic did not, in the comparison with the last two conditions.

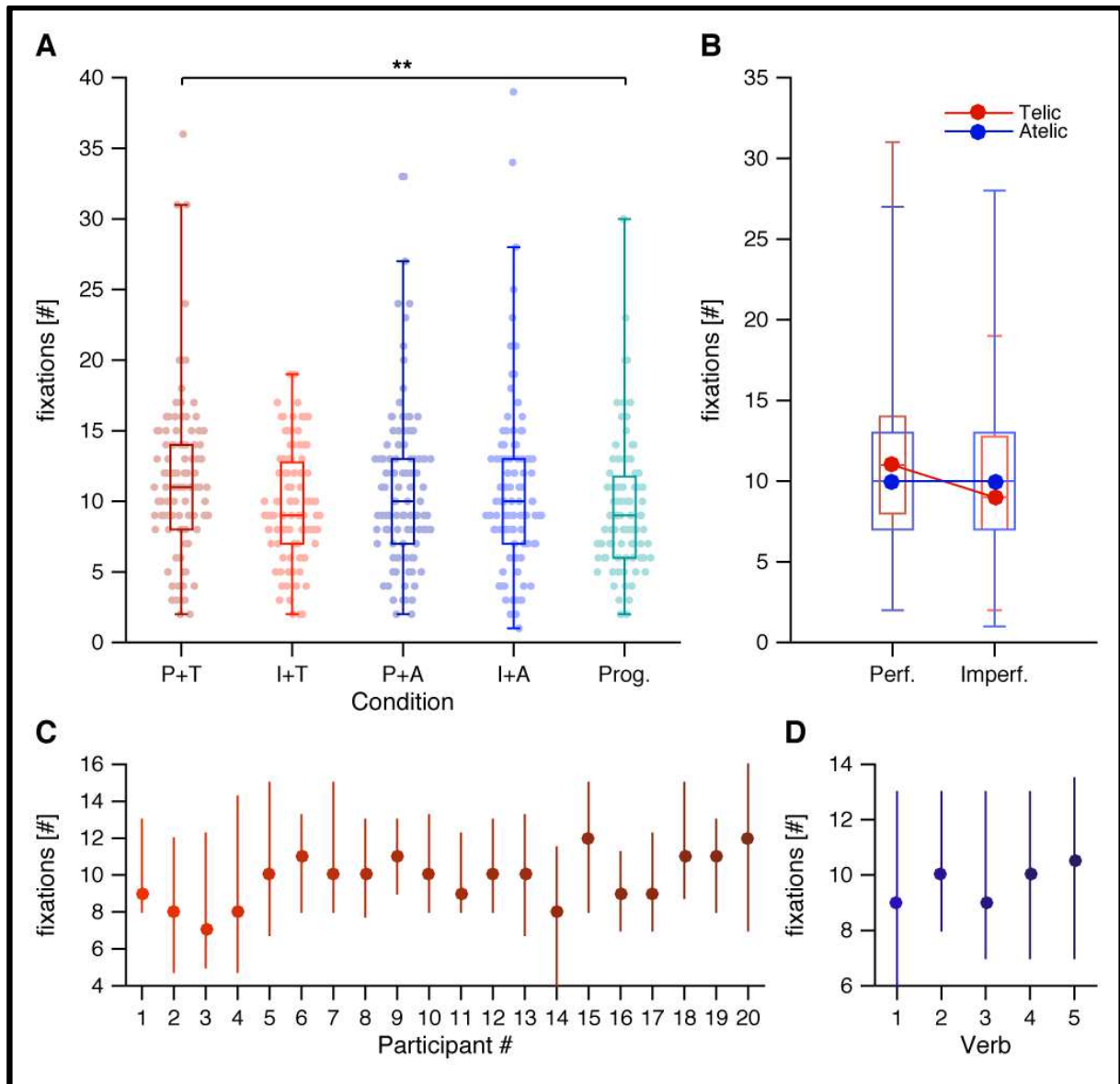
No subjects or verbs had to be excluded, as Kruskal-Wallis tests were also used to confirm that there were no significant differences in eye movement dispersion between participants ( $\chi^2(19) = 28.5$ ,  $p = 0.0739$ ; Figure 4C) or verbs ( $\chi^2(4) = 4.3$ ,  $p = 0.3693$ ; Figure 4D).

<b>Table 5:</b> Post-hoc test p-values	1: Perfective telic	2: Imperfective telic	3: Perfective atelic	4: Imperfective atelic
2: Imperfective telic	1	-	-	-
3: Perfective atelic	0.9275	0.949	-	-
4: Imperfective atelic	<b>0.03*</b>	<b>0.0419*</b>	0.2169	
5: Progressive atelic	<b>0.006**</b>	<b>0.0094**</b>	0.0725	0.9921

### Number of fixations

A complementary characteristic of eye movements that reflect visual processing is a reduced tendency to fixate on a point in the screen, which is defined by doing so for at least 50 ms. As can be seen in Figure 5A, while there are still some noticeable differences, there is no clear hint of a gradual progression across conditions. The only difference that

stands out here is the one between the first and last condition (11 [8.5 14.5] versus 9 [6 12], respectively).



**Figure 5.** Amount of fixations.

Statistical analysis is in line with this observation, with the Kruskal-Wallis test showing significant differences among groups ( $\chi^2(4) = 12.6$ ,  $p = 0.0136$ ), and subsequent post-hoc tests, summarized in Table 2, confirming a single significant comparison between group 1 and 5, i.e. more fixations in the perfective telic condition than in the progressive atelic condition ( $p = 0.0072$ ).

Similar to eye movement dispersion, there were no significant differences for number of fixations between participants ( $\chi^2(19) = 23.97$ ,  $p = 0.1975$ ; Figure 2C) or verbs ( $\chi^2(4) = 4.3$ ,  $p = 0.717$ ; Figure 2D).

<b>Table 6:</b> Post-hoc test p-values	1: Perfective telic	2: Imperfective telic	3: Perfective atelic	4: Imperfective atelic
2: Imperfective telic	0.1174	-	-	-
3: Perfective atelic	0.7084	0.7962	-	-
4: Imperfective atelic	0.5049	0.9296	0.9978	
5: Progressive atelic	<b>0.0072**</b>	0.8739	0.2297	0.3962

## 5. Discussion and conclusion

### Hypothesis 1

*The telic perfective condition entails smaller eye movements with fewer fixations than the other conditions.*

Eye movement dispersion was the lowest in the perfective telic condition, in line with one half of the hypothesis. In that sense, the condition conveying the most “completedness” indeed takes one end of the spectrum regarding eye movement dispersion. However, the differences were significant only compared to the two conditions yielding the most dispersion, i.e. imperfective atelic and progressive. While this means that no definitive statements can be made about the relation between perfective telic and the intermediate mismatching conditions (as their differences were not significant), this outcome actually fits rather well with the notion of a spectral character of ocular behaviour evoked by the temporal properties of predicates, with matching conditions making the boundaries of this hierarchical structure, and the mismatching lying in the intermediate space.

Regarding the fixation count, the outcome interesting points in the opposite direction than the one hypothesized. I expected fewer numbers of fixation for the perfective telic condition compared to the other conditions. This hypothesis was based on the logical assumption that, in the case of less eye movements, the eyes will fixate for longer amounts of time on fewer points. This expectation was supported by the photo-like metaphor so often used for the perfective conditions and by other studies showing more static ocular behaviour for the perfective conditions (Anderson & Matlock, 2008; Huettenlocher et al., 2014; Kořenář, 2016). However, the data presented in this study show more fixations, in fact the highest number across all conditions. While this group was only significantly different from the progressive condition, the effect was quite robust. Nevertheless, it must be noted that the difference between these two groups was not very substantial: on average, the perfective telic condition showed only two more fixations than the progressive condition did (11 versus 9).

In spite of the arguably modest size of the effect, it would be useful to anticipate on how it may have come to be. The number of fixations is quite a problematic category regarding its interpretation. While staring at the same spot for a long time does make it less likely there will be many additional fixations, there was a minimal duration before a fixation was inferred: 50 ms. If the eyes move too vividly, there is a chance that the eye tracking software simply will not register fixations, because the eyes never fixate on a point long enough. Moreover, saccadic behavior is an important property of eye movement that can conflate with this variable of fixation counts. Whereas for the time being this finding remains somewhat of an enigma in terms of its interpretation, there is good reason to believe more extended data analysis using more sophisticated eye movement algorithms can further elucidate the current rich dataset.

## **Hypothesis 2**

*The atelic imperfective condition entails more widely spread eye movements with more fixations than conditions with perfective and/or telic aspect.*

It is said, that the Dutch imperfective (o.v.t.) enables for access to the stages of the encountered situation, resulting in a movie-like processing of the event. Such a processing of the information activates also the visual processing, resulting in more vivid and dispersed eye movements (Huette et al. 2014; Kořenář 2016).

The outcomes from this eye tracking experiment show that the dispersion of eye movement was indeed significantly higher for both the imperfective atelic and progressive conditions, than both telic conditions (1 and 2). The highest differences were observed in comparison with the first condition, perfective telic, which goes in line with the predictions about the hypothesized dynamic of completeness and visual processing as reflected in eye movement, shown in chapter 1.7 *Research question and hypotheses*.

The dispersion analysis is also the only part where the mismatching conditions had different outcomes: while both were closer to the first condition, perfective telic, than the fourth condition, imperfective atelic, only the imperfective telic condition showed a significant difference with the fourth condition. While this by no means constitutes

evidence for differential location on the spectrum of completedness, eye movement, and visual processing, future evidence may shed reveal how the more subtly different conditions may differ in these respects.

Another interesting finding is that the mismatching conditions (2 and 3) seemed to lie closer to perfective telic, than to the fourth condition, imperfective atelic. This might suggest that the use of atelic and imperfective components together may be reciprocally enhancing, i.e. their combined use could lead to more enhanced visual processing, than each by themselves (when the other component is telic or perfective).

In case of the second outcome measure, the number of fixations, the data did not confirm the hypothesized effect, but rather left the imperfective atelic condition in the intermediate space between the perfective telic and the imperfective atelic (4<sup>th</sup> and 5<sup>th</sup>) conditions.

### **Hypothesis 3**

*The progressive condition entails more widely spread eye movements with more fixations than the other conditions.*

It was hypothesized that the progressive condition will reveal the most dispersed eye movements based on its unbounded character. This condition made one end of the dynamic spectrum indeed, entailing the widest ocular behaviour from all the conditions. Even the atelic imperfective condition revealed denser eye movement dispersion, even while this difference was not statistically significant. This is in line with a whole range of psycholinguistic studies, showing that more vivid mental stimulation is typical for progressive conditions (e.g. Bergen & Wheeler, 2010; Magliano & Schleich, 2000; Matlock, 2010). However, the hypothesized comparison between atelic imperfective and progressive condition was unprecedented.



I argue, that the not fully grammaticalized character of the progressive condition, which goes in hand with a lower usage frequency, could potentially be an important reason for the position of the progressive at the end of the researched spectrum. Eye tracking in a reading experiment has shown that less frequent words elicit longer



dispersions (Rayner, 1998). The same work also argues, that longer words have the same effect. This refers to online processing, of course, but no research has investigated how long such an effect may last after exposure to the stimulus, nor whether this holds also for auditory stimuli. Hence, even though the eye movements have been measured after the auditory stimuli were played, there is reason to believe that the longer, analytic form of progressive in Dutch and its arguably lower frequency could have pushed this verbal form on the top of the spectrum regarding its non-completedness.

Not only does this condition entail the most dispersed eye movements, it also takes the point that is opposite to telic perfective on the spectrum of the number of fixations. Since this variable has turned out to move in the opposite direction along the completedness-spectrum than originally hypothesized, we conclude the same opposite result for the progressive condition as we did for the perfective telic one when evaluating Hypothesis 1. In all, it must be said, that while the directionality may be opposite, it is interesting that in broad lines, these outcomes still do correlate to the completedness spectrum. The same considerations apply here too, with future, more sophisticated analysis potentially offering more insight into this finding

Altogether, the outcomes can be schematized as shown in Table X:

<b>Table X.</b> Hypothesized dynamic between experimental conditions and outcome measures.					
<b>Conditions</b>	1: Perfective telic	2: Imperfective telic	3: Perfective atelic	4: imperfective atelic	5: Progressive (atelic)
<b>Eye movement dispersion</b>	Less  More				
<b>Number of fixations</b>	Fewer  More				

**Interaction between lexical and grammatical aspect**

Contrary to a wide range of studies on grammatical aspect, this study aimed to investigate how the interaction of grammatical and lexical aspect affects conceptualisation, as reflected in eye movements. Only a limited number of studies have

focused on the interplay of these verb properties and to my knowledge, this study is the first one focusing on Dutch. The findings from Yap et al. (2009) and Becker et al. (2013) are partially conflicting. In the former, construction of mental representations of activities and accomplishments is faster/easier when their inherent temporal properties and grammatical aspect match (imperf. activities, perf. accomplishments) rather than mismatch (perf. activities, imperf. accomplishments). To the contrary, EEG evidence from the latter study suggested that matching grammatical and lexical aspect does not make construction of mental representations of activities any easier. However, there was a discourse availability advantage for imperfective accomplishments over perfective ones.<sup>28</sup>

The current study did not investigate the ease with which the verbal predicates are processed. But if one accepts the notion that processing is mirrored in eye movements, this study can contribute to discussion about the conflicting results of Yap et al. (2009) and Becker et al. (2013). In the current study, the significant differences between the both matching and both mismatching conditions were found. This would support the findings presented by Yap et al. (2009), as he found the processing prominence for both matching conditions. Results of this study cannot account for the facility of language processing in the case of matching conditions. However, as the matching conditions yielded significantly different eye movements than the mismatching ones, these results can account for the different ways of processing of sentences where lexical and grammatical aspect match, and where they mismatch. Ergo, the results of this study support the findings presented in Yap et al. (2009).

With respect to the interplay of lexical and grammatical aspect, the current findings suggest, that the existence of a hierarchic structure of verb properties as it was presented in Kořenář (2016), holds also for Dutch. The conditions in which lexical and grammatical aspect matched (telic perfective, atelic imperfective) were on the extremes of the spectrum, differing significantly not only from each other, but also from the mismatching conditions regarding ocular behaviour.

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<sup>28</sup> Kořenář (2016)

Yet, the data shows that telicity dominated the effects on ocular behaviour, suggesting a stronger role for lexical aspect than for grammatical aspect. For a Slavic reader, this may be very surprising, as the perfectivity is the always present, not omissible feature of the verb. However, in Dutch, language which uses its verbal tense system to express perfectivity, it is less unexpected. Thus, the grammatical aspect in Dutch may be processed unwittingly along with other functions which are ascribed to the verb tense, at the same time, the lexical aspect strikes out, because it is implemented by the means of the whole nominal phrases. Hence, the conditions which differ in terms of lexical aspect reveals more significant differences in eye movements. Noteworthy, this effect, even though significant, was quite small.

Nevertheless, this may be the first evidence for a prominence of one of the tested verb properties over the other regarding conceptualisation. Continuing this line of research could be fruitful, because the current results revealed interesting facts about the reciprocal influence of grammatical and lexical aspect, and their interplay, on conceptualisation. Further research could implement sentences which are manipulated in terms of telicity by different arguments than direct objects. One of the possibilities to do so is the usage of countable temporal adverbials such as *for 15 minutes*.

### **Progressive and o.v.t.: ongoing grammaticalization**

This experiment is novel because it investigated the psycholinguistic reality of several tenses in Dutch, including the competing conditions *atelic-imperfective* and *progressive*. In Flecken (2010) and Schmidová & Flecken (2008), the psycholinguistics of progressive was studied contrastively with the Dutch v.t.t. Their results go in line with the data presented in this thesis. However, no link between the non-grammaticalized progressive construction and the imperfective o.v.t. was made. The current study revealed evidence suggesting, that progressive and imperfective atelic influence the eye movements in the similar way, yet, there are observable significant differences between imperfective atelic and progressive conditions. In this respect, this study offers very novel insight in the choice for v.t.t. or o.v.t., both of which are used to express the past in Dutch, based on cognitive experience the concrete forms entail.

These results can be especially valuable for the research on grammaticalization processes and their motivation. The Dutch progressive has not been established as a fully-fledged tense yet (Flecken, 2011; Schmidová & Flecken, 2008) which is the case of the progressive in English, also called the continuous *tense*. The fact that Dutchmen have in their repertoire another marker to express imperfective character of a situation, which is shared with the o.v.t, has implication on the use of both of those form in the future. If a longitudinal research is conducted, where the influences of those verb forms will be investigated on the regular base, results presented in this thesis could serve as a departure point, witnessing the contemporary effects on the mental representation of the progressive and o.v.t.

### **Methodological contribution**

This study also provides valuable information about the link between language and vision in contexts where no visual referents are available. Using parts of the methodology of Huettenlocher et al. (2014), this study continues the line of the research using the blank screen paradigm and as such provides data on the processing of pure linguistic material with arguably no or maximally limited biases produced by accompanying visual stimuli. This methodology also offers great value to research focused on the connections between brain areas that are crucial for language and those devoted to perception and motor systems.

The novel approach to the designing of the experiment was applied as no movement verbs were used. Data from this study suggest, that the features of perfectivity, which is manifested in Dutch by the means of grammatical markers, have measurable influence on the sensorimotor behaviour of the eye movements regardless implication of a motion. This devalues the possible concerns that observed differences in existing eye tracking studies (Huettenlocher et al., 2014) and behavioural studies (e.g. Matlock, 2010; Richardson & Matlock 2007) regarding perfective or imperfective were caused by the prominent role of movement verbs on our cognition. Furthermore, this brings up for discussion the issue whether mirror neurons can be activated by other means than visual perception.

For this purpose, a study employing neuro-imaging techniques in combination with visual and auditory stimuli needs to be conducted.

Methodologically, future research should focus on analogous experiments as the current one with broader samples, and more auditory stimuli. To ensure that the effect found in this study is not caused by the fact that participants somehow knew what the experiment was about, both within- and between-participant comparisons should be made. It is widely assumed that in experimental research it is necessary to run both, the within and between-participants version of the experiment (for more on this problematic specific for cognitive science experiments see e.g. Stanovich & West, 2008). However, as Huettenlocher et al. (2014) mentioned in their study, the situation for aspect is particular and this assumption is supported by three studies (Matlock, 2010, 2011; Fausey & Matlock, 2011), where the between-subject experiments showed convergent results that were in line with the within-subject results. Noteworthy, the possible effect of the repeated measures was minimized by thought-out randomization of stimuli based on two Latin squares designs, and their subsequent combination, resulting in even more randomization.

### **Abstract linguistic elements and embodiment**

More broadly, the results of this study may indicate a concrete embodiment of cognition on a lexico-semantic and morpho-syntactic level, in that different constructions of the same reality can be "acted out" by eye movements differently. The results fit with theories of cognitive linguistics and support the idea that grammar, as every part of the language, has detectable mappings from form to meaning and vice versa. This study supports the idea that language and all its parts consist of three basic components (structure, meaning and function) which influence each other and reflect our cognition. It shows that morpho-syntactic and lexico-semantic properties of verbs influence our mental representation in a measurable way. This leads one to wonder if parts of language systems such as grammar or semantic types verbs, which were

considered to be abstract, may be a more concrete player in perception than previously thought.<sup>29</sup>

## Dutch verbal system

Even though there has been paid enough attention on the role of tenses in Dutch, no study has, to my knowledge, concerned the psycholinguistic, cognitively adequate reality of fully grammaticalized verbal forms. In this respect, this research represents a tremendous contribution to debate on Dutch verbal system.

There has been attempts to address the function of verbal forms in Dutch regarding their communicative purposes and their adequacy for the mental representation. For example, Janssen (1994b) discussed the various communicative situations in which perfective is more likely to be used above the imperfective and vice versa. He stated that language user prefers to use perfective when speaking with children, arguing this being a supporting evidence for bigger extent of *actuality of a situation* expressed preferably by perfective aspect. According to him, the speakers would like to draw the children to the conversation, conceptualizing the word more actually.

Although his suggestions are addressing the psycholinguistics of tenses in Dutch and a plausible explanation is offered, no empirical research has corroborated his ideas. The current study supports the notion, that the investigated tenses has also different communicative functions, as the various verbal predicates influence the eye movements in significantly different ways.

The departure point for the experimental design of the current study was Verkuyl's (2000) notion quadratic scheme of two oppositions in Dutch verbal system, perfective-imperfective and telic-atelic. The basic predicates as defined in Verkuyl (1994) were used, resulting in four possible combinations of perfectivity and telicity (telic-perfective; telic-imperfective; atelic-perfective; atelic-imperfective). Results of this study suggest, that Verkuyl's in fact mirrors the cognitive reality of the four conditions. Given the

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<sup>29</sup> Kořenář (2016)

framework of the generative grammar from which Verkuyl (2000; 1994) proceeds, he has never explicitly referred to his quadrant in terms of cognitive concepts of temporality which are co-created by the means of language. Yet, the results from this study suggest that he has proposed very cognitively adequate theoretical notion of how lexical and grammatical aspect in Dutch interact with each other.

On the hand, Verkuyl (2000) argues that in the mismatching condition, the telicity or atelicity does not change the way the various stages of the situation can be accessed, because this remains granted by the perfective or imperfective aspect. Results from the current study show, that in the case of atelic-imperfective conditions, the eye movements were very widely dispersed, suggesting the access to the various stages of the heard situation. If the assumptions from Verkuyl (2000) holds, one would expect relatively dispersed eye movements for imperfective-telic condition too. This was, however, not what the results revealed. In the case of the imperfective-telic condition, the dispersion of fixations yielded eye movements which were the most alike the perfective-telic condition. Thus, the results of this study raise concern, that access to the stages of a situation, which was previously thought to fall into the domain of the grammatical aspect, is co-influenced by the lexical aspect as well. However, further research would be necessary to disprove the notion, that imperfective aspect grants the access to the situation also for telic predicates.

## **5.1 Conclusion**

Let me sum up, what's been discussed in the previous paragraphs of this chapter. This study aimed to investigate the interplay of two temporal verb categories, lexical and grammatical aspect. The results of the current study affirm the connection between eye movements and language processing, as established in previous literature. Specifically, the ocular behaviour here reported offers evidence for the notion that grammatical properties of processed sentences can be reflected in eye movements. Importantly, grammatical and lexical aspect can change the properties of situations expressed by verbs and as such cognitive experience.

The results of the current study affirm the connection between eye movements and language processing, as established in previous literature. Contrary to the majority of the previous studies, the present study better reflects frequent situations in the real world, where we are listening to language while no explicit visual task is presented.

Most studies which have been done on this topic with comparable methodology were done on English. Aspect in English behaves differently than in Dutch. Therefore, the current study offers new insight into the psycholinguistic reality of grammatical and lexical aspect in other Germanic languages, and as such can be used as valuable cross-linguistic material for comparisons of aspect across languages.

Based on existing experimental studies in Dutch, the progressive construction *aan het + verb* was investigated in this work along the fully grammaticalized verbal forms. Thanks to the results of this thesis, the rival forms with the shared property of imperfectivity (o.v.t. and progressive construction) could be compared with each other with respect to the influence they have on the sensorimotor system. These results can be used for the further research in grammaticalization of the progressive in Dutch.

This work has revealed evidence for the connection between grammatical processing and eye movements. As it turned out to be empirically possible to account for differences in various verbal forms by the means of spontaneous eye movements, this methodology could be further used for testing of cognitive adequacy of theories about verbal systems.

In a broader sense, this study exemplifies that a connection between two competing frameworks, in this case generative grammar and notions taken from the cognitive linguistics, can be fruitful and meaningful.

In closing, thanks to its broad survey of secondary literature, this thesis can serve as a solid overview on the theoretical and experimental approach to both grammatical and lexical aspect in Dutch.



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## Appendices

### Appendix I - stimuli

Zij at.

Zij at drie botterhammen.

Zij heeft gegeten.

Zij heeft drie botterhammen gegeten.

Zij was aan het eten.

Jan waste.

Jan waste een glas.

Jan heeft gewassen.

Jan heeft een glas gewassen.

Jan was aan het wassen.

Anneke las.

Anneke las een hoofdstuk.

Anneke heeft gelezen.

Anneke heeft een hoofdstuk gelezen.

Anneke was aan het lezen.

Ik speelde.

Ik speelde een ronde Rummikub.

Ik heb gespeeld.

Ik heb een ronde Rummikub gespeeld.

Ik was aan het spelen.

Hij zong.

Hij zong een liedje.

Hij heeft gezongen.

Hij heeft een liedje gezongen.

Hij was aan het zingen.

## **Appendix II – form in Dutch**

*Met het invullen van dit formulier geeft u toestemming om uw gegevens te beheren volgens de Wet bescherming persoonsgegevens.*

Nummer: [filled out by the examiner]

Geslacht:

Leeftijd:

Kruis aan wat van toepassing is. Vul in als dat nodig is.

Ik studeer

Wat? .....

Ik werk

Waar? .....

Ik beheers een moedertaal.

Welke? .....

Ik beheers meerdere moedertalen.

Welke? .....

- Ik ben linkshandig.
- Ik ben rechtshandig.
- Ik heb een oogaandoening.

Welke?.....

- Ik heb een gehoorandoening.
- Ik lijd aan leerstoornis.

Welke?.....

- Ik ben gediagnosticeerd met ADHD.

### **Appendix III – form in English**

*By filling out this form, I agree that the filled out information will be used in accordance with the Dutch Law for protection of personal data.*

Number: [filled out by the examiner]

Sex:

Age:

Tick the box if appropriate. Specify if necessary.

- I study

What? .....

- Ik work

Where? .....

- I have one mother tongue.
- Which one? .....
- Ik have more mother tongues.

Which ones? .....

- I am left-handed.
- I am right-handed.

- I have an eye disease/disorder.  
Which one?.....
- I have a hearing impairment.
- I have a learning disability.  
Which one?.....
- Ik am diagnosed with ADHD.

## Appendix IV. – Event detailed statistics

*Explanatory notes:*

PT – perfective telic

IT – imperfective telic

PA – perfective atelic

IA – imperfective atelic

PR – progressive

PXX – participant and his number

Stimulus	Participant	Fixation Dispersion Average [px]	Fixation Count				
				zingenIT	P01	69,80	10
				zingenPA	P01	343,10	16
				zingenIA	P01	96,20	8
				zingenPR	P01	44,10	5
lezenPT	P01	81,60	8	spelenPT	P01	56,80	9
lezenIT	P01	66,80	8	spelenIT	P01	212,40	8
lezenPA	P01	160,60	9	spelenPA	P01	213,40	21
lezenIA	P01	73,10	4	spelenIA	P01	77,40	4
lezenPR	P01	69,80	13	spelenPR	P01	65,30	7
etenPT	P01	271,20	15	wassenPT	P01	117,10	11
etenIT	P01	299,80	8	wassenIT	P01	60,10	17
etenPA	P01	356,90	13	wassenPA	P01	83,80	4
etenIA	P01	300,70	8	wassenIA	P01	306,60	11
etenPR	P01	115,10	11	wassenPR	P01	43,50	12
zingenPT	P01	83,30	13	lezenPT	P02	232,10	16

lezenIT	P02	61,80	spelenPR	P03	35,10	7
lezenPA	P02	124,40	wassenPT	P03	201,00	20
lezenIA	P02	464,50	wassenIT	P03	883,00	19
lezenPR	P02	93,90	wassenPA	P03	202,00	8
etenPT	P02	1265,10	wassenIA	P03	4808,00	2
etenIT	P02	156,50	wassenPR	P03	1382,00	2
etenPA	P02	87,70	lezenPT	P04	44,41	24
etenIA	P02	965,90	lezenIT	P04	69,21	5
etenPR	P02	1284,10	lezenPA	P04	171,56	11
zingenPT	P02	1230,80	lezenIA	P04	1459,09	3
zingenIT	P02	187,00	lezenPR	P04	638,30	4
zingenPA	P02	170,00	etenPT	P04	145,40	3
zingenIA	P02	919,00	etenIT	P04	84,00	9
zingenPR	P02	2637,30	etenPA	P04	151,60	2
spelenPT	P02	120,00	etenIA	P04	95,10	14
spelenIT	P02	1537,20	etenPR	P04	412,70	11
spelenPA	P02	147,00	zingenPT	P04	273,20	6
spelenIA	P02	620,00	zingenIT	P04	62,10	19
spelenPR	P02	525,70	zingenPA	P04	301,60	5
wassenPT	P02	63,70	zingenIA	P04	322,40	13
wassenIT	P02	80,00	zingenPR	P04	70,40	17
wassenPA	P02	117,80	spelenPT	P04	112,40	6
wassenIA	P02	240,40	spelenIT	P04	561,40	12
wassenPR	P02	560,40	spelenPA	P04	439,00	8
lezenPT	P03	57,10	spelenIA	P04	321,80	3
lezenIT	P03	659,70	spelenPR	P04	65,70	53
lezenPA	P03	68,80	wassenPT	P04	59,80	4
lezenIA	P03	354,60	wassenIT	P04	1654,00	5
lezenPR	P03	587,10	wassenPA	P04	120,20	15
etenPT	P03	2015,30	wassenIA	P04	159,10	21
etenIT	P03	955,00	wassenPR	P04	666,10	7
etenPA	P03	125,90	lezenPT	P05	390,90	3
etenIA	P03	2684,90	lezenIT	P05	266,70	8
etenPR	P03	1152,90	lezenPA	P05	76,60	4
zingenPT	P03	124,10	lezenIA	P05	252,10	2
zingenIT	P03	487,60	lezenPR	P05	62,90	8
zingenPA	P03	2078,20	etenPT	P05	58,10	8
zingenIA	P03	6862,70	etenIT	P05	366,50	12
zingenPR	P03	384,60	etenPA	P05	247,80	23
spelenPT	P03	396,70	etenIA	P05	215,80	3
spelenIT	P03	681,70	etenPR	P05	417,70	30
spelenPA	P03	321,30	zingenPT	P05	263,60	31
spelenIA	P03	58,70	zingenIT	P05	140,30	45

zingenPA	P05	820,70	9	etenPT	P07	60,40	9
zingenIA	P05	96,50	10	etenIT	P07	56,00	7
zingenPR	P05	205,00	11	etenPA	P07	176,30	13
spelenPT	P05	60,00	12	etenIA	P07	877,00	21
spelenIT	P05	84,00	13	etenPR	P07	528,00	16
spelenPA	P05	216,60	14	zingenPT	P07	46,00	36
spelenIA	P05	203,70	15	zingenIT	P07	89,00	7
spelenPR	P05	124,00	16	zingenPA	P07	87,00	9
wassenPT	P05	56,00	17	zingenIA	P07	310,00	15
wassenIT	P05	249,20	18	zingenPR	P07	609,00	9
wassenPA	P05	116,00	19	spelenPT	P07	171,00	9
wassenIA	P05	310,00	20	spelenIT	P07	3123,00	10
wassenPR	P05	3680,20	21	spelenPA	P07	166,00	12
lezenPT	P06	1382,10	22	spelenIA	P07	983,00	14
lezenIT	P06	479,80	23	spelenPR	P07	308,00	8
lezenPA	P06	134,00	24	wassenPT	P07	59,00	15
lezenIA	P06	1116,00	25	wassenIT	P07	1265,10	10
lezenPR	P06	1156,00	26	wassenPA	P07	156,50	5
etenPT	P06	137,00	27	wassenIA	P07	87,70	15
etenIT	P06	83,30	28	wassenPR	P07	965,90	8
etenPA	P06	69,80	29	lezenPT	P08	1284,10	14
etenIA	P06	343,10	30	lezenIT	P08	1230,80	9
etenPR	P06	96,20	31	lezenPA	P08	2502,60	8
zingenPT	P06	44,10	32	lezenIA	P08	143,70	9
zingenIT	P06	56,80	33	lezenPR	P08	223,10	13
zingenPA	P06	190,00	34	etenPT	P08	244,60	31
zingenIA	P06	780,80	35	etenIT	P08	2813,60	7
zingenPR	P06	586,80	36	etenPA	P08	215,50	7
spelenPT	P06	2759,80	37	etenIA	P08	114,20	11
spelenIT	P06	653,10	38	etenPR	P08	748,00	10
spelenPA	P06	2784,70	39	zingenPT	P08	132,00	4
spelenIA	P06	803,90	40	zingenIT	P08	72,00	15
spelenPR	P06	52,00	41	zingenPA	P08	123,00	6
wassenPT	P06	52,00	42	zingenIA	P08	395,00	10
wassenIT	P06	72,00	43	zingenPR	P08	401,00	9
wassenPA	P06	92,30	44	spelenPT	P08	124,00	15
wassenIA	P06	2352,20	45	spelenIT	P08	79,00	6
wassenPR	P06	140,00	46	spelenPA	P08	166,00	5
lezenPT	P07	115,90	47	spelenIA	P08	1783,00	14
lezenIT	P07	52,30	48	spelenPR	P08	182,00	13
lezenPA	P07	184,00	49	wassenPT	P08	65,00	10
lezenIA	P07	80,00	50	wassenIT	P08	129,00	9
lezenPR	P07	92,60	51	wassenPA	P08	163,00	9



wassenIA	P08	618,00	13	spelenIT	P10	82,10	10
wassenPR	P08	396,00	10	spelenPA	P10	138,00	13
lezenPT	P09	112,40	15	spelenIA	P10	81,00	4
lezenIT	P09	561,40	15	spelenPR	P10	1430,70	9
lezenPA	P09	439,00	14	wassenPT	P10	782,80	12
lezenIA	P09	321,80	9	wassenIT	P10	92,00	13
lezenPR	P09	65,70	13	wassenPA	P10	126,90	4
etenPT	P09	59,80	4	wassenIA	P10	77,30	28
etenIT	P09	1354,00	10	wassenPR	P10	965,50	7
etenPA	P09	160,00	10	lezenPT	P11	1004,00	12
etenIA	P09	840,00	13	lezenIT	P11	83,40	13
etenPR	P09	1115,00	11	lezenPA	P11	147,00	7
zingenPT	P09	157,00	18	lezenIA	P11	2078,20	9
zingenIT	P09	154,00	14	lezenPR	P11	156,20	8
zingenPA	P09	110,00	8	etenPT	P11	953,50	12
zingenIA	P09	1560,00	10	etenIT	P11	2093,10	16
zingenPR	P09	408,00	13	etenPA	P11	67,00	3
spelenPT	P09	931,30	11	etenIA	P11	286,00	15
spelenIT	P09	2714,10	10	etenPR	P11	1108,00	8
spelenPA	P09	5480,30	9	zingenPT	P11	173,00	9
spelenIA	P09	493,10	16	zingenIT	P11	75,00	9
spelenPR	P09	1557,00	10	zingenPA	P11	151,00	33
wassenPT	P09	166,00	11	zingenIA	P11	1629,60	8
wassenIT	P09	171,00	9	zingenPR	P11	117,00	11
wassenPA	P09	113,00	8	spelenPT	P11	156,00	17
wassenIA	P09	1614,00	13	spelenIT	P11	102,30	9
wassenPR	P09	401,00	23	spelenPA	P11	134,00	10
lezenPT	P10	126,00	14	spelenIA	P11	1053,20	6
lezenIT	P10	144,00	8	spelenPR	P11	667,70	5
lezenPA	P10	186,00	10	wassenPT	P11	81,20	15
lezenIA	P10	1172,60	17	wassenIT	P11	140,80	8
lezenPR	P10	2400,50	9	wassenPA	P11	61,00	8
etenPT	P10	766,00	14	wassenIA	P11	636,90	9
etenIT	P10	3529,40	13	wassenPR	P11	492,40	9
etenPA	P10	691,70	14	lezenPT	P12	62,20	20
etenIA	P10	928,80	13	lezenIT	P12	107,00	8
etenPR	P10	6963,50	15	lezenPA	P12	136,70	9
zingenPT	P10	118,00	18	lezenIA	P12	799,60	10
zingenIT	P10	78,00	14	lezenPR	P12	623,00	10
zingenPA	P10	103,00	9	etenPT	P12	41,00	11
zingenIA	P10	96,50	10	etenIT	P12	182,10	11
zingenPR	P10	589,40	9	etenPA	P12	45,40	8
spelenPT	P10	335,00	8	etenIA	P12	896,00	9

etenPR	P12	542,20	15	zenPA	P14	147,10	17
zingenPT	P12	462,20	10	zenIA	P14	1195,60	4
zingenIT	P12	1532,40	14	zenPR	P14	128,00	5
zingenPA	P12	4321,40	13	tenPT	P14	101,00	10
zingenIA	P12	821,30	14	tenIT	P14	2502,60	8
zingenPR	P12	142,60	6	tenPA	P14	143,70	13
spelenPT	P12	709,10	13	tenIA	P14	223,10	8
spelenIT	P12	54,00	9	tenPR	P14	104,60	8
spelenPA	P12	385,70	11	zingenPT	P14	2813,60	2
spelenIA	P12	116,60	6	zingenIT	P14	215,50	2
spelenPR	P12	138,00	6	zingenPA	P14	199,20	24
wassenPT	P12	70,20	14	zingenIA	P14	273,30	5
wassenIT	P12	546,00	13	zingenPR	P14	646,00	11
wassenPA	P12	676,50	3	spelenPT	P14	188,00	3
wassenIA	P12	119,00	9	spelenIT	P14	228,40	4
wassenPR	P12	471,50	16	spelenPA	P14	62,00	3
lezenPT	P13	146,30	7	spelenIA	P14	237,00	9
lezenIT	P13	150,30	3	spelenPR	P14	2759,80	2
lezenPA	P13	183,00	6	wassenPT	P14	653,10	14
lezenIA	P13	129,00	12	wassenIT	P14	2784,70	11
lezenPR	P13	3597,00	13	wassenPA	P14	803,90	6
etenPT	P13	2141,50	5	wassenIA	P14	141,00	19
etenIT	P13	4510,50	14	wassenPR	P14	770,00	5
etenPA	P13	230,30	12	zenPT	P15	105,00	8
etenIA	P13	666,50	10	zenIT	P15	146,00	15
etenPR	P13	558,70	7	zenPA	P15	356,70	15
zingenPT	P13	407,00	11	zenIA	P15	1544,00	12
zingenIT	P13	113,00	15	zenPR	P15	396,00	6
zingenPA	P13	70,20	6	tenPT	P15	132,30	15
zingenIA	P13	41,00	8	tenIT	P15	973,70	15
zingenPR	P13	1058,00	8	tenPA	P15	103,50	16
spelenPT	P13	134,40	12	tenIA	P15	175,00	7
spelenIT	P13	185,00	14	tenPR	P15	3153,70	7
spelenPA	P13	187,80	15	zingenPT	P15	743,70	16
spelenIA	P13	93,00	15	zingenIT	P15	223,10	12
spelenPR	P13	188,60	10	zingenPA	P15	104,80	33
wassenPT	P13	671,00	14	zingenIA	P15	2813,60	9
wassenIT	P13	175,00	12	zingenPR	P15	215,50	12
wassenPA	P13	99,00	16	spelenPT	P15	114,20	11
wassenIA	P13	114,10	15	spelenIT	P15	91,40	8
wassenPR	P13	268,20	10	spelenPA	P15	1144,70	15
lezenPT	P14	175,00	20	spelenIA	P15	2469,80	8
lezenIT	P14	444,20	10	spelenPR	P15	91,40	14

wassenPT	P15	2144,70	zingenIA	P17	322,40	7
wassenIT	P15	2769,30	zingenPR	P17	70,40	11
wassenPA	P15	151,20	spelenPT	P17	112,40	5
wassenIA	P15	299,80	spelenIT	P17	561,40	6
wassenPR	P15	356,90	spelenPA	P17	439,00	11
lezenPT	P16	300,70	spelenIA	P17	321,80	9
lezenIT	P16	115,10	spelenPR	P17	231,50	9
lezenPA	P16	83,30	wassenPT	P17	132,60	16
lezenIA	P16	69,80	wassenIT	P17	384,60	13
lezenPR	P16	343,10	wassenPA	P17	396,70	24
etenPT	P16	96,20	wassenIA	P17	681,70	7
etenIT	P16	344,10	wassenPR	P17	65,30	7
etenPA	P16	56,80	lezenPT	P18	1223,30	11
etenIA	P16	212,40	lezenIT	P18	89,50	4
etenPR	P16	213,40	lezenPA	P18	1183,70	18
zingenPT	P16	77,40	lezenIA	P18	177,40	19
zingenIT	P16	65,30	lezenPR	P18	1139,10	17
zingenPA	P16	117,10	etenPT	P18	1512,00	9
zingenIA	P16	60,10	etenIT	P18	1974,40	10
zingenPR	P16	83,80	etenPA	P18	2068,20	9
spelenPT	P16	306,60	etenIA	P18	94,20	12
spelenIT	P16	43,50	etenPR	P18	77,00	12
spelenPA	P16	232,10	zingenPT	P18	183,00	15
spelenIA	P16	61,80	zingenIT	P18	540,00	9
spelenPR	P16	134,40	zingenPA	P18	918,00	8
wassenPT	P16	199,20	zingenIA	P18	56,00	13
wassenIT	P16	273,30	zingenPR	P18	154,00	14
wassenPA	P16	525,70	spelenPT	P18	61,00	16
wassenIA	P16	63,70	spelenIT	P18	172,00	8
wassenPR	P16	80,00	spelenPA	P18	138,00	5
lezenPT	P17	117,80	spelenIA	P18	1122,00	15
lezenIT	P17	240,40	spelenPR	P18	1650,00	10
lezenPA	P17	560,40	wassenPT	P18	81,00	11
lezenIA	P17	57,10	wassenIT	P18	128,00	16
lezenPR	P17	659,70	wassenPA	P18	119,00	13
etenPT	P17	68,80	wassenIA	P18	502,00	6
etenIT	P17	354,60	wassenPR	P18	805,00	6
etenPA	P17	151,60	lezenPT	P19	53,00	10
etenIA	P17	95,10	lezenIT	P19	142,00	8
etenPR	P17	412,70	lezenPA	P19	75,00	27
zingenPT	P17	273,20	lezenIA	P19	1734,00	9
zingenIT	P17	62,10	lezenPR	P19	61,80	6
zingenPA	P17	301,60	etenPT	P19	127,40	12

etenIT	P19	199,20	10	zenIA	P20	220,00	9
etenPA	P19	273,30	10	zenPR	P20	868,00	5
etenIA	P19	525,70	13	zenPT	P20	1254,80	17
etenPR	P19	925,70	8	zenIT	P20	289,40	14
zingenPT	P19	252,10	14	zenPA	P20	178,00	10
zingenIT	P19	62,90	14	zenIA	P20	430,60	12
zingenPA	P19	589,60	8	zenPR	P20	215,50	11
zingenIA	P19	366,50	7	zingenPT	P20	114,20	15
zingenPR	P19	247,80	6	zingenIT	P20	91,40	9
spelenPT	P19	215,80	13	zingenPA	P20	2144,70	11
spelenIT	P19	417,70	12	zingenIA	P20	2469,80	39
spelenPA	P19	263,60	11	zingenPR	P20	126,40	7
spelenIA	P19	140,30	15	spelenPT	P20	445,40	16
spelenPR	P19	820,70	4	spelenIT	P20	141,90	16
wassenPT	P19	96,50	15	spelenPA	P20	821,20	16
wassenIT	P19	190,00	12	spelenIA	P20	541,60	6
wassenPA	P19	160,70	16	spelenPR	P20	423,00	7
wassenIA	P19	177,00	34	wassenPT	P20	1141,30	13
wassenPR	P19	606,00	4	wassenIT	P20	132,00	14
lezenPT	P20	388,80	4	wassenPA	P20	370,10	13
lezenIT	P20	85,00	6	wassenIA	P20	258,70	16
lezenPA	P20	120,00	16	wassenPR	P20	237,00	6