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Attention meets language: a corpus study on the expression of motion in Estonian

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UNIVERSITY OF TARTU
Press

University of Tartu, Institute of Estonian and General Linguistics

Dissertation accepted for the defence of the degree of Doctor of Philosophy on October 18th, 2016 by the Committee of the Institute of Estonian and General Linguistics, Faculty of Arts and Humanities, University of Tartu

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Defence of the dissertation: February 21st, 2017 at 14.15, in Senate Hall, University Main Building, Ülikooli 18, Tartu

This study has been supported by the Graduate School of Linguistics, Philosophy and Semiotics, and the Centre of Excellence in Estonian Studies; funded by the (European Union) European Regional Development Fund and European Social Fund.

European Union
European Regional
Development Fund

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ISSN 1406-5657
ISBN 978-9949-77-342-8 (print)
ISBN 978-9949-77-343-5 (pdf)

University of Tartu Press
www.tyk.ee

ACKNOWLEDGMENTS

Moving from *there* to *cognition* has taken me more than a hundred thousand words and this process has filled me with immense happiness. I am genuinely grateful for being given the opportunity to have experienced this stimulating process. Reading well-written articles, solving problems I encountered when conducting my study, diving into the fascinating world of data collection and annotation, and bringing my current state of knowledge into one structured text file has been an exhilarating mental exercise. This process, fantastic and fabulous, would not have been so wonderful without so many extraordinary people around me.

First and foremost, I am deeply and profoundly indebted to my supervisors in Tartu, Renate Pajusalu and Ilona Tragel, and to my temporary supervisor in Manchester, Eva Schultze-Berndt. I consider it a great privilege of having Renate as my supervisor. She has given me constant support from the very beginning of my university studies in linguistics. Her encouragement, warmth, and a remarkable ability to express difficult ideas in simple words has accompanied and inspired me throughout my studies. It is also an equally great privilege of having Ilona as my supervisor. Even simply her presence could make me do more than I could have possibly imagined. My study has benefited so much from her fantastic energy, endless care, and great wisdom. Finally, I was very fortunate of being able to spend a year at the University of Manchester under Eva's guidance. She helped me tremendously with our thorough discussions on my research topic, and she always gave me insightful and useful critiques of my texts. I thank her whole-heartedly for her truly emphatic attitude towards my research topic, and myself. I would like to thank all my supervisors for trusting and believing in me, sharing their competence and thoughts with me, reading and commenting on various drafts of my thesis, and providing their generous help whenever I needed it.

Secondly, I would like to give thanks to the three reviewers, Anetta Kopecka, Ene Vainik, and Toomas Kirt, for their valuable time they spent on carefully reading my thesis, critically evaluating it, and kindly providing feedback. I have made every attempt to improve the quality of the thesis based on their very constructive feedback.

I also express my sincere, heartfelt, and extreme gratitude to Roger Yallop who has guided me to express my thoughts more succinctly. He forced me to step out of my comfort zone by giving me feedback on my drafts from the perspective of a critical and intellectual English speaking reader. I thank him for his endless support, infinite working hours, perfectionism, and high-quality feedback.

In addition, I am truly appreciative to my fellow PhD students, friends, and colleagues in the Institute of Estonian and General Linguistics at the University of Tartu. Their passion to their work and high quality of their research always made my days cheerful. I feel proud to belonging to such a supportive and thriving community. My thanks go especially to Nele Salveste, because she was always willing to read, comment on, and discuss my drafts, no matter where she was. Her sparkling personality, deep engagement with whatever she deals with, and critical thinking has inspired me throughout my studies in linguistics. I would also like to thank Anni Jürine, Jane Klavan, Maria Reile, Tene Viiburg, Helen Hint, and Piret Piiroja for reading and commenting on various sections of the manuscript, and for providing me with wonderful company throughout my doctoral studies. Without them and their constant feedback on my drafts, writing up this study would have been not only very difficult, but also rather lonely.

Moreover, I thank Kairi Kreegipuu for her collaboration in conducting a crucial experiment for the purpose of this thesis, and for reading and commenting on several sections of the manuscript. Thanks are also extended to the University of Tartu Press for their kind support in the publishing process, and in particular to Tiia Ilus for preparing the publishable version of the manuscript. I thank all the people who have provided their aid in various tiny aspects of this study, and all the volunteers who have participated in the experiment. Finally, I give thanks to Lauri Eesmaa for his assistance in the sections of the manuscript that are written in Estonian.

I also wish to acknowledge the following people. Firstly, I thank Haldur Õim for giving me the opportunity to be involved in his research project before starting my doctoral studies. Our many discussions have helped me to trust my own intuitions of language and semantics that I have followed when conducting this research. Secondly, I sincerely thank Ann Veismann who has been my ‘first-aider’ whenever I ran out of all reasonable ideas myself. Not only did she help me with the linguistic issues, she also kept me motivated with her wonderful empathy and warm-heartedness. Finally, special thanks go to Reet Kasik who generously offered her help during the development stage of my study whenever I asked for it.

Needless to say, all deviances from an ‘immaculate research’ and a ‘perfect thesis’ are due to myself despite the many efforts of Renate, Ilona, Eva, Anetta, Ene, Roger, Nele, Anni, Jane, Maria, Tene, Helen, Piret, Kairi, Ann, Tiia, and Lauri who have endeavoured to make this thesis meet the highest standards of a linguistic study.

I am very thankful to Tiia Margus and Mare Valge for ensuring that my studies ran smoothly and were stress free. I also very much appreciate the joy and loveliness of Leelo Padari and the ‘corridor crew’ for their cheerleading. I would also like to express my sincere gratitude to the many wonderful teachers I have had and the many inspiring scholars and people from all walks of life. Particularly so from those I met during my studies in music at the Heino Eller Tartu Music School; during my studies in philosophy, history, and linguistics at the University of Tartu; and also from my time as a visiting PhD student at the University of Manchester.

Conducting this research would not have been possible without financial support. I thank all the institutions who have awarded me funding, and all the people who have made these funds available. These institutions include the Graduate School of Linguistics, Philosophy and Semiotics; the Archimedes Foundation; the Estonian Students Fund in USA; Alfred Kordelin's Foundation; and the Centre of Excellence in Estonian Studies (TK145). I have also benefited from participating in the research projects: "The lexical and grammatical regularities in the linguistic development of 3-7 year old children" (ETF7492), "Language and meaning: semantics and grammar in a cognitive perspective" (SF0180056s08), and "Referential devices in Estonian and adjacent languages: experimental approach" (PUT701).

Furthermore, conducting this research would not have been possible without the support from my friends and family. I thank Stella for her everlasting friendship, Nele for always being there, and Maria for lighting up our workspace. I also thank our wonderful community of neighbours, and all the other dear friends who make my, and my family's, everyday life so joyful and fun. Above all, I thank my parents for their constant support and for the things I do not even know what to be thankful for, my grandparents for being them, my parents-in-law for always willing to help, and all the other members of my immediate and extended family for being born into our family trees.

Finally, my sincere gratitude belongs to my most beloved and dearest ones, Lauri, Krõõt and Pärt, for having accompanied me fifteen, eight and six years respectively. There are no words that could ever express this fortune and love I am so grateful for. I thank them so much for this.

CONTENTS

ABBREVIATIONS

Abbreviations in glosses

1, 2, 3	person	INE	inessive
ABE	abessive	INF	infinitive
ABL	ablative	LAT	lative
ADE	adessive	LOC	locative
ALL	allative	NOM	nominative
APP	active past participle	PART	partitive
COM	comitative	PL	plural
COMP	comparative	PPP	passive past participle
ELA	elative	PRS	present
ESS	essive	PST	past
GEN	genitive	PTCP	present participle
GER	gerund	SEP	separative
ILL	illative	SG	singular
IMPERS	impersonal	TERM	terminative

Other abbreviations

AdpP	adpositional phrase
Adv	adverb, adverb phrase
AmbigVerb	verb(s) of ambiguous motion with regard to animacy
AnimVerb	verb(s) of animate motion
BinnedSpeed	categorical speed rating of verb
BM, BothMotions	verb(s) of ambiguous motion with regard to translational/self-contained motion
DemAdv	demonstrative adverb
FC	fiction corpus
GV, GoalVerb	goal verb(s)
HV, HorVerb	verb(s) of horizontal motion
HorVert	type of motion with regard to horizontality/verticality
HVV, HorVertVerb	verb(s) of ambiguous motion with regard to horizontal and vertical motion
InanimVerb	verb(s) of inanimate motion
MMV, ManMotVerb	manner of motion verb(s)
MotionType	type of motion
NV, NeutralVerb	neutral verb

NumP	quantity phrase
NC	newspaper corpora
NP	noun phrase
PostpP	postpositional phrase
PrepP	prepositional phrase
ScM, SelfContMotion	verb(s) of self-contained motion
SV, SourceVerb	source verb(s)
TM, TranslMotion	verb(s) of translational motion
VerbSpeed	numeric speed rating of verb
VerbType	type of verb
VV, VertVerb	verb(s) of vertical motion

1. INTRODUCTION

There is no human without language and no brain without motion. After all, only humans possess language with such a complexity and diversity of functions, and only species capable of movement have a brain. Thus, both language and motion are fundamental for human beings. This fundamentality has led to an enormous research interest into language and motion, with language of motion included. As a result, much is known about language, motion, and the cognitive and neurological processes behind producing and interpreting language, motion, and motion language. Rapid changes in linguistics over the past decades have yielded various means to access the structure of language, resulting in the state of knowledge about the structure of language being ever richer. At the same time, developments in cognitive psychology have provided invaluable knowledge into human perception and cognition. In linguistics, the importance of treating language as a cognitive ability of human beings has become widely acknowledged, with the cognitive basis of language receiving arguably the greatest attention of all.

How motion can be expressed has been an interest for a range of disciplines. In the framework of cognitively oriented linguistics, Talmyan motion typology is a case in point. Indeed, after Talmy's (1985; 2000b) approach to the motion event and lexicalisation patterns, there has been an exponential growth of studies into motion expressions and the typological status of languages (Aske 1989; Slobin 1996; Papafragou et al. 2002; Ibarretxe-Antuñano 2004a; Slobin 2004; Filipović 2007; Beavers et al. 2010; Croft et al. 2010; Goschler & Stefanowitsch 2013a). To a lesser extent, the Goal-biased nature of language has been discussed in the literature (Ikegami 1987; Dirven & Verspoor 1998; Stefanowitsch & Rohde 2004; Lakusta & Landau 2005). As motion is fundamental for human experience, it is not surprising that motion descriptions have been found to serve as the basis for many metaphorical and metonymic extensions (Lakoff & Johnson 1980; Lakoff 1987; Johnson 1987; Radden 1996; Talmy 2000a) which has led to an understanding that language is strongly inclined towards dynamic expressions (Talmy 2000a).

Up to now, very little attention has been paid to the structure and cognitive underpinnings of motion descriptions outside the studies of the lexicalisation patterns, Goal-bias, and figurative language. Furthermore, linguistic findings have received little psychological validation. The current study aims to address this gap by exploring the semantic structure of motion clauses and factors, both linguistic and cognitive, that contribute to these patterns. In other words, how motion is expressed is the objective of the study, given that it is a human being who is able to both perceive as well as express motion, and that this human being possesses particular properties of perception, attention, and memory.

The study develops the '**hypothesis of consistent windowing**' according to which domain-important information should be expressed in an enhanced manner to adequately reflect the characteristics of cognitive processing and to allow effective processing of language in the first place. The hypothesis of consistent windowing expands upon Talmy's (1996; 2000a) approach to windowing of attention where attention-given information is said to be windowed by means of expressing it. As for motion, if some spatial setting is expressed, it thus receives attention, and is hence windowed. For example, in *She headed to the city*, the final portion of the path (i.e., the city) is windowed.

The hypothesis of consistent windowing, in turn, is developed in this thesis to capture the essence of the enhanced structure of language. It suggests that not only a windowing of attention, but a consistent windowing of attention occurs in language. This means that the most important aspects of some situation, which clearly attract one's attention when visually observing this situation, are also expressed in a way that reflect such attentional patterns. One way to do this is by means of redundancy in that the same or similar information is expressed by different linguistic elements simultaneously. As such, a language structure obeying the consistent windowing tendency can be seen in a form of multiple expression of important information. In such patterns, elements would be consistent in depicting the most important information and would, thereby, direct one's attention even better to the relevant portions of the scene. For example, both the verb and the other spatial expression in a clause may window (i.e., express) similar spatial information such as information about Goal-directedness in the above example of heading to the city.

Driven from what is known about processing and expressing motion, and the interplay between language and other cognitive abilities of human beings, the study examines the tendencies of how space and manner are described. The material consists of 9500 actual motion clauses of Estonian, representing 95 frequently occurring Estonian motion verbs. These corpus data are analysed by a combination of different statistical methods.

The hypothesis is tested by examining possible combinations of expressions of the same or similar spatial or manner information within one motion clause. More specifically, the verb and other important expressions in a clause is expected to have a preference of expressing (i.e., windowing) similar spatial or manner meanings. For instance, if a verb specifies the goal of motion, then it should have a tendency to combine with Goal expressions (e.g., *suundus tuppa* '(s)he headed to the room'), while if it specifies the source, it should combine with Source expressions (e.g., *lahkus toast* '(s)he left the room'). In the same vein, manner of motion verbs would combine more readily with manner expressions (e.g., *jooksis kiiresti* '(s)he ran quickly') than directional verbs (i.e., source and goal verbs).

The results of the study strongly confirm the consistent windowing hypothesis, while also attesting the unsurprising flexibility and complexity of language. The typical patterns of motion expressions clearly reflect attentional patterns which would also appear when observing some physical motion situation. Given the current state of knowledge in cognitive psychology, the consistent windowing structure, thus, accounts for a cognitively plausible description of language.

The thesis is structured into two parts. The first part (Sections 2–7) explains the theoretical and practical basis of the study and comprises the following six sections:

- Section 2 explains the aim and expectations of the study.
- Section 3 provides an overview of core findings about motion perception and cognition, the expression of motion, and the evidence for the intertwined nature of language and other cognitive domains.
- Section 4 discusses and defines the most important concepts and terms for the current study.
- Sections 5 and 6 are dedicated to the issues of material elicitation and the procedure.
- Section 7 gives a short overview of the most important characteristics of the Estonian language with respect to the expression of motion.

The second part (Sections 8–11) discusses the results and comprises the following four sections:

- Section 8 characterises the data of the study from the perspective of semantic categories and their formal manifestations.
- Section 9 presents the main results of the study. Sections 9.1 and 9.2 examine clausal patterns of spatial and manner information respectively. Section 9.3 analyses the importance of other factors in determining clausal patterns of motion verbs. Section 9.4 brings the results together in classifying the verbs on the basis of their clausal patterns and in evaluating the findings of the current study from a different angle.
- Section 10 discusses the findings of the study, and Section 11 summarises the main results and implications of the study.

2. AIM AND HYPOTHESES

The aim of the thesis is to provide an account of main structural patterns of motion clauses in Estonian as attested in corpus material. Motion clauses depict motion, and are limited by actual motion instances in this study (e.g., *Keeleteadlane jookseb pargis* 'A linguist is running in the park'). The structural patterns of these actual motion clauses are assumed to reflect cognitive processes underlying the process of spatial cognition, but also language production and comprehension. This assumption is grounded by the understanding that the description of a language should, at the very least, represent linguistic reality as accurately as possible, and also be psychologically plausible (see also Langacker 1987: 12–13). To meet this principle, I embark on the main general cognitive principles considering visual perception, attention, and working memory. Then, linguistic and psycholinguistic findings about the structure of motion clauses are described. Based on these findings, I suggest a **consistent windowing hypothesis**, which is tested on 9500 actual motion clauses containing 95 frequent motion verbs in Estonian. The data are interpreted from both the viewpoint of linguistic and from general cognitive principles. However, I would like to stress that this thesis does not provide much psychological evidence, because this requires an entirely different type of investigation.

Thus, the main hypothesis of the thesis is that there is a consistent windowing structure of motion clauses. This means that information that is essential to conceptualise a motion situation is depicted via several expressions in a clause (hereinafter called 'multiple expression'). Multiple expressions direct one's attention as well as simultaneously reflecting attentional patterns. In other words, what is perceived as important when observing motion, should also be expressed as important. The term 'windowing', itself, refers to the windowing of attention as coined by Talmy (1996; 2000a: 255–309). Here, he views windowing as both a linguistic and a cognitive process that directs attention to the relevant and important portions of the scene. In other words, foregrounded parts of a scene are windowed (i.e., expressed), while others are backgrounded and gapped (i.e., not expressed). As for motion, the initial, medial, and final portion of the path may be windowed or gapped (i.e., expressed or not expressed). For instance, the phrase *jooksis majja* '(s)he ran into the house' windows the final portion of the path, and gaps the initial and medial portion of the path.

In the current study, I apply the term 'windowing' to capture the idea that linguistic patterns both reflect as well as direct attention. As such, this term is only meant to refer to linguistic phenomena which are presumably attentionally motivated. Furthermore, the study suggests that this windowing happens in a particular manner. More specifically, I expect the most important information to be expressed in an enhanced way in motion clauses that results in patterns where some information is strongly foregrounded, whereas other information is backgrounded or even absent. Linguistic enhancement of important information can be achieved using various methods (e.g., intonational patterns or word order). One particular way of enhancing important meanings is to reflect verbal semantics in clausal patterns, which is the objective of the current thesis. As such, similar meanings would be present both in motion verbs and in other elements of motion clauses. Metaphorically, these expressions of similar meanings are like different windows to the same portion of the scene. For example, if a goal verb combines with a Goal phrase (e.g., *sisenes majja* '(s)he entered the house'), both the verb and the spatial expression window (i.e., express) the same, final portion of the path. Hence, the term 'consistent windowing'.

With regard to motion, two semantic areas have been proposed in the literature as the most relevant ones to express (Talmy 2000b: 21–146; Slobin 2006; Ibarretxe-Antuñano 2009). Firstly, the expression of spatial settings is essential in order to describe that something changes its location. Secondly, a specification of the way motion is conducted is important for the characterisation of the qualitative properties of motion. This also includes a specification of the type of mover because how some entity can move depends essentially on its abilities to move (e.g., whether the mover is animate or inanimate). For these reasons, spatial and manner expressions in motion clauses are the main interest of this study. In terms of the consistent windowing hypothesis, I predict that spatial and manner information is expressed in an enhanced manner, by means of multiple expression (i.e., by more than one clausal unit), to reflect the attentional patterns of processing visual motion. For the purposes of clarity, the hypotheses of the study are presented below. The theoretical underpinnings, and supportive evidence for these hypotheses are discussed in more detail in the next section.

The main hypothesis regarding spatial information is that motion verbs and other spatial expressions in a clause have a tendency to describe the same portion of the path. More specifically, the following expectations for spatial expressions can be outlined:

(i) Source verbs (i.e., verbs specifying the starting point of motion, such as *lahkuma* 'leave') would co-occur with Source expressions (i.e., with expressions referring to the starting point of motion, such as *majast* 'from the house'). In this case, both the verb and the other spatial expression would window the initial portion of the path (e.g., *lahkus majast* '(s)he left the house').
(ii) Goal verbs (i.e., verbs specifying the destination of motion, such as *sisenema* 'enter') would combine with Direction or Goal expressions (i.e., with expressions referring to the destination of motion, such as *majja* 'into the house'). In this case, both the verb and the spatial expression would window the final portion of the path (e.g., *sisenes majja* '(s)he entered the house').
(iii) Manner of motion verbs (i.e., motion verbs specifying mainly manner, such as *jooksma* 'run') would co-occur with Trajectory or Location expressions (i.e., with expressions referring to the route or place where

motion is conducted, such as *majas* ‘in the house’). In this case, both the verb and the other spatial expression would window the medial portion of the path (e.g., *jooksis majas* ‘(s)he ran in the house’).

It is important to note that we should not expect some absolute patterns to emerge or that other combinations would be impossible. Rather, it should be kept in mind that only tendencies, typical patterns, or some core features of typical patterns are expected.

It should also be noted that I assume that manner of motion verbs do not form a homogeneous group of non-directional verbs as often claimed in the literature (Talmy 1985; 2000b; Levin 1993). In fact, I premise that manner of motion verbs exhibit directional information and this directionality is present in varying amounts with respect to different manner of motion verbs (see also Aske 1989; Cifuentes Férez 2010; Kopecka 2010; Cardini 2012 about motion verbs entailing both directional and manner features).

Assuming this premise, I predict that the more prominent the information about directionality in manner of motion verbs, the more likely they combine with directional spatial expressions (e.g., *kihutas majja* ‘(s)he dashed into the house’ vs. *uitas majja* ‘(s)he strolled into the house’). As such, manner of motion verbs with salient directional features may behave similarly to goal verbs in windowing the final portion of the path.

As for manner information, I hypothesise it to be expressed in a similar pattern to spatial information. In other words, I predict the following patterns of consistent windowing of manner:

(i) Manner of motion verbs are likely to be combined with expressions of manner of motion (e.g., *jooksis kiiresti* ‘(s)he ran quickly’). In such patterns, manner information would be windowed by multiple expressions. This prediction is based on the studies that report the importance of manner information in motion situations (e.g., Slobin 1996; 2006; Slobin et al. 2014). That is, if manner is important to conceptualise, the expression of it should draw maximum attention to manner settings.

(ii) Source and goal verbs are less likely to combine with expressions of manner of motion as manner settings may not be of the primary importance when focusing on spatial settings.

These hypotheses are based on the assumption that language cannot be separated from cognition. This means that if attention is selective and limited so that only the most relevant information is processed in depth (James 1890: 403–405; Kahneman 1973; Baddeley & Hitch 1974; Desimone & Duncan 1995; Luck et al. 2000; Cowan et al. 2005; Alvarez & Franconeri 2007), and only a limited amount of information is possible to convey by a linguistic expression, it is plausible that linguistic patterns reflect attentional ones. The current study tests the possibility that attentional patterns are reflected by means of multiple expression as stated in the hypotheses.

The following sections elaborate on motion processing and the structural properties of motion clauses. Firstly, I discuss the main cognitive abilities of human beings that are relevant to motion processing with respect to the current study. Then, I examine the linguistic findings of structural patterns of motion clauses. Next, I investigate the key findings in language from the viewpoint of cognitive psychology and psycholinguistics. Finally, I return to the expectations of the study and revisit the consistent windowing hypothesis in light of the cognitive and linguistic evidence.

3. BACKGROUND

Over the past decades, linguists have witnessed an increasingly rapid growth of studies into the expression of motion (Talmy 1985; 2000b; Vulchanova & Zee 2012; Goschler & Stefanowitsch 2013a). At the same time, the processing of motion (Nakayama 1985; Burr & Thompson 2011; Nishida 2011) and attentional phenomena related to it (Pashler 1998; Styles 2000; Petersen & Posner 2012) have received enormous attention in cognitive psychology. More recently, psychological and psycholinguistic studies have been conducted on the links between expressing and processing of motion (Kaschak et al. 2005; Papafragou & Selimis 2010; Lakusta & Landau 2012; Lindsay et al. 2013; Speed & Vigliocco 2013). Overall, the current state of knowledge regarding motion is comparatively rich. In the following, I take stock of the key findings in these disciplines to evaluate the hypothesis of consistent windowing as pursued in the current study.

Firstly, I discuss the most relevant cognitive abilities that are applied to process physical, visual motion. Then, I give an overview of relevant linguistic studies of motion clauses. Finally, I bring cognition and language together and describe the results of psycholinguistic and other language-embedded psychological studies. Furthermore, as the emphasis of this study is on language and linguistic studies, I do not discuss cognition, psychological and neurological studies in great detail.

3.1. Motion cognition

There is no language without cognition. This statement is almost tautological. As if there were no language without language and no cognition without cognition. In fact, in line with the main assumptions of cognitive linguistics (Langacker 1987: 12–13, 99–146), one may find it impossible to interpret findings of observed language phenomena without referring to some aspect of cognition. In other words, "Language is an integral part of human cognition. An account of linguistic structure should therefore articulate with what is known about cognitive processing in general" (Langacker 1987: 12).

A vast array of linguistic studies, not just those manifesting themselves as 'doing cognitive linguistics' exploit concepts that originate in cognitive psychology. For example, the concept of attention, and other related terms, such as salience, foregrounding, and profiling, are widely exploited in linguistics when explaining linguistic phenomena. In fact, one could argue that attentional issues are at the very core of cognitive linguistics. For instance, the Figure/Ground distinction taken from Gestalt psychology (Koffka 1935: 177–210) is of primary importance in both Talmy's (1985; 2000a; 2000b) and Langacker's (1987; 1991) approaches. The role of joint attention is seen as being essential in language acquisition (Tomasello & Farrar 1986; Carpenter et al. 1998), and also in socialising in general by means of language (Diessel 2006). Even outside the approaches which explicitly state the importance of attention, researchers, independently from the research subject, often make use of vocabulary that refers to attentional phenomena.

Thus, the reason for making reference to studies from cognitive psychology has two sides. On the one hand, the structure of language is, by the fact of its existence, psychologically possible, and consequently, the explanation of this structure has to be psychologically plausible. On the other hand, in the current study, the structure of cognition itself serves as a basis for formulating expectations and hypotheses regarding the structure of language. For that reason, relevant studies in cognitive psychology need to be tackled. I focus primarily on two domains of cognition in proposing the hypotheses and explaining the findings. These domains are the visual perception of motion and attention. Alongside attention, working memory is also briefly discussed. Other domains, such as long-term memory, thinking, or automatic, attention-free processing (e.g., Schneider & Shiffrin 1977; Shiffrin & Schneider 1977), are also relevant regarding motion expressions. However, they are not discussed here because they are out of the scope of this research.

In the following sections, I provide an overview of the pertinent findings regarding visual perception of motion and attentional phenomena related to motion perception. After that, I re-explain the hypotheses introduced above in light of these cognitive abilities of human beings. The main proposals are: (i) differences in processing different kinds of motions should result in differences in language; and (ii) limitations of attention ultimately need to be reflected in language structure.

3.1.1. Visual perception of motion

Perception is a prerequisite for cognition. An overview of motion perception is, thus, in order before turning to attentional processes. Here, the exact mechanisms of motion perception in their complexity are not of primary importance. Instead, I focus on the key findings in this research area that are relevant to the current study, and introduce only the most important mechanisms from a neurological perspective. How motion is perceived and processed has been an interest for a whole branch of cognitive psychology (for reviews, see Nakayama 1985; Burr & Thompson 2011; Nishida 2011). In fact, the study into motion perception is rather exhaustive and has provided many interesting findings that are not only related to the processing of motion, but about the functional properties of the human brain in general. Regarding motion perception, the following main findings relevant to the current study can be outlined.

First of all, motion is processed differently from that of non-motion. Furthermore, whether an object is capable to move or not has its influence on processing (Beauchamp et al. 2002). Many researchers (Ungerleider & Mishkin 1982; Livingstone & Hubel 1988; Goodale & Milner 1992) suggest that neurological mechanisms are different when one is observing some moving object from when one is looking at some static object or at some individual features of it. This approach is known as visual segregation in processing (for review, see McIntosh & Schenk 2009). According to the original model (Goodale & Milner 1992), there are two main pathways where visual information is forwarded in the brain: the dorsal stream (also called magnocellular, M- or "where" pathway) and the ventral stream (also called parvocellular, P- or "what" pathway). Research (Ungerleider & Mishkin 1982; Albright 1984; Livingstone & Hubel 1988; Goodale & Milner 1992; Watson et al. 1993; Dupont et al. 1994; Tootell et al. 1995) shows that spatial information (i.e., location and motion) is processed in the dorsal pathway where the V5 (MT) brain area is mainly responsible for analysing motion (although other areas, such as the primary visual area V1 and the area V3a in the dorsal stream show motion-specific processes too). Information about the object, its shape and colour is processed in the ventral pathway, mainly in the area known as V4.

As the nerves projecting to the dorsal pathway are larger in diameter than those projecting to the ventral one (Fitzpatrick et al. 1983), the processing of information in the former is faster than in the latter (Schmolesky et al. 1998). What follows is that objects in motion are often processed faster than static objects or their individual features (Livingstone & Hubel 1987; Aschersleben & Müsseler 1999). Indeed, as moving objects can potentially cause more harm than static ones, one needs to react faster in the former case (Barrett 2016: 250−252). For the same reason, moving objects are easily discovered outside the fovea; even in peripheral vision one is able to detect motion (Tynan & Sekuler 1982). The two pathways are not completely separated though. There is much evidence that the two are interrelated (Kreegipuu et al. 2006; Milner & Goodale 2008; Rosa et al. 2009). Furthermore, in some cases and depending on the task, the processing of non-motion features may be faster than motion ones (Moutoussis & Zeki 1997).

Secondly, the faster the motion is, the faster the processing is (Tynan & Sekuler 1982; Kreegipuu & Allik 2007). Furthermore, the faster the motion is, the faster the detection is of specific features (e.g., colour) of the moving object (Kreegipuu et al. 2006). For example, the speed of detecting the onset or offset of the moving stimulus has been shown to be dependent on the speed of the moving stimulus: the faster the motion is, the faster the detection is, whereas the onset, in turn, is processed faster than the offset (Kreegipuu & Allik 2007). Similarly, the speed of detecting the direction of motion decreases when the speed of motion increases (Burr et al. 1998; Hutchinson & Ledgeway 2010).

Finally, perceiving motion is not only a matter of processing distinct features (e.g., direction or colour), but also a matter of taking in complex patterns. That is, typically, bundles of features need to be processed in everyday life. The law of common fate by the Gestaltists is well known: what moves together, goes together (Wertheimer 1923). Moreover, complex motion patterns can be perceived with ease as demonstrated by Johansson's (1973; 1976) experiments of biological motion. Biological motion, featuring highly complex motion patterns with respect to studies focusing on only one feature, can be easily and efficiently processed. In these classical experiments of Johansson (1973; 1976), visual scenes of movers were created where only lighting dots were presented to the participants. The participants showed an ability to detect motor patterns solely based on these moving dots. This provided evidence that in the process of perception, multiple moving features are combined into one meaningful whole. Further investigations have shown that people are able to infer from jointly moving dots a wide array of properties about the mover (for review, see Troje 2002). These findings have support from neurological studies as well (Bonda et al. 1996; Grossman et al. 2000).

Nevertheless, the neurological findings of biological motion are somewhat mixed. For instance, biological motion (which can be viewed as a type of manner of motion) is shown to be processed in the V5 region in the dorsal stream (Beauchamp et al. 1997). This indicates that complex motion patterns and distinct motion features are processed in the same region. Conversely, Wu et al. (2008) report that manner of motion and directional motion are processed in a segregated neural manner: manner information is processed as "what" information in the ventral stream; whereas path information is processed as "where" information in the dorsal stream.

The results from perception studies regarding motion are comparable to those obtained in studies of attention. Moreover, it is often difficult to classify these studies as belonging to either a perceptional or attentional domain. After all, "it can be argued that attention is involved, in varying degrees, in *all* cognitive performances" (Carroll 1993: 547). The following section is dedicated to motion processing from the perspective of attention.

3.1.2. Attention and motion

In cognitive psychology, much is known about attentional mechanisms in general and about the visual attention of motion (for review, see Pashler 1998; Styles 2000; Petersen & Posner 2012). Before discussing the most relevant specific findings about motion, I give an overview about the main functions and mechanisms of visual attention.

The main function of attention is to select information of which processing is beneficial (James 1890: 403–404; Chun & Wolfe 2001: 273). In other words, attention is essential to maintain efficient functioning. By means of selection, the processing of some information available in the environment is enhanced, while other information is reduced (James 1890: 403–405; Ghatan et al. 1998; Luck et al. 2000). This means that attention given information is processed in more detail and in depth, while other information receives limited or no processing. In this way, the amount of information that humans have the ability to process is kept within reasonable limits.

Consequently, attention is by nature limited in that one cannot distribute the focus of his/her attention evenly across the observed scene within one current time span (Desimone & Duncan 1995; Alvarez & Franconeri 2007). In line with everyday experience, it can be concluded that attentional processing has its clear limits, as the possible area for input is always larger than the capacity to process (Kahneman 1973; Cowan et al. 2005). The limitations are evident when considering the size of working memory (where attention is one part of this mechanism); working memory accommodates as little as approximately four units of information (Baddeley & Hitch 1974; Cowan et al. 2005). Shen et al. (2014) have shown that the capacity of storing 3 to 4 units of information also applies to the processing of motion, i.e., kinematic patterns.

Attention can focus on places (Posner 1980; LaBerge 1983), objects (Duncan 1984; Yantis 1992), places and objects (Egly et al. 1994), and individual features (Maunsell & Treue 2006). In the case of places, several theories exist. Most notably, focused attention has been seen as a spotlight (James 1890: 402−458; Posner 1980) or zoom-lens (LaBerge 1983; Eriksen & James 1986). As such, the focus of attention is shiftable (Posner 1980), the size of it is changeable (Eriksen & James 1986), and it can choose objects similarly to locations (Egly et al. 1994). Spatial attention can focus contiguously, that is, on adjacent regions in space (Eriksen & Yeh 1985), but it can also be divided and focus simultaneously on distinct and non-adjacent regions (Awh & Pashler 2000). Being dividable means that there are limitations of processing. These occur depending on several factors, such as the sameness of the medium and similarities in processing of two input areas (Wickens 1991).

Regarding the mechanisms of attention, both from a psychological and neurological viewpoint, bottom-up (automatic, stimulus-driven) and bottom-down (volitional, goal-directed) attention have been differentiated (James 1890; Egeth & Yantis 1997; Kastner & Ungerleider 2000; Buschman & Miller 2007) with the current state of knowledge suggesting interactions between the two (Corbetta & Shulman 2002; Mechelli et al. 2004). This means that attention may be directed to something because of the salience of the objects or because of the intentions one have.

When looking at attentional patterns in perceiving visual motion, several findings can be described. Firstly, moving objects typically evoke bottom-up, automatic attention (Yantis & Hillstrom 1994), but top-down, controlled attention has been shown to have its influence on bottom-up processing as well (Yantis 1992). Whether with or without goal-driven (i.e., top-down) selection, moving objects capture attention; one directs one's gaze more readily to moving rather than static objects, and easily tracks the moving object (Tipper et al. 1990; Franconeri & Simons 2003). This means that anything that moves is easier to notice than something that is not moving. Moreover, attentional observation may lead one to believe that the motion is faster than it actually is (Turatto et al. 2007). However, some researchers are more cautious. For example, Abrams and Chris state that "motion per se does not automatically attract attention" (2003: 427), and Howard and Holcombe suggest modestly that "Under some circumstances, moving objects capture attention" (2010: 2087) as there might be no reason to pay attention to the moving object in the first place. Nevertheless, the onset of motion (Yantis & Hillstrom 1994; Abrams & Christ

2003), and the change of direction (Howard & Holcombe 2010) clearly attract attention.

Secondly, attention tends to focus on the destination of the moving object rather than on the departure point. For example, Regier and Zheng (2007) show that people can more easily detect changes between two stimuli at the endpoint (i.e., Goal) of visual motion. Similar results have also been obtained by Papafragou (2010). Lakusta et al. (2007) demonstrate that 12-month infants process both Source and Goal of motion, with the latter receiving extra processing. Furthermore, both adults and 4-year-old children differentiate better between Goals than Sources (Lakusta & Landau 2012), but children seem to be inclined towards Goal only if motion is intentionally carried out by an animate mover (Lakusta & Carey 2015). This is consistent with studies that suggest the importance of attentional processing of biological motion (Simion et al. 2008; Klin et al. 2009).

Finally, the allocation of attention to the mover is different when one focuses on spatial (i.e., directional) or motor pattern features (i.e., manner of motion). Eye-tracking research (Papafragou et al. 2008; Soroli 2012) shows that there are more looks directed at the legs and the destination of the mover when path information is foregrounded in the scene. On the other hand, there are more looks aimed at the general body of the mover when the manner of motion (i.e., the motor pattern of biological motion) is in focus.

3.2. Motion language

In this section, I report the most relevant findings regarding the structure of expressions that are used to describe this kind of physical motion. Most linguistic studies on motion descriptions are conducted within a Talmyan framework. Primarily, the lexicalisation patterns and components of the motion event, as proposed by Talmy (1985; 2000b), are of particular interest in cognitive linguistics. Derived from Talmyan studies, Rappaport Hovav and Levin (2010; 2013) have developed a proposal of a complementary structure of motion descriptions (i.e., manner/result complementarity), and Aske (1989) and Slobin and Hoiting (1994) a proposal of the boundary crossing constraint. Outside Talmyan studies, Ikegami (1987) and Dirven and Verspoor (1998) have suggested the *goal-over-source* principle which has been investigated in many languages (e.g., Stefanowitsch & Rohde 2004; Nikitina 2009; Lewandowski 2012; Pajusalu et al. 2013).

This study investigates structural properties of motion descriptions in terms of covariance patterns. As the above-described areas of research are also concerned with structural properties of motion expressions, these are highly relevant. However, this study aims not to contribute to these areas of research as its primary purpose.

To provide an overview of structural characteristics of motion language I, firstly, discuss the role of spatial expressions in language. Then, I briefly introduce the main suggestions and findings in these two broad areas of research. Next, I turn to specific studies conducted in these frameworks in order to provide grounding and initial support for my consistent windowing hypothesis. At the end of the section, I summarise that verbs of different types (i.e., source verbs, goal verbs, and manner of motion verbs) have differences in their typical clausal patterns. In addition, motion verbs themselves are more flexible in terms of semantics than suggested by studies embarking on the complementary view. This flexibility, in turn, may explain the variety of clausal patterns motion verbs have. Finally, as language is, by nature, highly complex and multifactorial, the role of other factors in motion clauses is explicated.

3.2.1. The importance of spatial expressions

Often, expressions of space are considered as somewhat unimportant when discussing *real* grammar and syntax. This is because spatial information is prototypically not encoded by the so-called grammatical cases (Palmer 1994: 6–8, 44–46) and consequently, it is easily seen as something that does not contribute to the essence of language grammar and syntax. For instance, in the Role and Reference Grammar (Valin 2005: 4), spatial (as well as temporal) expressions are regarded as non-arguments which constitute a periphery of the clause. In Talmy's (2000a: 262–265) view, spatial expressions are also something that can be omitted from a sentence. They are optional; hence, adjuncts. One of the main arguments of regarding space and time as having secondary importance in a language lies in the idea that spatial expressions can be omitted without any damage to the grammaticality of a sentence (Talmy 2000a: 262–265; Dowty 2003; Valin 2005: 1–30). For instance, from the sentence *She read a book (in the park) (in the afternoon)*, the spatial and time phrases may be left out. In other words, the sentence would be grammatical also without these phrases. This may be because temporal and spatial information are not of the primary importance to the grammatical representation of this particular event.

Contrary to these claims, however, the same authors admit the importance of spatial expressions in motion expressions. Naturally, when tackling activities that are not spatially determined nor constrained, one can easily conclude that spatial information is optional and does not need to be expressed. For example, in most cases, reading a book does not entail that spatial circumstances need to be detailed. However, when it comes to motion, an activity which is spatially both determined as well as constrained, this spatial information becomes essential in order to conceptualise the situation described by a language. In other words, for the domain of motion, spatial expressions do not belong to a periphery, but to the core of the language.

It is therefore not surprising that in seminal work, Talmy (1985: 60–61; 2000b: 25) states that there are four obligatory constituents of the motion event: the Figure, the Ground, the Path, and the Motion (i.e., the presence or absence of the movement itself). The Path and the Ground specify the spatial settings of motion. It can be inferred that the Path and the Ground information must be identifiable in one way or another, because otherwise no interpretation of motion would be possible. This spatial information can be given by a motion verb root alone. However, and dependent on the language, one can find spatial expressions elsewhere in the same clause as well. Moreover, a clause standing for motion can even be considered to be ungrammatical without spatial expressions.

The proposal of the 'windowing of attention' (Talmy 1996; 2000a: 255–309) clearly indicates the importance of spatial expressions both to language and to cognition in general. Talmy's proposal is built on the idea that language can serve as a tool to direct one's attention. That is, through language the process of the windowing of attention becomes into being. In Talmy's words, "In this process, one or more portions of a referent scene … will be placed in the foreground of attention while the remainder of the scene is backgrounded" (Talmy 2000a: 258). In terms of language, this means "the inclusion in a sentence of explicit material referring to the portion or portions of the total scene to be foregrounded, and the omission of material that would refer to the remainder of the scene intended for backgrounding" (Talmy 2000a: 258). As for motion, different portions of the path may be windowed (i.e., expressed): the initial, medial, or final portion of the path (Talmy 2000a: 265–268). These 'windows' over the path, in turn, serve as the means to direct one's attention to the most important spatial settings that are needed to conceptualise the scene, and convey socially relevant messages.

Regarding motion, spatial information is, thus, absolutely essential in order to conceptualise the situation, to understand motion, and to express that something is moving. In other words, the expression of spatial information is essential for the interpretation of motion. In addition to this essence, spatial expressions have other important features in a language. Most notably, linguistic expressions of spatial information seem to possess attention directing properties. Simultaneously, spatial expressions themselves reflect attentional patterns. Thus, and in the domain of motion, spatial expressions are of the primary importance.

3.2.2. Expression of motion

As in most study fields in linguistics, the study of motion expression has its roots in introspective investigations. The current study makes particular reference to two such investigations: the lexicalisation patterns (Talmy 1985; Talmy 2000b: 19–212) and the *goal-over-source* principle (Ikegami 1987; Dirven & Verspoor 1998: 87–89).

3.2.2.1. The motion event and lexicalisation patterns

The impact of Talmy's typology of motion descriptions cannot be underestimated. The invaluable contribution of his study to cognitive linguistics, and to linguistics in general, can be succinctly summarised by saying that there is no motion without Talmy. One cannot even talk about motion without mentioning the components of the motion event, and one cannot describe motion expressions in a language without explicating the typological status of the language. This current study is no exception to this. Thus, it is essential to introduce Talmy's approach in this study. As such, I cite his description of the motion event below:

> *The basic motion event consists of one object (the **Figure**) moving or located with respect to another object (the reference object or **Ground**). It is analyzed as having four components: besides **Figure** and **Ground**, there are **Path** and **Motion**. The **Path** (with a capital **P**) is the path followed or site occupied by the Figure object with respect to the Ground object. The component of **Motion** (with a capital **M**) refers to the presence per se of motion or locatedness in the event. ... In addition to these internal components, a Motion event can be associated with an external **Co-event** that most often bears the relation of Manner or of Cause to it. [bold in original]*
>
> (Talmy 2000b: 25–26)

From a typological perspective, given that the core schema is "either the path alone or the path together with the ground object" (Talmy 2000b: 218), languages fall into two groups:

> *Languages that characteristically map the core schema into the verb will be said to have a **framing verb** and to be **verb-framed** languages. ... On the other hand, languages that characteristically map the core schema onto the satellite will be said to have a **framing satellite** and to be **satellite-framed** languages. [bold in original]*
>
> (Talmy 2000b: 222)

In other words, in verb-framed languages, "the verb root at once expresses both the fact of Motion and the Path" (Talmy 2000b: 49), whereas in satellite-framed languages "the verb expresses at once both the fact of Motion and a Co-event, usually either manner or the cause of the Motion" (Talmy 2000b: 27). The former strategy can be exemplified by the expression *väljus joostes* '(s)he exited running', and the latter by *jooksis välja* '(s)he ran out'. These examples also point to the fact that languages typically possess both strategies (see also Talmy 2000b: 52–53; Kopecka 2006; Filipović 2007; Ibarretxe-Antuñano 2009).

Talmy's typological proposal of satellite- and verb-framed languages has triggered an avalanche of studies on the status of individual languages (e.g., Slobin 1996; Chen & Guo 2009) with a proposal of the existence of three (Slobin 2004) or perhaps even four (Huang & Tanangkingsing 2005) types of languages instead of two. It has also been shown that the structure of many languages does not seem to fit into the model of lexicalisation patterns, and that many, if not all, languages combine the two strategies (e.g., Zlatev & Yangklang 2004; Kopecka

2006; Filipović 2007; Ibarretxe-Antuñano 2009; see also Goschler & Stefanowitsch 2013a).

The lexicalisation patterns have also been studied from a psycholinguistic (e.g., Gennari et al. 2002; Papafragou et al. 2008), diachronical (e.g., Kopecka 2009; Fanego 2012; Verkerk 2014), language acquisition (e.g., Papafragou & Selimis 2010; Hickmann et al. 2011), second language acquisition (e.g., Choi & Bowerman 1991; Brown & Gullberg 2011), and gestural (e.g., Zheng & Goldin-Meadow 2002; Stam 2006) perspective. The well-known concepts of manner salience (Slobin 2004; 2006) and path salience (Ibarretxe-Antuñano 2009) as well as the boundary crossing constraint (Aske 1989; Slobin & Hoiting 1994) and manner/result complementarity (Rappaport Hovav & Levin 2010; Levin & Rappaport Hovav 2013) originate in this field of study.

3.2.2.2. The **goal-over-source** *principle*

Beyond Talmyan studies of the lexicalisation patterns, the *goal-over-source* principle (Ikegami 1987; Dirven & Verspoor 1998: 87–89; for a similar concept, see also Talmy 2000a: 270–271) has received attention in linguistics with respect to motion descriptions. The principle attempts to capture the salience of different spatial categories. It states that there is a Goal-bias in languages because Goal is the most informative or interesting (Dirven & Verspoor 1998: 87–89) spatial category for human beings. As such, Goal is more salient than Source which, in turn, is more salient than the other spatial relations. Linguistically, this means that Goal is more frequently expressed than the other spatial categories. The principle itself is widely known, accepted, and proved (Lakusta & Landau 2005; Pajusalu & Orav 2007; Pléh 2010; Hoffmann 2012; Lewandowski 2012; Kabata 2013; Pajusalu et al. 2013).

For instance, Lakusta and Landau (2005) report the experiments on the English language where participants (both adults and children) were asked to describe motion situations. These situations were presented to them as videos. In the videos, a mover proceeded from the Source object to the Goal object, and the situations were created to depict specifically manner of motion. The results show that there is a clear preference of describing Goal and not Source of motion. The corpus study on Estonian of Pajusalu et al. (2013) seems to concur with these findings. They examined the expression of spatial categories in 1168 sentences which were comprised of a variety of motion verbs. The results indicate that Goal is dominantly expressed, whereas Source and Location are significantly less frequent.

However, these studies overlook the fact that specific semantic features of a verb contribute to the expression of space. This is a common feature of studies based on the Goal-bias principle, because they do not differentiate between different verbs; namely between source, goal, and manner of motion verbs. For instance, the data in Pajusalu et al. (2013: 50) consist of a large number of sentences with goal verbs (i.e., verbs which express the destination of motion;

e.g., *minema* ‘go’, *jõudma* ‘arrive’), and a significantly smaller number of sentences with manner of motion verbs (i.e., verbs which express the way motion is conducted; e.g., *kõndima* ‘walk’) and source verbs (i.e., verbs which express the origin of motion; e.g., *kaduma* ‘leave’). Thus, the bias is reported on the basis of data comprising different types of motion verbs, and these verbs are mainly goal verbs. In other words, these verb samples tend to give an unrepresentative sample for analysis, because they fail to take into account verb-specific factors, such as whether the verb is a path or manner of motion verb. This may result in their findings being somewhat distorted. Another commonly occurring weakness of the studies of the Goal-bias is that they examine only some spatial categories and exclude other, possibly important ones. This is the case for Lakusta and Landau (2005) because they only monitor the use of Source and Goal expressions, and not Location or Trajectory ones. Thus, the possible biases that manner of motion verbs combine with Location and Trajectory expressions are overlooked.

A number of studies exist which provide counterevidence for the *goal-over-source* principle, and suggest that Goal may not be the most salient spatial category (Stefanowitsch & Rohde 2004; Nikitina 2009; Taremaa 2013). In addition, studies reporting the boundary crossing constraint in verb-framed languages where manner of motion verbs cannot combine with Source and Goal expressions (Aske 1989; Slobin & Hoiting 1994; Jones 1996) are contrary to what could be expected on the basis of the principle. What unites these studies in providing such converse results is that they do consider the type of motion verb or specific semantic features of a verb when analysing the spatial expressions of motion clauses. In other words, and unlike studies based on the *goal-over-source* principle, verb-specific factors are fully accounted for in their data analysis. This strongly suggests that both source verbs and manner of motion verbs behave significantly differently from goal verbs with respect to this principle.

However, studies based on the Goal-bias principle do seem to indicate that, in general, there is a Goal-bias in language. In other words, people tend to use Goal expressions more often than other types of spatial expressions.

3.2.3. Combinations of motion verbs and spatial expressions

The studies conducted within these two frameworks (the lexicalisation patterns and the *goal-over-source* principle) provide important information about the structure of motion clauses and about motion verbs in particular. The following sections aim to cover the most important findings of these two frameworks, and also present the studies outside these two frameworks with respect to the hypothesis of consistent windowing pursued in the current study.

Regarding combinations of motion verbs and spatial expressions, the ‘boundary crossing constraint’ is well known. The constraint says that in verb-framed languages, manner of motion verbs cannot be used in descriptions that express crossing a boundary, such as moving into something (Aske 1989; Slobin & Hoiting 1994). That is, it would be impossible to say *jooksis majja* '(s)he ran into the house' in a verb framed language. Path verbs exhibit no such constraints. In other words, it is a matter of combining manner of motion verbs with Goal (and also Source) expressions (i.e., with telic expressions); in satellite-framed languages, these combinations are possible (although some restrictions may apply), whereas in verb-framed languages, these are typically not possible (Aske 1989; Slobin & Hoiting 1994; Filipović 2007; Nikitina 2009: 1123) or, if possible, may make use of distinct morphosyntactic means (Kita 2006: 449–462).

One typical example of such a verb framed language is Spanish which allows only some manner of motion verbs to combine with telic expressions (Aske 1989; Slobin & Hoiting 1994). Italian shows similar tendencies in that only such manner of motion verbs that incorporate directional meaning can co-occur with Goal expressions (Cardini 2012). In French, another verb-framed language, Jones (1996: 401) argues that manner of motion verbs cannot typically combine with Source and Goal phrases. As for more exotic examples of a verb-framed language, in Wan, a South-eastern Mande language spoken in the Ivory Coast in Africa, it is also not possible to have combinations of manner of motion verbs and Source or Goal expressions (Nikitina 2009: 1123).

To summarise, verb-framed languages show distinct clausal patterns for path verbs and manner of motion verbs. In satellite-framed languages, manner of motion verbs are freely combinable with telic expressions. However, the possibility to have free combinations does not necessarily mean that such combinations actually occur and are productively produced. In the next section, I give an overview on studies that provide findings of how verbs (mostly, but not only, in satellite-framed languages) combine with spatial expressions. The semantic features of motion verbs are the departure point. Firstly, I deal with clausal patterns of directional verbs (i.e., source and goal verbs; also known as 'path verbs'[1]). Then, I discuss differences between directional and manner of motion verbs.

3.2.3.1. Source verbs versus goal verbs

Source verbs and goal verbs foreground different portions of the path of motion: source verbs profile or express the initial (e.g., *lahkuma* 'leave', *väljuma* 'exit'), whereas goal verbs profile or express the final portion of the path (e.g., *saabuma* 'arrive', *sisenema* 'enter'). Furthermore, it is highly probable if we consider all the world's languages, there are many more goal verbs than source verbs (see, for example, Creissels 2006: 24 about West-African languages). As goal verbs

[1] As this study focuses only on two types of path verbs (i.e., source verbs and goal verbs), and does not examine path verbs which express the trajectory of motion (e.g., *ületama* 'cross'), the term 'directional verbs' is used hereinafter to refer to source and goal verbs.

are more prevalent, most of the studies on motion verbs tend to focus on goal verbs (or on manner of motion verbs) rather than on source verbs. As for goal verbs, the results indicate clearly that they tend to co-occur with Goal expressions in most cases (Rohde 2001; Rakhilina 2004; Stefanowitsch & Rohde 2004; Cristobal 2010; Kopecka 2010).

This can be further illustrated with a corpus study (Cristobal 2010) conducted on English and Spanish goal verbs (specifically, 'arriving verbs'; e.g., English *arrive*, Spanish *llegar* 'arrive' and English *come*, Spanish *venir* 'come'). Cristobal shows that these verbs in the two languages are Goal-profiling and are almost obligatorily expressed together with Goal expressions. More importantly, the results infer that goal verbs themselves show variation with respect to the degree of directionality. For instance, *arrive* and *llegar* 'arrive' can be seen as more strongly Goal-oriented than *come* and *venir* 'come'.

However, there have been very few studies conducted in source verbs. One rare exception is Rohde (2001: 140–150, 312–324) who demonstrates that some English source verbs (i.e., the so-called source-biased verbs *scrape*, *shoo*, *remove* and departure verbs *bolt*, *emigrate*, *leave*) are mostly found incorporated within Source constructions.

Furthermore, Levinson (2006: 157–158, 199–204) reports for the verb-framed language, Yélî Dnye, a language isolate spoken in Rossel Island in Papua New Guinea, that directional verbs (i.e., path-encoding verbs in his terms) take spatial phrases according to their semantics in that verbs indicating Source combine with Source expressions and verbs indicating Goal combine with Goal expressions. Manner of motion verbs can combine with both. In this way, the spatial expression 'repeats' the information present in the verb (Levinson 2006: 199). Levinson concludes that in Yélî Dnye, "the path is not in fact fully specified in the verb" (Levinson 2006: 199) and that "not only do we have a 'verb-framing' pattern in Talmy's (1983) sense of directional marking being lexicalized inside the verb, but in a typologically unusual pattern even source/goal marking is absorbed largely within the verb" (2006: 202). Similarly, in Japanese (a verb-framed language), the spatial features of Source and Goal are expressed both by the verb as well as the preposition simultaneously (Kita 2006: 449–462). The kind of semantic agreement between the prefix and the form of spatial expression is present in many languages (see, for example, Cardini 2012 for Italian).

Moreover, if a language does not differentiate Source and Goal expressions morphosyntactically, the distinction may be based on verbal semantics only (Creissels 2006). The Yélî Dnye language typifies this (Levinson 2006: 200−201). Yukatek Maya, a Mayan, possibly verb-framed, language spoken in the Yucatán peninsula in the area of Mesoamerica (Bohnemeyer & Stolz 2006: 274, 293–302) is another example. In this language, Source and Goal information is only distinguished by the verb as "The ground-denoting phrase is sensitive neither to Source-Goal distinction nor even to the dynamicity of the event" (Bohnemeyer & Stolz 2006: 298). The contextual information is also highly relevant, as in some cases the meaning of the verb is not enough either (see also Nikitina 2009).

3.2.3.2. Directional verbs versus manner of motion verbs

Directional verbs (i.e., path verbs) and manner of motion verbs are typically seen as completely different kinds of motion verbs on the basis of their semantics in that directional verbs express only direction, and manner of motion verbs only manner information (e.g., Levin 1993: 263–269; Talmy 2000b: 25–57). If this strong dichotomy were valid, one would expect directional verbs to exhibit different clausal patterns from manner of motion verbs. Surprisingly, though, the clausal patterns of the two kinds of verbs are not frequently studied. Instead, two clausal phenomena are normally discussed with respect to directional and manner of motion verbs. Firstly, using Talmy's lexicalisation patterns (1985; 2000b) as the basis, the presence or absence of satellites carrying information about the Path has received much attention from researchers (e.g., Slobin 1996; 2004; Ibarretxe-Antuñano 2004b; Kopecka 2006; Peyraube 2006). Secondly, the boundary crossing constraint has been proposed and studied (Aske 1989; Slobin & Hoiting 1994), which is related to the form and meaning of spatial expressions that may or may not be combined with manner of motion verbs. In verb-framed languages, it is argued that manner of motion verbs do not combine with boundary crossing spatial expressions, such as the Goal ones; satellite-framed languages generally allow combining manner of motion verbs with the Goal expressions (Aske 1989; Slobin & Hoiting 1994).

However, research suggests individual differences are also present at the verb level in satellite-framed languages. For instance, Stefanowitsch and Rohde (2004) analyse co-occurrences of English motion verbs and locative phrases based on corpus data. They show that across all verbs, Goal is expressed most frequently. This finding seems to provide support for the *goal-over-source* principle (Ikegami 1987) in that the number of Goal expressions overrides the numbers of expressions of other spatial categories. However, if verb-specific semantic factors are taken into account, Stefanowitsch and Rohde (2004) reveal somewhat different results. More specifically, their data indicate that, in English, source verbs (e.g., *escape*) tend to combine with Source phrases, and goal verbs[2] (e.g., *go*) tend to combine with Goal phrases. Manner of motion verbs exhibit some variation as some of these, such as *stroll* and *cruise*, prefer Trajectory, whereas others, such as *flee* and *climb* prefer Goal phrases. Generally, it seems that verbs of different semantic types may behave differently with respect to the *goal-over-source* principle.

Rakhilina (2004) has reached a similar conclusion about the Russian language. She demonstrates that the degree to which different motion verbs combine with Goal expressions varies across verbs, and this is due to the verb semantic features. In other words, as Rakhilina (2004: 22–23) stated herself, "The problem with goal-bias principle is that, when applied to all possible verbs of motion in all natural languages, it yields different results: for example, within one and the

[2] Note that the verb *go* was interpreted as a neutral verb in Stefanowitsch and Rohde (2004).

same language different verbs of motion show surprisingly different frequencies of Goal expressed in the corpus".

Similarly, for the Polish language, Kopecka (2010: 240–241) reports that whereas most manner of motion verbs can occur in directed-motion constructions (i.e., in clauses with expressions of Source and Goal), some manner of motion verbs cannot. The examples of such verbs include the Polish counterparts for the verbs: *stagger*, *hobble*, *rove*, *roam*, *saunter*, *stroll*, and *limp*. Furthermore, she argues that the semantics of these verbs prevents the combination of these verbs with directional phrases, because these verbs express unbounded (e.g., aimless) motion. More specifically, Kopecka (2010: 231–232) shows that all types of motion verbs can occur in directed motion constructions. However, non-directed motion constructions contain only verbs expressing manner meanings. That is, no path verb occurs in non-directed, aimless motion sentences. Taken together, one can infer from Kopecka (2010) that in Polish, directional verbs tend to combine with directional expressions and manner of motion verbs with Location expressions. Moreover, verbs clearly incorporating both directional and manner features can be established in Polish.

For the Estonian language, there is also some evidence that manner of motion verbs may exhibit different clausal patterns than directional, goal verbs: manner of motion verbs *kulgema* 'run, proceed' and *looklema* 'wind' occur mainly with expressions of Location, and Trajectory, while goal verbs *viima* 'take, lead', *minema* 'go', *suunduma* 'head', *tõusma* 'rise', and *pöörama* 'turn' tend to combine with Direction, and Goal expressions (Taremaa 2013).

3.2.3.3. Motion verbs expressing both the Path and Manner

Having demonstrated that manner of motion verbs show mixed results in their ability to combine with expressions of bounded path, such as Goal, the issue of directional and manner verbs themselves needs to be addressed. Typically, manner of motion verbs and directional verbs (i.e., path verbs) are contrasted: the former are claimed to express no information about the Path, while the latter is said to express only the Path (Levin 1993: 263–267). However, many authors report findings of verbs which express both path and manner features.

For example, the English verb *climb* has been widely debated in the literature. Most authors analyse the verb *climb* as a manner of motion verb (Özçalışkan & Slobin 2000; Slobin 2004). Others maintain that *climb* does specify upward motion simultaneously to manner information (Goldberg 2010). Yet, some researchers remain hesitant to strictly classify *climb* as a directional or manner of motion verb. For example, Levin (1993: 263, 265) lists the verb both as a directional (although assigned with a question mark) and as a manner of motion verb. Rappaport Hovav and Levin (2010: 16) state that verbs, such as *climb*, express only one meaning (either directional or manner) at a time, and is dependent on the context: "verbs that appear to lexicalize both manner and result actually only lexicalize one in any given use" (Rappaport Hovav & Levin

2010: 16). According to their view, the verb *climb* is a manner of motion verb to which directional meanings are added by the context.

Similar discussions can be found when considering other verbs, such as the English verbs: *scale*, *plunge*, *soar*, *dive*, and *schuss* (Goldberg 2010; Levin & Rappaport Hovav 2013); all of which express vertical motion. In addition, the meaning of the verb *fall* has been discussed in the same way although, naturally, the discussion goes the other way around. It is argued that whereas *fall* is seen primarily as a directional verb (see also Lakusta & Landau 2005: 7), it nevertheless incorporates some sense of manner (Cardini 2008: 548–549).

As for other languages, Aske (1989: 3) suggests that in Spanish (a verb-framed language), there are three types of manner of motion verbs based on the degree of motion (i.e., path or directionality) salience. Firstly, there are "activity/manner verbs that strongly imply motion" exemplified by Spanish verbs *corer* 'run' and *rodar* 'roll' (Aske 1989: 3). Secondly, there are "verbs in which the manner of the activity is more salient", such as *cojear* 'limp' and *saltar* 'jump' (Aske 1989: 3). Finally, there are "verbs that do not imply motion" (Aske 1989: 3). For the latter type of verbs that do not entail motion, Aske provides example sentences with the English verbs *squeeze*, *twist*, and *grab* for which he argues there is no Spanish counterpart.

Similarly, Cifuentes Férez (2010) indicates that there are some English and Spanish verbs that conflate both the Path and Manner. However, in her interpretation, the vast majority of motion verbs in these languages express either the Path or Manner. For instance, in English (a satellite-framed language) such verbs are: *charge*, *climb*, *dive*, *lunge*, *plummet*, *skedaddle*, *trail* (Cifuentes Férez 2010: 244) and in Spanish (a verb-framed language) the verbs are: *abalanzarse* 'to dash to', *escabullirse* 'to slip away', *precipitar(se)* 'to (cause to) fall down from a high place', and *trepar* 'to climb' (Cifuentes Férez 2010: 249). These examples suggest that manner of motion verbs may have a directional reading when verbs express either fast, vertical, or chasing motion. I elaborate further on fast and vertical motion in Section 3.3.3.

Kopecka (2010: 231–232), reporting on Polish motion verbs, includes "verbs encoding both Path and Manner" (Kopecka 2010: 231) into the four types of verbs (i.e., Manner verbs, Path verbs, Manner+Path verbs, and one verb that is neutral). According to Kopecka, there are verbs expressing both Path and Manner simultaneously. She maintains that despite the historical combination of Path prefixes and manner verbs, these verbs (e.g., *uciekać* 'run away') are "as wholes rather than as morphologically complex verbs" (Kopecka 2010: 231). The idea of directional manner of motion verbs is also one of the main assumptions of Cardini's (2012) study. He argues for both directional (e.g., *correre* 'run', *volare* 'fly') and non-directional (*camminare* 'walk', *zoppicare* 'limp') manner of motion verbs in Italian.

Thus, manner of motion verbs may possess differing degrees of directionality as has also been proposed by Rohde (2001: 271). This difference of salience of directionality can be reflected in clausal patterns. It seems plausible that in verb-framed languages, this pattern is manifested in a strict manner, so that one can posit a boundary crossing constraint. On the other hand, in satellite-framed languages, one can talk about tendencies rather than about strict constraints. What is important is the fact that manner of motion verbs may incorporate directional meanings, which, in turn, may explain whether manner of motion verbs combine with Goal expressions or not. It should be noted, however, that the presence of directionality in verbal semantics ultimately depends on what the term directionality itself means. I discuss the issues of defining the key terms (including the path and directionality) in Section 4.3.1.1.

In this current study, I consider manner and directional features of motion verbs as aspects that are, perhaps, always present to some degree. In other words, directionality and manner are considered to be a matter of degree. On the one hand, there may be verbs that are highly directional, but may incorporate hidden manner features. On the other hand, there may be verbs that entail strong manner meanings, but simultaneously evoke directional aspects. Thus, the semantics of motion verbs is flexible in that directional verbs can have manner meanings, and manner of motion verbs can have directional meanings.

3.3. Motion, attentional patterns, and language

Having discussed motion from the psychological and linguistic perspective, the next step is to bring these two disciplines together. In other words, the aim of this section is to show how the perception and attention of motion, and language are related. As this current study is underpinned on the assumption that one cannot separate language from cognition, one presumably cannot describe verbally more than it is possible to process visually. This does not suggest that there is a one-to-one relationship between language and perception, the claim of which would clearly underestimate a number of factors contributing to language structure (see also Landau & Lakusta 2006). Nonetheless, the perception of motion, and language are clearly related (see also Kaschak et al. 2005).

There are two types of studies that differ from this scope. Firstly, there are psychological studies which apply language (i.e., linguistic stimuli) as a tool to test hypotheses originating in the field of cognitive psychology. Secondly, there are psycholinguistic studies which aim to understand the processing, production, or comprehension of language itself. Needless to say, these two types of approaches are not mutually exclusive (e.g., Gathercole & Baddeley 1993). The following section highlights key findings from both lines of research. The aim is to gain a more thorough understanding on the connection between general cognitive processes and language when talking about the structure of motion descriptions.

3.3.1. Studies of cognitive psychology: linguistic stimuli of motion

Much research in cognitive psychology makes use of linguistic stimuli, such as studies of working memory (Baddeley & Hitch 1974) and long term memory (Craik & Tulving 1975). In addition, studies on mental simulation that aim to clarify simulation processes (Hauk et al. 2004) are another valuable source, and are of interest here as they clearly indicate the link between language and cognition.

Regarding motion, a study conducted by Loftus and Palmer (1974) is a prime example. In their seminal study, participants were shown pictures of car accidents. Then, they were given descriptions of the scenes consisting of motion expressions where the speed, as expressed by motion verbs, was altered. When the participants were asked about the consequences of the depicted accident, they were more likely to say that the vehicle in the accident had broken glass when a fast motion verb was used, and unbroken glass when a slow motion verb was used. Although the main focus of this study was not on verbal semantics but on the mechanisms of false memories, these results support the idea that differences in language represent differences in cognition and vice versa.

Another example of how linguistic stimuli may prime the behaviour is the study conducted by Bargh et al. (1996). They demonstrate that people who had a task to combine sentences from slow motion words (associated with elderly people) also walked in a slower manner after leaving the experiment than those who had created sentences from speed-neutral words[3].

Finally, the study on mental simulation by Hauk et al. (2004) provides converging evidence about the relationship between language and cognition. In their experiment, participants encountered written action words referring to actions that can be carried out with different body-parts. Hauk et al. (2004) report that such activity words activate not only the language areas in the brain, but also those responsible for conducting activities with specific body-parts. As such, the results indicate a close connection between language and cognition, but also between language and planning of body movements (i.e., action).

3.3.2. Psycholinguistic studies on the expression of motion

The use of linguistic stimuli in psychology studies is somewhat ‘accidental’ (though by no means arbitrary) in that linguistic stimuli are used only to study something non-linguistic. However, this rich source of material can also be used to study linguistic matters, and especially so in language and cognition studies. More exhaustive information on language and cognition can be obtained from

[3] However, the results of the original experiments of Bargh et al. (1996) were not fully replicated later by Doyen et al. (2012). There are many suggestions for the failure of the replication (Doyen et al. 2012; Klein et al. 2012), but none of these consider the linguistic input itself, nor the language of it – the one used in the experiment of Bargh et al. was in English, whereas the one of Doyen et al. was in Belgian French.

psycholinguistic studies. Similarly to research on motion events, both lines of research (i.e., the lexicalisation patterns and the *goal-over-source* principle), has been investigated from the psycholinguistic perspective. In addition to these, the processing of motion-related language in general (e.g., motion verbs) has been studied.

3.3.2.1. Psycholinguistic studies on the lexicalisation patterns

The psychological reality of the lexicalisation patterns has been an interest for many researchers (Slobin 1996; Naigles & Terrazas 1998; Özçalışkan & Slobin 2000; Gennari et al. 2002; Papafragou et al. 2002; Slobin 2004; Papafragou et al. 2006; Papafragou et al. 2008; Papafragou & Selimis 2010; Soroli 2011; 2012; 2012; Athanasopoulos & Bylund 2013; Bylund et al. 2013). These psycholinguistically-driven studies have mainly been concerned with addressing two questions. The first question is how the speakers of verb-framed and satellite-framed languages (either children or adults) encode motion and process motion expressions. The second question is whether, and if so, to what extent, the typological status of a language affects spatial cognition. This issue is concerned with the proposal for linguistic relativity in the domain of motion as put forward by Slobin (1987).

As in the first scenario, the results tend to be consistent with Talmy's proposal in that verb-framed languages prefer path (i.e., directional) verbs, whereas satellite-framed languages prefer manner verbs (Gennari et al. 2002; Papafragou et al. 2002; Slobin 2004). In addition, and in language mediated tasks, speakers of different types of languages tend to allocate attention differently to visual motion (Papafragou et al. 2008; Soroli et al. 2012). As in the second scenario, it has been found that differences in spatial cognition only occur if the processing of motion is somehow intervened linguistically. As long as the task is not language-mediated, there are no processing differences of actual motion between speakers from typologically different languages (Gennari et al. 2002; Papafragou et al. 2002).

For instance, Papafragou et al. (2002) in their study that included children and adults, report that speakers of English (a satellite-framed language), and speakers of Greek (a verb-framed language) perform equally well in non-linguistic tasks with regard to the processing of motion. They show that both recognition memory, and similarity-based classification of the motion events, where either the Path or Manner information was manipulated, was not affected by the language. However, when asked to describe verbally the scenes, clear differences occurred as English speakers had a preference of using manner of motion verbs, while Greek speakers preferred path verbs.

Similar results are presented by Gennari et al. (2002), who compare English (a satellite-framed language) and Spanish (a verb-framed language) by using motion videos. The results show that recognition memory tasks indicate no differences in terms of language type in processing path and manner information, even in the presence of linguistic encoding. Across both language groups, however, the possibility of verbal encoding, either before or during watching the scene, improved correct answers of recognition. Again, when verbally describing the scenes, English speakers made more use of manner expressions than Spanish ones. The same was true for a similarity task where participants had to decide upon the similarity between the given scene and the Path- or Manner-altered scene. However, and in the language-mediated condition, English speakers were Manner-biased and Spanish speakers were Path-biased.

These results are further supported by Papafragou et al. (2008), who examined the speakers of English and Greek for their motion descriptions as well as their eye-movements while describing the motion, or while simply inspecting motion videos. Whilst watching motion videos, they detected no significant differences in eye-movement patterns. When language was involved, the results revealed significant differences between the two languages both from the linguistic and eye-movement (i.e., attentional) perspective.

All in all, the basic cognitive processes seem to be independent of language. This has also been shown by Malt et al. (2014) who found that speakers of different types of languages tend to assign names for human upright spatial motion in similar ways both within and across languages. This suggests that people may perceive manner of motion in similar ways regardless of language type. However, when language is involved, the attentional patterns change, and this provides strong evidence that language does, indeed, direct attention.

3.3.2.2. Psycholinguistic studies on the* goal-over-source *principle

As shown previously in Section 3.1.2, humans, in general, tend towards a Goal-directed nature (Lakusta et al. 2007; Regier & Zheng 2007; Papafragou 2010; Lakusta & Landau 2012; Lakusta & Carey 2015). This has also been found in linguistic studies (Ikegami 1987; Dirven & Verspoor 1998: 87–89; Lakusta & Landau 2005; Pajusalu & Orav 2007; Pléh 2010; Hoffmann 2012; Lewandowski 2012; Kabata 2013; Pajusalu et al. 2013) and in psycholinguistic studies (Lakusta & Landau 2005; 2012; Regier & Zheng 2007; Papafragou 2010; Athanasopoulos & Bylund 2013). In fact, one of the main reasons for accepting the validity of the *goal-over-source* principle may be due to the psycholinguistic studies that provide evidence for this hypothesis.

For example, Lakusta and her colleagues have shown the Goal-bias in language production, both in children and adults. In Lakusta and Landau (2005), they asked English speaking participants to describe the manner of the motion events presented in videos. In the videos, both Source and Goal were depicted, with participants being directed to express both. However, Goal was expressed dominantly despite the visual input. Lakusta and Landau (2012) have replicated these results by fine-tuning their earlier experiments. Moreover, research has also shown that speakers tend to describe Goal in more detail than Source (Regier & Zheng 2007; Papafragou 2010).

There is also some evidence that languages differ with respect to the degree of which Goal is expressed. Athanasopoulos and Bylund (2013) in their comparison of English and Swedish speakers demonstrate that Swedish speakers tend to express Goal significantly more often than English speakers. While both are satellite-framed languages, they differ in their preferable aspectual constructions in that English makes use of a progressive construction to refer to the ongoing event (and hence, is an aspect language), whereas Swedish uses simple present (and can be seen as a non-aspect language). These aspectual differences are seen as factors that contribute to the results of unequal frequencies of Goal expressions in the two languages.

3.3.3. Other factors that influence the attentional patterns of motion descriptions

Thus far, I have discussed spatial and kinematic cognition and the structure of language focusing mainly on spatial factors and somewhat less on manner. However, our cognition is not limited to process only such spatial and manner features, nor is language a two- or three-factorial phenomenon. In the following sections, I discuss three other factors that can contribute to the structure of motion clauses. Two of these have spatial grounding: the speed or velocity of motion, and the general direction of motion (being either horizontal or vertical). In addition to these and as shown above in the context of the *goal-over-source* principle, the animacy of the described mover may influence the structural patterns of space. Due to practical constraints, the thesis does not engage with other factors that could affect the patterns of motion clauses (e.g., aspectual properties of verb constructions).

3.3.3.1. Motion speed

Manner of motion verbs represent a variety of semantic features that all add qualitative information to the event expressed (see Section 4.4 for a more detailed overview). These semantic particularities, in turn, can have a great influence on the presence of spatial expressions. One of these semantic particularities is the speed of motion. For instance, one is more likely to express Goal when describing the situation with the verb *hurry* than with the verb *meander*. Hurrying somewhere typically entails the need to reach some destination as quickly as possible, whereas aimless motion is obviously rather senseless to the existence of any Goal.

Thus, the speed of motion may be associated with the linguistic representation of motion. In other words, the speed of motion is one such semantic feature that may also be connected with the linguistic realisation of spatial information. This is because the processing of visual motion of different speeds is sensitive to the speed of the mover (Tynan & Sekuler 1982; Burr et al. 1998; Kreegipuu et al. 2006; Kreegipuu & Allik 2007; Hutchinson & Ledgeway 2010) as discussed in Section 3.1. Furthermore, psychological (Loftus & Palmer 1974; Bargh et al. 1996; see also Section 2.3.1) and psycholinguistic studies have yielded that the expressions of motion conducted in different speeds is also processed differently (Matlock 2004; Richardson & Matlock 2007; Lindsay et al. 2013; Speed & Vigliocco 2013). The speed of actual motion has also been shown to be the primary factor that affects the lexicalisation of manner of motion in that manner of motion verbs differ mostly with respect to speed information (Slobin et al. 2014).

For example, Matlock (2004) and Richardson and Matlock (2007) have shown that labour-intensive and difficult motion (which implies slow motion), even if provided with fictive motion expressions (i.e., with dynamic expressions referring to static scenes), takes more time to process as evidenced by the participants' reaction times and gaze allocation durations. The influence of the speed information (as embedded in verb meanings) on processing the motion expressions has also been explicitly studied by Lindsay et al. (2013) and Speed and Vigliocco (2013).

Lindsay et al. (2013) examined how people process slow and fast motion sentences. In their experiment, the speed of motion was contained within manner of motion verbs used in sentences with Trajectory and Goal expressions, e.g., *The hiker will sprint along the trail to the cottage*[4]. They used eye-tracking and mouse movement methods to explore whether fast motion was processed faster than slow motion. The results of their study show that in the case of fast motion, the mouse was moved considerably faster when dragging the depicted agent to Goal than in the case of slow motion. In addition, fast motion resulted in more eye fixations and a longer observation time to Goal entity, and reaching Goal took less time than slow motion. In contrast, slow motion entailed more eye fixations with a longer summed dwell time to the path entity. Lindsay et al. (2013) interpreted their results as supporting evidence to the theory of mental simulation which states that processing an activity evokes the same sensorimotor pattern that would be evoked when conducting the same activity (Zwaan 2003).

Speed and Vigliocco (2013) conducted a very similar study at around the same time. They used similar sentences including sixteen slow and sixteen fast motion verbs which described motion to some Goal, e.g., *The lion ambled/ dashed to the balloon*[5]. They also had a visual scene accompanied by a spoken sentence, and they used eye-tracking technique to measure the differences in attentional patterns. However, and differently from Lindsay et al. (2013), the sentences in their study contained only Goal expressions, and did not contain any Trajectory expressions. In addition, the experiments were slightly more complex as they manipulated the speed of the speech. Furthermore, a distractor that led the participant to a wrong second destination was added to half of the visual scenes. The main result of Speed and Vigliocco (2013) is consistent with

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4 Example from Lindsay et al. (2013; see Table S1).
5 Example from Speed and Vigliocco (2013).

that of Lindsay et al (2013) in that attention allocation to the destination of motion is faster with fast motion verbs, and slower with slow motion verbs.

In these two experiments (Lindsay et al. 2013; Speed & Vigliocco 2013), speed was expressed by motion verbs. As Lindsay et al. (2013: 9) point out, speed can also be expressed in different ways such as through the use of certain adverbs. Thus, and given the current study, one must also account that the verb may not be the only element in a sentence carrying speed information. Speed information could also be found in manner adverbials at the clause level, and may also naturally emerge from the context and world-knowledge.

Furthermore, there are other weaknesses in their studies. The authors assume that their verbs describe fast or slow motion towards some Goal, and the stimuli contain both the path as well as the Goal object. In addition, these experiments do not show evidence that all these verbs are inherently Goal-directed. Conversely, it seems that it is possible to combine these verbs with Goal expressions to describe telic motion in English. Whereas most fast motion verbs tend to be more Goal-directed or at least widely used to express Goal-directedness, the verbs of slow motion may not contain this kind of telic information. One example is the verb *meander* that expresses aimless motion, but it probably does not entail any proceeding towards some Goal.

3.3.3.2. Verticality and horizontality

Due to gravity, experiencing vertical motion is significantly different to that of horizontal motion. The visible effects of gravity, or the fight against gravity that surrounds us, provides rich knowledge about possible motion trajectories. Gravity is so impressive that according to one study, moving along the vertical axis is one of the main contents of people's dreams (Maggiolini et al. 2007). Furthermore, gravity induced motion provides information about the speed of movement in that downward motion is considerably faster than any typical horizontal movement. In addition, vertical motion entails information about force because whereas falling is forceless, rising requires extra energy to pull against gravity. Consequently, moving upwards would need even more energy than moving horizontally.

The assumption here is that experiencing and expressing both horizontal and vertical motion are very closely related if not intertwined. This is supported by evidence from cognitive psychology that demonstrates the embodied roots of language. For instance, Dudschig et al. (2012a) found that verbs expressing either upward or downward motion in German facilitate the subjects to make hand movements in a similar direction. Meteyard et al. (2012) obtained similar results where the directional meaning of the verb helps to detect motion conducted in the same direction and slows down detecting motion in another direction.

Therefore, it is highly likely that the processing differences of vertical and horizontal motion may appear in linguistic structures. Our knowledge of possible motions along the horizontal axis is substantially different to that of the vertical axis, and could possibly influence the way we talk about moving either horizontally or vertically. Indeed, verbs expressing vertical motion are different to those expressing horizontal motion (Nikitina 2009). However, this directionality effect upon language structure has received comparatively little attention in linguistics. One rare example is Tragel and Veismann (2008) who have given convincing evidence on how horizontal and vertical movement are related to aspectual meanings. Their corpus study clearly indicates that when verbs are combined with verbal particles expressing vertical motion, the sentence can be interpreted as conveying a perfective aspect. In contrast, when verbs are combined with particles expressing horizontal motion, the sentence describes a continuous aspect.

It is more than likely, however, that not only the aspect and horizontality/verticality go hand in hand, but that horizontality/verticality influence also other linguistic structures due to the processing differences of horizontal and vertical motion. As visual input and world knowledge are different considering verticality and horizontality, this difference, in turn, may result in processing differences. As a result, the salience of the movement along the horizontal and vertical axes is considerably different. More precisely, vertical motion could be seen as much more salient than horizontal motion.

This difference in salience can be inferred also from the hotly debated issue of manner/result complementarity. It is perhaps not surprising that counter-examples to this complementarity view consist of motion verbs expressing vertical motion, such as *climb*, *scale*, *dive*, and *fall* (see also Section 3.2.3.3 above). Research indicates that verbs expressing vertical motion pose some problems in their classification as either directional (i.e., path) or manner of motion verbs (e.g., Goldberg 2010; Levin & Rappaport Hovav 2013).

As such, verbs of vertical motion, such as *climb* and *fall*, are difficult to reject as being, at least to some extent, directional motion verbs. However, and at the same time, they also express, to some degree, how motion is carried out. In other words, these verbs all specify the general vertical axis, and this axis also includes directional information even though its exact direction may be somewhat ambiguous. Conversely, when dealing with verbs that express mainly horizontal movement, the sense of direction is neither that evident nor that important. This insignificance of the horizontal axis seems to allow researchers to divide motion verbs more easily into two distinct categories; directional and manner of motion verbs.

3.3.3.3. Animacy

The factor of animacy in linguistics is like gender in social sciences: the must-be factor that always has a capacity to influence any linguistic phenomenon one observes (e.g., Comrie 1989; Dahl & Fraurud 1996; Mak et al. 2002; Bresnan & Hay 2008; Malchukov 2008). Regarding the possible role of animacy in the domain of motion descriptions, reference to the *goal-over-source* principle is, again, pertinent.

Namely, the principle has been suggested to apply particularly to animate motion in that clauses with an animate mover are more likely to contain Goal specifications (Dirven & Verspoor 1998: 87–89). This suggestion has been supported by several corpus studies. For instance, Stefanowitsch and Rohde (2004) have demonstrated that for the verb *fly*, the proportion of Goal phrases were significant, and for the verb *roll*, somewhat higher when the depicted mover was an animate being than when it was an inanimate mover or a vehicle.

Similarly, in Taremaa (2013), Estonian actual motion sentences with animate movers were more likely to contain Goal expressions than fictive motion sentences with their fictively moving path entities. Also, different verbs show differences in whether they are typically used to refer to animate or inanimate motion in European Portuguese (Batoréo 2008). However, regarding non-linguistic experiments, the results are somewhat mixed (Lakusta & Landau 2012; Lakusta & Carey 2015).

The animacy of the mover is also closely related to the manner of motion in that the possible ways of how one can move are determined by the type of the mover. For example, only animate movers, typically human beings, can use their limbs to walk, stroll, or joggle, whereas both animate and inanimate movers may roll and fall. In addition, only human beings can enter the room while talking (which would account for a manner expression), whereas they are less likely to move by bouncing.

The animacy of the mover is also closely related to the agentivity. That is, only animate movers can instigate a movement although they can also move unintentionally (e.g., when falling). This explains also why the Goal-bias applies mainly to animate motion as animate movers typically move for some reason and often to reach some destination. This also means that when agentive motion is conducted, the manner of it is also decided and controlled by the mover. It may also be that animate motion is, thus, much more manner-rich than inanimate motion.

3.4. Hypotheses revisited

Only a small amount of information at any particular time available in the environment can receive elaborate cognitive processing. At the same time, the processing of motion is essential for human beings. This is supported by neurological evidence. For instance, the neurological mechanisms behind the processing of motion are different to the processing of static objects. This results in the faster processing of entities in motion than those in a static position. Moreover, the speed of motion influences the speed of processing in that fast movers tend to be processed faster than slow ones. As for attentional patterns, moving entities easily attract attention. As attention is limited, it must be selective and can only focus on one, or perhaps on two places in one time span. Simultaneously, the amount of information that is attentionally processed is also limited. As the entity that moves typically captures attention, the surrounding region of the mover is more likely to be given attention than at some further location. This means that the entire visually available scene is not processed with equal depth. To put it differently, attention given parts of a scene are processed in great detail.

Assuming the intertwining nature of language and other cognitive abilities of human beings, the perceptual and attentional properties and patterns should be reflected in language. It is likely that attention given to parts of the scene is also linguistically expressed in an enhanced manner to reflect the characteristics of processing. Regarding motion, the mover and its surrounding spatial region should be expressed in an enhanced manner or in more detail. However, attentional patterns are also influenced by other factors. For instance, Goal of motion may receive extra processing, and this may lead the attention to focus on Goal, rather than on Location of the mover.

In terms of the hypotheses of the current study, the consistent windowing hypothesis, I assume that limitations in attentional processing as well as everyday experience regarding the perception of motion contribute to the structure of motion clauses. Thus, the hypothesis suggests that the amount of information carried by motion clauses should be minimally given, while the most important information should be given maximum emphasis. I predict that this maximum emphasis is reached by applying redundancy, where the most important information is expressed in multiple ways within the same clause. This multiple expression can be seen as a semantic agreement between motion verbs and other expressions in the clause, and is hereinafter called 'consistent windowing'.

In particular, the hypothesis of consistent windowing suggests that a motion verb, and the other spatial expression in a clause, window the path in a consistent way. Namely, the prediction is that goal verbs combine mostly with Direction or Goal expressions (e.g., *sisenes majja* '(s)he entered the house'), and source verbs with Source expressions (e.g., *väljus majast* '(s)he exited the house'). As such, a motion verb and a spatial expression would window the same portion of the path. We would also expect that low-directional manner of motion verbs do not combine, or combine rarely, with expressions of Source or Goal (that is, with boundary crossing expressions), and prefer Trajectory, and Location expressions (e.g., *uitas majas* '(s)he strolled in the house').

Manner of motion verbs, which conceal a higher rate of directionality, are more readily combined with telic expressions, with Direction or Goal ones (e.g. *kihutas majja* '(s)he dashed into the house') being the most common. This argument can be seen to be vice versa as well: the higher the rate of combinations with directional expressions, the more directional the verb is. Viewed from this perspective, clausal patterns could be used as a tool in establishing how directional a particular verb is.

The consistent windowing hypothesis applies also to manner information. In particular, if manner is important, it should adhere to the hypothesis in a similar way as spatial expressions and be expressed in an enhanced way. If manner is expressed in an enhanced way, this would mean that there is a tendency to express the manner information in the verb and outside the verb simultaneously.

In other words, I predict manner of motion verbs to co-occur with manner expressions (e.g., *sõitis kiiresti* '(s)he drove fast') more frequently than directional verbs do. This prediction could also be viewed from a different angle and contrary to Talmy's lexicalisation patterns in that particularly manner of motion verbs do not combine with satellites (i.e., directional verbal particles), whereas directional verbs do combine with satellites.

In addition to spatial relations and manner features, other factors that are perceived as important in everyday life may contribute to the clausal patterns of motion verbs. Three factors that have been given much importance in the literature are taken into account in the study, (i) the speed of motion, which is closely related to the degree of directionality, (ii) the verticality or horizontality of motion, and (iii) the animacy of the mover.

I predict the differences in clausal patterns with respect to these to be as follows: (i) faster motion expressed by a verb entails more directional motion and more combinations with directional spatial categories (e.g., Source, and Goal), whereas verbs of slower motion combine more readily with Location, and Trajectory; (ii) vertical motion suggests fast and/or forceful motion; hence, Goal-prominence; (iii) animate motion results in a higher rate of Goal expressions.

As language is multivariate by nature, some other possible effective factors that can influence the principal structures of motion clauses are also discussed briefly. These include the genre of the text, the general frequency of the motion verb, and minor semantic units of motion clauses. Although other factors, such as aspect and agentivity, may also influence the structure of motion clauses, these remain beyond the scope of the current study.

It should also be noted that the study has a 'verb-central scope' in that the data are elicited with motion verbs and the patterns of motion descriptions are also analysed with respect to verb semantic factors. As such, and in general, the many ways to express motion, or dynamic information in a language, is not addressed in the current study. In addition, only expressions of actual motion are examined and no reference is made to metaphoric or metonymic extensions of motion expressions.

4. KEY CONCEPTS

In cognitive linguistics, there are many general concepts that researchers tend to be particularly fond of. While some of those concepts are comparatively well defined and thoughtfully used, others are often used on an intuitive basis and lack exhaustive specification. In order to apply as well-defined concepts as possible, the following sections discuss the main terms of the study. These refer both to non-linguistic as well as linguistic categories from the domains of motion in general, space, manner, and attention. A special emphasis is on the principal concepts that are used in the current study: (i) motion, motion clauses, and motion verbs; (ii) directionality, directional motion verbs, and portions of the path; (iii) manner, manner of motion verbs, and manner expressions; (iv) construction, pattern, structure, combination, and co-occurrence; (v) attention, windowing, salience, foregrounding, and backgrounding. Simultaneously, the elaboration on these concepts sets the scene for this study. The more specific concepts, such as spatial categories Location, Goal, and so forth, are dealt with in the section of coding schema (see Section 6.1).

4.1. Category and variable

I apply the term '**category**' (e.g., 'spatial category', 'the spatial category Goal') throughout the study when referring to the important concepts of the study. The reference to these concepts is needed to operationalise the language and, thus, to meet the objectives of this study. In principle, these categories are non-linguistic and conceptual, but I assume them to have a linguistic representation[6]. Thus, I understand 'category' as something which can be labelled and which presumably has a conceptual status of unit for human beings. As a statistical counterpart to the category, I use the term '**variable**'. That is, 'variables' stand for the categories which are annotated in the data analysis.

It should be noted, though, that this study makes every attempt to specify the borders within the applied categories, and these categories are carefully selected on the basis of previous research. Despite this fact, these categories are often dynamic with shiftable and shifting borders (see also Croft & Cruse 2004: 74−106). Furthermore, whether the categories differentiated in the current study are also those that language speakers actually operate with when processing language may be a matter of debate (see also Divjak & Arppe 2013: 234).

[6] Depending on the paradigm, many of such categories are also given more specific labels such as '(deep) cases' or 'semantic roles' (Fillmore 1968; 1971; 1982; 2003); 'thematic relations' or 'semantic relations' (Gruber 1965; Jackendoff 1972; 1983); 'thematic roles' (Frawley 1992); and 'argument roles' (Goldberg 1995).

4.2. Motion concepts

It is imperative in linguistic studies that investigate how motion is expressed in a language to have a clear definition of what ‘motion’ is. As such, I describe below the definitions and categorisations of motion, and define ‘motion’, ‘motion clauses’, and ‘motion verbs’ for this thesis.

4.2.1. Background and elaboration

Motion, in the discipline of physics, is defined as a “change in the position of a body or system with respect to time, as measured by a particular observer in a particular frame of reference” (Daintith 2009: 341). Not surprisingly, definitions of motion in linguistics are very similar. For example, Langacker (1987: 167) defines motion as a “change through time in the location of some entity”. What is important in this study when it comes to the expression of motion is to clarify some further aspects of motion. The concepts of ‘self-contained motion’ and ‘translational motion’, ‘motion event’ and ‘motion activity’, ‘motion verbs’, and ‘motion clauses’ are, thus, addressed in the following sections.

4.2.1.1. Translational versus self-contained motion

There are two main types of motion possible: motion in one place (e.g., rotation) and motion from one place to another (e.g., running). Naturally, both of these can be expressed linguistically as exemplified by *The ball bounced up and down on the same floor tile* and *The ball bounced down the hall*[7]. Following Talmy (2000b: 35–36), the former can be categorised as ‘self-contained motion’ and the latter as ‘translational motion’ (known also as ‘translocational motion’).

Most research to date has focused on translational motion as Talmy’s (2000b: 35–36) motion event model (see Section 3.2.2.1 for the description of the model) applies only to translational motion. The model also covers “locatedness in the event” (Talmy 2000b: 25). This means that the model stands not only for the expressions which describe the translational movement of some entity (e.g., *The pencil rolled off the table*[8]), but also the location of some entity (e.g., *The pencil lay on the table*), which could be interpreted as potential motion or the state that can turn into movement. Self-contained motion is not covered by the model, although self-contained motion, similarly to the location, could also be seen as a state that can become translational motion.

There are two problems, however, in restricting the study of motion clauses to translational motion only. First, the exclusion of self-contained motion from the model may lack justification. This is because both the static location as well as the dynamic self-contained motion have the potential to develop into

[7] Examples from Talmy (2000b: 36).
[8] Examples from Talmy (2000b: 26).

translational motion. Thus, both could be subsumed under the model of a motion event.

Second, the distinction between translational and self-contained motion may not be clear-cut. That is, one of the biggest difficulties in differentiating translational motion from self-contained motion is in determining the criteria which would distinguish the border between the two. This concerns both the physical motion itself as well as the linguistic expression of it. For instance, rotation may and may not be fixed to a certain location; bouncing may occur within the same general location such as a floor tile, but in reality, such bouncing with absolutely no shift of the location is rare.

Not only may the situation be differently interpreted in terms of the presence of the location change, but also the linguistic description itself may be interpreted from different angles. There are two ways on how to decide whether a shift in position occurs or not. It could be based on the meaning of the motion verb, or on the interpretation of the whole linguistic context that also includes the pragmatic and discourse context.

Either purposefully or not, authors tend to combine these two criteria in their studies. This is because there is difficulty in deciding upon the meaning of the verb as Pederson (2012: 2620–2621) surmises that "Even with careful semantic analysis, it is not always clear whether a particular … verb is also a verb of translocational motion" and that "the relation between what is semantically entailed and what is pragmatically implied is often not clear". Consequently, authors tend to use the whole expression (typically a sentence or a clause) with a particular verb in order to establish the semantics of the verb, including whether the verb represents translational or self-contained motion (e.g., Vendler 1957; Cardini 2008; Zlatev et al. 2010).

What follows is that when the interpretation of the type of motion is done on the basis of the linguistic context, the verb is typically understood to express translational motion if it can combine with directional path phrases (Cardini 2008: 540) or, more specifically, if it can combine with Source or Goal phrases (Zlatev et al. 2010). In Cardini's study (2008), all motion verbs which are used in the dictionary examples to express translational motion are considered to be motion verbs of translational motion. Zlatev et al.'s study (2010) takes an even more radical approach in that the actual sentences, and not the verbs themselves, are divided into translational and self-contained motion expressions. Whenever a verb is used in a description which expresses unbounded motion (e.g., *John ran in the park*), it is argued that it loses its translational properties and, as a result, the motion can only be seen as a self-contained one (Zlatev et al. 2010).

The current study examines motion verbs regardless of whether they express self-contained or translational motion. This is because motion verbs do not appear to fall into discrete categories of self-contained and translational motion, but instead they seem to form a continuum between these two edges. As a consequence, it may be difficult to decide whether a verb expresses primarily self-contained or translational motion. For example, the verb *värisema* 'shake, tremble' expresses mostly self-contained and the verb *jooksma* 'run' translational motion, whereas verbs such as *hüppama* 'jump' and *tõusma* 'rise' can express both. The interpretation of the type of motion in these cases are grounded in the context in which these verbs are used.

The sentential context, however, may not be a reliable criterion in differentiating between the semantic types of motion verbs, or at least not on an exemplar basis. Instead, a construction grammar approach (Goldberg 1995; 1997; 2010) may be taken in that there is an interplay between the meaning of the verb (which would be the same across different constructions) and the meaning of a motion construction. For instance, in Estonian, verbs which express self-contained motion, and even location, can be used in sentententential contexts that imply translational motion, while one would not analyse these to be verbs of translational motion (e.g., *seisin ukse äärde* 'I went next to the door and stood there' (Lit. 'I stood to next to the door')). Finally, even if linguistic contexts, such as whole clauses, are a reliable 'framework' that can be used to distinguish between verb types, this reliability must be proved at first. In other words, as clausal patterns themselves are of interest in the current study, it would not be justified to include or exclude any linguistic material on the basis of clausal structures.

4.2.1.2. A note on the motion event and motion activity

Examining the expression of motion, researchers typically adopt the term 'motion event' following Talmy (2000b: 25). Some authors, however, distinguish between the 'motion event' and 'motion activity'. The event is typically seen as a bounded portion of a temporal continuum (Talmy 2000a: 215). Consequently, the motion event has often been attributed telic properties, whereas activity, motion activity included, lacks such boundaries and is, hence, atelic (Vendler 1957; Aske 1989; Pourcel & Kopecka 2005; Pourcel 2010; Zlatev et al. 2010; Cardini 2012). In these approaches, the distinctive linguistic feature that distinguishes between the event and the activity is the presence of the expression of the boundaries (i.e., Source or Goal). If the boundary is expressed, the sentence refers to the motion event (and is telic); if the boundary is not expressed, the sentence refers to a motion activity (and is atelic).

The vast majority of studies (e.g., Talmy 1985; 2000b; Slobin 1996; 2004; Slobin et al. 2014), however, do not maintain this distinction between the event and activity (or at least it is not explicitly stated) in the examinations of motion clauses, nor does Talmy's account for the lexicalisation patterns suggest the exclusion of atelic instances. Moreover, one would find it difficult to justify the inclusion of some motion expressions and exclusion of others on aspectual grounds, and specifically on lexical aspectual grounds. I make no distinction between the motion event and motion activity, because in the current study, all clausal patterns of motion verbs that refer to actual motion are of interest. If needed, the general term 'motion' is used.

4.2.1.3. Motion verbs

Trivial as this statement seems, a motion verb is a verb that expresses motion. More specifically, one can agree with Miller and Johnson-Laird who define "verbs of motion as verbs that describe how an object changes from a place *p* at time *t* to another place *p'* at a later time *t + i*" (1976: 528). This seeming triviality of the semantic content of motion verbs is reflected also in the linguistic studies as the issue of 'motionness' is typically not discussed with regard to verbs (for a rare exception, see Miller & Johnson-Laird 1976: 526–531). Instead, the semantic types of motion verbs are given great attention, particularly in the distinction between path and manner of motion verbs (see Section 3.2 for an overview).

Whereas the types of motion verbs are also a concern of this study, the 'motionness' of verbs is also an issue. Namely, differentiating motion verbs from other verbs is somewhat problematic. This, in turn, causes difficulties in the extraction of motion verbs from all verbs as detailed in Section 5.1.2. The issues with the distinction between path and manner of motion verbs were already introduced in Sections 3.2.3.2 and 3.2.3.3. and is further dealt within the following sections of path and manner concepts. Other semantic features of motion verbs, such as the type of motion (either translational or self-contained), horizontality and verticality of motion, and speed of motion is discussed in Section 6.1.1.

4.2.2. Definition of 'motion', 'motion clauses', and 'motion verbs'

Put briefly, '**physical motion**' is an observable situation where some concrete entity changes its location, position, or orientation in space; or where the entity moves by keeping its same general location in space. I analyse linguistic descriptions expressing such situations as '**motion clauses**' and respective verbs as '**motion verbs**'. Two types of motions can be differentiated: motion in which the mover moves from one place to another and motion in which the mover keeps its general location. Following Talmy's terminology, I call the former as '**translational motion**', and the latter as '**self-contained motion**'. I do not utilise the terms 'motion event' and 'motion activity', the distinction of which would suggest aspectual differences. Instead, I refer to '**motion**' and restrict the situation on sentential grounds. That is, only clausal patterns of motion are analysed. Whether the clause can be analysed as referring to an event or activity, however these would be defined, is irrelevant. The '**clause**', itself, is understood here as a linguistic unit that clusters around the finite form of the verb. The more detailed account for expressions included in the study can be found in Section 5.2.2.

4.3. Spatial concepts

Without spatial interpretation, no verb could be analysed as being a motion verb or, more generally, no description as being a motion description. At the same time, motion expression itself creates the spatial interpretation. To account for the spatial settings of motion expressions, many concepts are used in linguistics. Amongst these, the term ‘Path’ (or ‘path’) is one of the main ones linguists operate with when talking about the spatial settings of motion (e.g., Talmy 1985; 2000b: 19–212). Although ‘path’ refers to a static entity, it nevertheless entails dynamic information and is closely related to (and often interchangeably used) with the term ‘directionality’ (see also Johnson 1987: 114).

In the current study, I utilise both the ‘path’ and ‘directionality’, but apply also more specific spatial terms. These are the ‘initial’, ‘medial’, and ‘final portion of the path’; ‘directional verbs’ (i.e., ‘source verbs’ and ‘goal verbs’); and terms for more specific spatial categories (e.g., Source, Trajectory, and Goal). I apply these terms in proposing the hypotheses, differentiating motion verbs from other verbs, and dividing motion verbs into rough, yet, by no means, discrete classes of directional and manner of motion verbs. These terms are also needed in coding the corpus data, and in interpreting the results. There are some other commonly used terms (namely, ‘Ground’ and ‘satellite’) which I do not employ in the study, but which are also discussed briefly in the following sections because they are closely related to the terms ‘path’ and ‘directionality’. The more specific spatial categories (e.g., Source, Trajectory, and Goal) are discussed in Section 6.1.2.1 (coding schema).

4.3.1. Background and elaboration

The Path is one of the core components of Talmy’s model of the motion event, and for that reason the term has been used in a variety of studies. In Talmy’s definition, “The **Path** (with a capital **P**) is the path followed or site occupied by the Figure object with respect to the Ground object” (Talmy 2000b: 25). The Figure is explained as “a moving or conceptually movable entity whose site, path, or orientation is conceived as a variable the particular value of which is the relevant issue” (Talmy 2000a: 184). The Ground, in turn, is defined as “a reference entity, one that has a stationary setting relative to a reference frame, with respect to which the Figure’s site, path, or orientation is characterized” (Talmy 2000a: 184).

As such, the definition of the Path is slightly tautological in that “The Path ... is the path” (Talmy 2000b: 25), and calls for more elaboration. This definition is presumably derived from the meaning of the word *path*, whereas this meaning itself is not further discussed by Talmy. In the English monolingual dictionaries, the *path* is defined as “a route or track between one place and another, or the direction in which something is moving” (Procter 1995: 1035), or as a “way or track laid down for walking or made by continual treading; the course or direction in which a person or thing is moving” (Pearsall & Hanks 1998: 1359).

These definitions suggest that the path comprises not only static, but also directional meanings (see also Johnson 1987: 114). These directional meanings may be interpreted in terms of a relation between the Figure and the Ground.

Nonetheless, it would still remain unclear what this relation means. It could be suggested that this relation is a schematic hypothetical motion route which, so to say, could be applied to any actual spatial entities. This can be exemplified by the *over*-schema in that one can move over a range of spatial objects but the general schema or path would be the same (Tyler & Evans 2001; Veismann 2009). This idea of 'path as a relation' is implemented partly in Talmy's (2000b: 25–26) description of the motion event as well as in many other accounts (e.g., Aske 1989; Filipović 2007; Croft et al. 2010).

To clarify the concept of Path, Talmy (2000b: 53–57) offers a description of its components arguing that "it [Path] is better understood as comprising several structurally distinct components" (Talmy 2000b: 53). The three components are: the Vector, the Confirmation, and the Deictic. The Vector include "the basic types of arrival, traversal, and departure that a Figural schema can execute with respect to a Ground schema" (Talmy 2000b: 53). Although Talmy avoids using typical semantic role labels originating from the work of Gruber (1965) and Fillmore (e.g., 1968; 1971), one could still see that typical counterparts to these basic types would be Goal, Trajectory/Path, and Source. The Confirmation component specifies whether a Figure object is located inside, or on the surface of the Ground object (Talmy 2000b: 54–56). The Deictic component of the Path refers to the location of the Figure object with respect to the speaker (Talmy 2000b: 56–57). Thus, all the three components of the Path specify, one way or another, the location of the Figure.

Furthermore, Talmy offers an analysis of the portions of the path that can be windowed, that is, expressed[9]. The path has the initial, medial, and final portion of it, all of which are expressed in English as prepositional phrases (Talmy 2000a: 265–267). Interestingly, no reference to the Ground is made in this analysis of windowing of path portions. In other words, and in this analysis, the path is not merely seen as some kind of relation, but as a concrete spatial route which portions, one could claim, if windowed, can be simultaneously analysed as Ground objects. In addition, it can also be seen that the portions of the path have counterparts in the semantic roles Source, Trajectory/Path, and Goal.

Another area where the term 'path' is used is the research into image schemas. In this field, the PATH or FROM-TO schema is discussed and studied, whereas the PATH schema is explicated as comprising "three elements (a source point A, a terminal point B, and a vector tracing a path between them) and a relation (specified as a force vector moving from A to B)" (Johnson 1987: 28). As such, the schema is often named as the SOURCE-PATH-GOAL schema (e.g., Lakoff 1987; 1989; Johnson 1989; Oakley 2007) as Source, Goal, and Path between them are clearly implied by it. In this embodied approach, Path is

[9] Note the use of small capital letter here which would indicate the will to set the analysis of the motion events and path portions apart.

defined as a schematic line starting from the point of the departure of the mover and ending with the destination point of the mover, whilst also covering all the intermediate locations.

The SOURCE-PATH-GOAL alternative naming of the PATH schema reveals something about the confusion the word *path* creates. On the one hand, the path (or Path, PATH) is used as a general, non-linguistic term covering all locations of the mover including Source and Goal. On the other hand, however, it is used as a linguistic term referring to the expression that is used to depict the general, conceptual path, or some segment of this path. In this latter meaning, the path, strictly speaking, does not necessarily cover Source and Goal. Due to this ambiguous scope of the concept path, the term 'trajectory' is sometimes used to refer to this meaning where the linguistic unit referring to (some segment of) the path needs to be named (Stefanowitsch & Rohde 2004; Taremaa 2013). The current study also exploits the term 'Trajectory' to refer to the area between the departure and destination point of motion.

4.3.1.1. Path and directionality

As can be inferred from the definitions of the *path*, the path does not refer to a static entity only, but entails also motion-like information. Closely related to the path or, to some, perhaps even constituting the same thing, is direction(ality). This is because the path has a directional nature, so that any path can be interpreted in terms of directional meaning (Johnson 1987: 114). Presumably for this reason, path verbs have a diversity of names in the literature, such as directional verbs (e.g., Yiu 2005), directed motion verbs (e.g., Beliën 2012), or verbs of inherently directed motion (e.g., Levin 1993: 263–264). In addition, the Talmy's concept 'Path' has also been interpreted as an 'abstract direction' (Levinson & Wilkins 2006: 535).

Nevertheless, the meaning of the term 'directionality' is rarely explicated. The word *direction* is generally defined as "a course along which someone or something moves; the course which must be taken in order to reach a destination; point to or from which a person or thing moves or faces" (Pearsall & Hanks 1998: 522). This definition suggests that directionality has a dynamic nature. In other words, there is some evolvement over time in space. We could also conclude that any specific point along the path is non-directional, whereas the whole path the mover covers is inherently directional. In addition to attaching directionality to only moving along some route, we could also include this concept to moving away from some place or moving closer to some place. These meanings would concern not only actual motion, but also fictive, and other abstract motion domains.

Thus, the path has directional properties as also suggested by Johnson (1987: 114). At the same time, the direction can be viewed in a more narrow way. Namely, under this viewpoint of image schemas, direction would refer mainly to the portion of the path between the particular location of the mover and

Source and/or Goal of the motion. This meaning is explicated in the overview of the coding schema in Section 6.1.2.1.5. It should be noted here, however, that these spatial categories also vary with respect to how directional they are. That is, the categories of the initial and final portion of the path (Source and FromDirection, and Direction and Goal) are presumably highly directional, whereas categories of the medial portion of the path (Location and Trajectory) are not directional (Location), or are modestly directional (Trajectory).

There are direct consequences to the main categories of motion verbs due to the path assuming some directionality. More specifically, this directionality affects the claims that path verbs express exclusively path information, and manner of motion verbs contain no path information (Talmy 1985; 2000b: 25−57; Levin 1993: 263–267). As already reported in Section 3.2.3.3, this argument has some weaknesses in that motion verbs can explicitly contain both directional and manner features. With regard to the semantics of the path, this discussion can be further supported. That is, Talmy's (2000b: 25–27) model of the motion events covers both path and manner of motion verbs. The core idea of this model is that it applies only to translational motion. This means that not only path verbs, but also manner verbs (e.g., *run*) need to express some translocation in order to fit in the model. However, when considering translational motion, the creation of a conception of the (schematic) motion path cannot be avoided. Otherwise, it would be impossible to say whether a verb expresses translational or self-contained motion. What follows is that both path and manner of motion verbs exhibit directional meanings. This directionality or path meanings may be seen as salient in path verbs and less salient in manner of motion verbs.

4.3.1.2. Directional verbs

Verbs which lexicalise primarily the spatial settings of motion are typically called 'path verbs' or 'directional verbs' (but also 'trajectory verbs'). Such verbs have been defined as "verbs of inherently directed motion" (Levin 1993: 263) where "the meaning of these verbs includes a specification of the direction of motion, even in the absence of an overt directional complement. … None of these verbs specify manner of motion" (Levin 1993: 264). Following Talmy, these verbs conflate the Path component in the verb root (Talmy 2000b: 49–57).

Path verbs or directional verbs, in turn, have been divided into 'source verbs' (e.g., *leave*) and 'goal verbs' (e.g., *arrive*), with the former specifying the starting point or the initial portion of the path, and the latter the destination or the final portion of the path (see also Langacker 1987: 246–247; Levin 1993: 264; Rohde 2001: 298–326). In addition, verbs expressing the medial portion of the path (e.g., *cross*), have sometimes been differentiated, called 'path verbs' (Levin 1993: 264) or 'trajectory verbs' (Taremaa 2013). In addition to these spatial features, motion verbs comprise information about general direction in terms of horizontal and vertical motion, as explained in Section 3.3.3.2.

4.3.1.3. A note on satellites

Finally, the term 'satellite' needs some discussion as it is pervasively used in the domain of motion expression. It is one of the defining points in establishing the typological type of a language in that if the Path is dominantly expressed as a satellite (and not a verb), the language can be analysed as a satellite-framed language (Talmy 2000b: 222). However, the term 'satellite', itself, is highly controversial and has been understood very differently by different researchers. Consequently, and as stated by Goschler and Stefanowitsch, "The category "satellite" is ill defined" (2013b: 5). It is difficult not to agree with their argument. Thus, I discuss the term 'satellite' only to justify why using the vague concept of satellite is avoided in the current study.

To start with, Talmy's definition of the 'satellite' is as follows:

> *It is the grammatical category of any constituent other than a noun-phrase or prepositional-phrase complement that is in sister relation to the verb root. It relates to the verb root as a dependent to a head. ... One justification for recognizing the satellite as a grammatical category is that it captures an observable commonality, both syntactic and semantic, across all these forms – for example, its common function across one typological category of languages as the characteristic site in construction with the verb for the expression of Path or, more generally, of the "core schema".*
>
> (Talmy 2000b: 102).

Therefore, in principle, satellite has a semantic basis in that it expresses Path information. At the same time, Talmy restricts it formally. He excludes prepositions from satellites although the two can incorporate the same lexical items. This is the main point where Talmy's proposal of satellites has been attacked. Several scholars have shown that Talmy's proposal to treat English prepositions as non-satellites lacks justification as the term satellite should be functionally, not formally driven (Stringer 2002; Filipović 2007; Croft et al. 2010: 205–206). Instead, a broader definition of satellite is suggested: "Anything that is not a verb root but encodes an event component will be analyzed as a satellite. This definition includes English prepositions which encode the framing/result subevent, even if they do not occur without an accompanying ground expression." (Croft et al. 2010: 206).

In Croft et al.'s (2010: 205–206) view, Talmy's definition of satellite excludes prepositions that have the same function as verbal particles in English. However, these prepositions, such as *into*, are never used as particles. Consequently, many linguists (e.g., Cifuentes-Férez & Gentner 2006; Filipović 2007; Croft et al. 2010) consider also prepositions to be satellites. Furthermore, one can find interpretations, such as “The term ‘satellite’ is crucial in his [Talmy’s] framework, and is applied to all adpositions which express PATH” (Stringer 2002: 157) although this is contrary to what Talmy has actually claimed, namely, that adpositions *are not* satellites.

Given this discussion, differentiating between satellites and adpositions does seem to lack justification. Moreover, and in Estonian, not only are there elements that are used solely as verbal particles, and elements that are used solely as adpositions, but also there are elements that can have both functions. Often, the function itself can be comparatively difficult to posit (see also Section 7.2.2). Furthermore, if one finds it difficult to rationalise the distinction between satellites and adpositions, it would be only one step further to have difficulties in differentiating between satellites and case suffixes on functional grounds.

To conclude, the term ‘satellite’ is not used in this thesis. This is because of two main reasons. Firstly, the term itself is too vague. Secondly, there is no need for such a term, because the primary purpose of this study does not aim to contribute to the research on the lexicalisation patterns. For these reasons, I utilise traditional linguistic terminology and refer to ‘verbal particles’, ‘adpositions’, and ‘cases’ (see also Section 7.2.2).

4.3.2. Definition of ‘directionality’, ‘directional verbs’, and ‘portions of the path’

In this study, I apply the general terms ‘**directional**’ and ‘**directionality**’ when talking about the spatial meanings a verb implies. As such, directionality refers to motion towards or away from something. When observing any physical motion, we locate the motion with respect to other spatial entities. This means that on visual grounds, we always analyse visual motion as moving towards or away from something, even if the mover itself considers his/her motion to be aimless or if the motion is conducted in one place. In other words, “Only relative motion can be measured; absolute motion is meaningless” (Daintith 2009: 341). Hence, directionality is an inherent property of any motion, either translational or self-contained. We can, thus, posit that the more translational the motion is, the more directional it is, whereas self-contained motion is ‘low-directional’.

I divide motion verbs into ‘directional’ and ‘manner of motion verbs’. ‘**Directional verbs**’[10] foreground spatial information (i.e., they express mainly

[10] The term ‘directional verb’ is preferred against the term ‘path verb’ in the current thesis. As mentioned above, path verbs may window the initial, medial, and final portion of the path. In this study, only such path verbs that express the initial or final portion of the path are included. Verbs describing the medial portion of the path (i.e., trajectory verbs, such as *ületama* ‘cross’, *läbima* ‘go through’, and *mööduma* ‘pass’) are not included due to their fixed morphosyntactic patterns (see Section 5.1). To specify that the results obtained are relevant only to source and goal verbs, and not to trajectory verbs, the term ‘path verb’ is avoided and the term ‘directional verb’ used.

spatial meanings), while ‘**manner of motion verbs**’ profile manner information (i.e., they express mostly manner meanings). However, I do assume, given the idea of directionality, that all motion verbs are directional, except that this directionality is present to differing degrees in motion verbs. Directional verbs are highly directional, whereas manner of motion verbs are less directional, with many of them incorporating directional meanings only modestly.

I use the term ‘**path**’ to refer to the elongated contiguous spatial area where the mover can be found during motion, i.e., when moving from some place to another. More specifically, I adopt Talmy’s approach to the windowing of attention and make use of the terms ‘**initial**’, ‘**medial**’, and ‘**final portion**’ of the ‘**path**’. The initial portion is the departure, and the final portion is the destination point of motion. The medial portion connects the two. In particular, the spatial categories, Source and FromDirection (from where or from a direction of which motion proceeds), stand for the initial portion of the path. Trajectory and Location (a route along which or a place where motion proceeds) stand for the medial portion of the path. Direction and Goal (towards which or to where motion proceeds) stand for the final portion of the path. These detailed six spatial categories are defined in the section of coding schema (see Section 6.1.2.1). Expressions of the initial and final portion of the path are taken as highly directional, whereas those of the medial portion of the path as non-directional, or modestly directional ones.

I use the terms ‘initial’, ‘medial’, and ‘final portion of the path’ in addition to the more specific spatial categories (e.g., Source and Goal) to propose the hypothesis (see Sections 2 and 3.4) and summarise the results (see Section 9). I argue that both the verb and other spatial expression can be understood in terms of these portions of the path in a similar way as with spatial expressions. That is, spatial expressions can refer to the initial (e.g., *majast* ‘from the house’), medial (e.g., *mööda teed* ‘along the path’), and final portion of the path (e.g., *majja* ‘into the house’), and so can verbs refer to these portions of the path. Thus, there are verbs of initial (e.g., *lahkuma* ‘leave’), medial (e.g., *hulkuma* ‘wander’), and final windowing (e.g., *saabuma* ‘arrive’).

4.4. Manner concepts

Every physical motion is conducted not only in some concrete spatial settings, but also in some particular manner. This particular concept refers to ‘manner’, which is, per nature, a semantic concept. This implies that it can be defined on a semantic basis only. However, in the literature, there is a tendency to treat manner as a self-explanatory term. Regardless of whether it is dealt within reference grammars (mostly in terms of manner adverbials (Erelt et al. 1993: 88) or manner adjuncts (Mittwoch et al. 2014: 670–673), or in the tradition of cognitive semantics (Talmy 2000b; Slobin 2006), manner is generally explained via *how*. In other words, manner is a matter of ‘howness’. A ‘manner expression’ describes “how, in what way, the process expressed in the VP [verb phrase] is performed” (e.g., *She walked slowly away*; Mittwoch et al. 2014: 670), whereas a ‘manner of motion verb’ is a verb which describes *how* motion is carried out (e.g., *He ran quickly*; Talmy 2000b: 29; Slobin 2006: 62).

The current study defines manner as precisely as possible for two main reasons. Firstly, this concept needs to be clear in order to separate manner of motion verbs from other motion verbs (see the procedure of extracting motion verbs in Section 5.1, and the tagging of manner of motion verbs in Section 6.1.1.2). Secondly, manner of motion verbs need to be distinguished from other verbs in order to test the hypothesis of consistent windowing. Furthermore, other manner expressions need to be tagged in the data to examine if manner also obeys the hypothesis of consistent windowing. That is, in order to find manner of motion verbs and the manner expressed somewhere else in a clause (Slobin 2004; 2006), one clearly needs to know what to search for as ‘somewhere else in the clause’ (see also Section 6.1.2.2.). The terms that are applied are ‘manner of motion verbs’ to refer to verbs, and ‘manner expressions’ to refer to other, non-verb expressions of manner.

4.4.1. Background and elaboration

Manner is, thus, comparatively poorly defined in linguistic studies (see also Slobin et al. 2014). In many cases, there is no need to define manner and not all studies on the lexicalisation patterns or on manner should be expected to include definitions of manner. In fact, there are studies that exclusively deal with manner without any need for a definition of it. In one type of such studies, the phenomenon under investigation defines itself, or is defined by the researcher when establishing the scope of the study. For instance, if motion verbs which express aquamotion are studied (e.g., Divjak & Lemmens 2007; Batoréo 2008), the semantic domain of manner is already defined as such, and further explanations of what is a manner of motion verb are clearly redundant. Moreover, when only one or two manner of motion verbs are studied (e.g., Taylor 1996; Gries 2006), the needlessness to define manner is even more clear.

Another issue considers the typicality of manner of motion verbs. Authors tend to limit their studies to the examination of prototypical manner of motion verbs (e.g., Iwata 2002) or unambiguous manner adverbials (e.g., Manninen 2003). In these cases, the ‘mannerness’ is self-evident. Thus, the challenge of finding good definitions for manner becomes more relevant when moving away from prototypical examples. Furthermore, when manner needs to be operationalised for statistical purposes, more precise decisions on the boundaries of the manner category need to be done.

Furthermore, and before I can discuss the ambiguous content of manner, I need to clarify how many ‘manners’ there are. In other words, is manner conflated in a verb different to that of occurring somewhere else in a clause, or is it the same manner? If there are different ‘manners’, then one would need different definitions for manner of motion verbs and manner expressions. If there is only one manner category, the definitions of manner conflated in motion verbs could be transferred to other manner expressions and vice versa.[11]

Intuitively, one could agree that manner as a semantic role is a general category and there might be no need to split it into different 'manners' based on the syntactic occurrences. This view is apparently supported by Talmy (2000b: 21−320) who seems to treat manner as one category which can be expressed by a verb (resulting in manner of motion verbs) or (if present at all) by some other element in a clause.

Nevertheless, problems arise when one attempts to describe both manner of motion verbs and other manner expressions on the same semantic basis. As the semantics of manner of motion verbs has received somewhat more attention in the literature than the semantics of other manner expressions, I begin with manner features incorporated in the meaning of manner of motion verbs and then turn to other manner expressions. Based on these overviews, I define manner on the purposes of this study.

4.4.2. Manner of motion verbs

Manner of motion verbs are motion verbs which specify *how* motion is conducted. However, this definition is too vague for this study. Thus, I present more specific definitions of manner of motion in linguistics in my description below.

This study is not going to exploit one typical, but somewhat vague definition of manner of motion verbs in which manner of motion verbs are motion verbs that do not describe the direction of motion (Levin 1993: 264–267). This view is expressed clearly in the definition of manner verbs by Filipović (2007: 83) which states that "Manner verbs themselves do not contain any information regarding the direction of motion and thus cannot provide us with any crucial information regarding the distinctions within the spatial frame". Regarding motion verbs, this would mean that manner is anything that is not a direction. As a result, there would be either directional verbs (e.g., *go* and *head*) or manner of motion verbs (e.g., *run* and *roll*). A similar approach can be found in Mani and Pustejovsky (Mani & Pustejovsky 2012: 94) where manner of motion verbs are defined as motion verbs which concern "no distinguished locations; they involve assignments of locations of the moving object from state to state". This, again, is a definition of manner of what motion verbs are not. Moreover, this definition is neither precise, nor useful as discussed in Section 3.2.3.

Regarding more concise descriptions, manner (of motion) is elaborated in some studies. For example, it has been described as a "source of propulsion" (Divjak & Lemmens 2007: 152, 172) or "way in which specific parts of the body move or are positioned … or way in which the Figure behaves during the

[11] Another related question would be whether manner of motion is different to manner in general; the issue of which the current thesis aims not to address.

motion event" (Lestrade & Reshöft 2012: 232). Some insights into manner can also be found regarding explanations in what does some particular manner of motion verb mean. To illustrate this, the verb *run* "typically denotes a manner-of-motion activity, typically of an animate being moving in a particular way and with a certain speed" (Montrul 2001: 172).

In some studies, possible manner features are named. For instance, Slobin (2004; 2006: 62), by means of example, lists some features that can be regarded as manner ones. These are body movements/motor pattern (e.g., *jump*), speed/rate (e.g., *sprint*), force dynamics (e.g., *tramp*) (Slobin 2004; 2006: 62); but also "rhythm, posture, affect, and evaluative factors" (Slobin 2004: 255). In a recent study, a more comprehensive overview of human gait expressions suggests the following manner features: "varieties of walking at a normal pace, relaxed walking, labored progress, impaired walking, quadrupedal movement, varieties of running, rapid movement, smooth movement, punctuated/repeatable movement" (Slobin et al. 2014: 716).

Dodge and Lakoff (2005: 67–68), discussing animate self-motion, name "the basic gait or general rhythm of muscular activity that the mover is using to bring about his motion" (e.g., *walk*, *run*, *jump*), the speed of motion (e.g., *saunter* vs. *stride*), the effort of moving (e.g., *trudge* vs. *stroll*), and parts of the body engaged in motion (e.g., *walk* vs. *crawl*). Kopecka (2010: 234–237), analysing Polish motion verbs, points out manner features, such as effort, attitude, unsteadiness, aimlessness, speed, energy, the medium of motion or the nature of contact with this medium, motor pattern, figure, and posture.

Almost all of these manner features occur also in a comprehensive analysis of English and Italian manner of motion verbs by Cardini (2008). Cardini (2008: 541–546) divides manner features into three groups: (i) perceivable features of motion; (ii) so-called fundamental concepts related to motion; and (iii) not perceivable features of motion connected to the inner state of the mover.

The features which can be perceived (observed, heard etc.) are the (i) very basic movements which arise from the contact of the mover and the surface, and consider oscillation (e.g., *bounce*[12]), rotation (e.g., *roll*), and continuous friction (e.g., *slide*); (ii) basic movements that an animate mover conducts either to move (e.g., *walk* and *trot*) or because they accompany the moving movements (e.g., *lollop*[13]); (iii) trajectory of motion (e.g., *zigzag* and *arc*); (iv) vehicle or instrument (e.g., *cycle*, *pedal*, and *ride*); (v) sound of motion (e.g., *rattle* and *whistle*) (Cardini 2008: 542–544).

The fundamental concepts that motion is related to are (i) the speed: fast (e.g., *zoom*) vs. slow (e.g., *drift*); (ii) energy/force: forceful/violent (e.g., *barge*) vs. weak/feeble (e.g., *totter*); (iii) weight: heavy (e.g., *trundle*) vs. light (e.g., *trip*); (iv) effort: easy/effortless (e.g., *coast*) vs. difficult/laborious (e.g., *clamber*); (v) continuity: continuous/steady (e.g., *flow*) vs. abrupt/jerky (e.g., *joggle*); (vi) harmony: elegant/co-ordinated (e.g., Italian *ballare*) vs. clumsy/awkward

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[12] Examples here and hereafter from Cardini (2008: 542–546) if not stated differently.
[13] My example.

(e.g., *lollop*); (vii) steadiness: controlled/steady (e.g., *march*) vs. uncontrolled (e.g., *stagger*) (Cardini 2008: 544–545).

Finally, the inner state of the mover (i.e., the emotional state of the mover) is also relevant to manner information. This includes haste (e.g., *hurry*), fear (e.g., *sneak*), confidence/arrogance (e.g., *swagger*), calm/relaxation (e.g., *stroll*), and gaiety (e.g., *caper*) (Cardini 2008: 545–546). It goes without saying that this kind of manner can ultimately be expressed if the mover is an animate mover.

However, some of the manner features are a matter of dispute in the literature and they could also be interpreted as borderline cases (see also Slobin et al. 2014: 704). These features are the trajectory, instrument, sound, and speed of motion. One example is that the trajectory is considered as a manner feature in Cardini (2008), but not in Lestrade and Reshöft (2012). Some authors also include the vehicle and instrument as a manner feature (e.g., Talmy 2000b; Cardini 2008), whereas others do not (e.g., Levin 1993; Lestrade & Reshöft 2012). The sound is sometimes regarded as a manner feature (e.g., Iwata 2002; Cardini 2008) and sometimes not (e.g., Rohde 2001; Lestrade & Reshöft 2012). The same applies to the speed which is viewed as manner in some studies (e.g., Dodge & Lakoff 2005; Slobin 2006; Cardini 2008; Kopecka 2010; Lindsay et al. 2013; Slobin et al. 2014), but not in others (e.g., Levin 1993; Lestrade & Reshöft 2012).

Thus, there is much support that manner of motion, mainly and dominantly, originates from specific motor patterns (i.e., how the mover moves him/her/itself during the motion). Furthermore, these specific motor patterns must also be observable when considering, at least, physical motion. In fact, even if referring to the emotional state of the mover, this emotional state is presumably observable in the motor pattern. That is, in the case of physical motion, one could argue that in terms of motion pattern, each of the features is somewhat perceivable. For example, if we consider the emotional state of the mover and haste when someone is hurrying, it does not necessarily mean that the mover actually proceeds quickly. However, if it is not the speed, then a particular motion pattern from which it is possible to deduce that the mover is hurrying is observable.

It should also be noted that although it is possible to list the features that a manner verb can have, the meaning of manner of motion verbs is typically very complex, because different features form bundles (see also Cardini 2008: 546). That is, several manner features are often expressed simultaneously by a manner motion verb. Moreover, “underlying dimensions of Manner may be gradient rather than discrete” (Slobin et al. 2014: 706), which means that different features of manner are lexicalised in different degrees in manner of motion verbs. This, in turn, makes it complicated to categorise manner of motion verbs into clear subtypes of manner of motion verbs.

Furthermore, Lindsay et al. (2013) suggest that slow motion verbs are much more manner rich (called also as ‘expressive manner verbs’ by Slobin et al. (2014)), and this could be understood (based on their list of motion verbs) as including manner features of force, effort, trajectory, body-movements, mental states, sound, etc. In other words, manner rich verbs lexicalise more manner features simultaneously. From this richness idea, they propose that "participants map visual inferences about characteristic manners of motion onto the visual world" (Lindsay et al. 2013: 10). Furthermore, slow motion verbs may express manner features more dominantly than fast motion verbs. Conversely, fast motion verbs may be more similar to goal verbs in that they depict the salient features of path information in addition to the speed one.

4.4.3. Other manner expressions

In order to define manner of motion verbs, semantic factors are usually sufficient in many languages. This is how manner of motion verbs can be and have been detected in linguistics (e.g., Levin 1993: 264–267; Talmy 2000b: 29; Slobin 2004: 255; Cardini 2008; Kopecka 2010; Slobin et al. 2014). Considering other manner expressions, authors tend to combine both morphosyntactic as well as semantic criteria to determine manner expressions. In most cases, the question of other manner expressions has to do with manner adverbials even though manner adverbials are definitely not the only means to express the meaning of manner. Furthermore, the concept of manner adverbial is a vague one as well (see also Virtanen 2008).

Most importantly, manner features present in verbs of motion may not be sufficient when establishing other manner expressions. Although no distinct definition for other manner expressions should be needed as it is, after all, the same manner, the ability of verbs to incorporate different meanings is still somewhat limited compared to other linguistic means such as noun or adverb phrases. That is, although all manner features should apply to manner expressions regardless of the form, if manner is expressed outside the verb, the formal and semantic variability is presumably much more diverse.

Indeed, a language can use a variety of means to express *how* something happens. At the same time, it is difficult to find a study that would take the semantic category of manner and then tackle the various linguistic means on how it can be encoded (for some rare exceptions, see Kopecka 2010; Slobin et al. 2014). Studies regarding Estonian are no exception to this, although the reference grammars do list constructions that can be used to express manner information (e.g., Erelt et al. 1993: 66–67, 86–94). To date, the most commonly discussed manner expressions are manner adverbials. However, in Talmyan studies, the gerund forms of manner of motion verbs have also been used as examples of manner expressions (e.g., *The bottle entered the cave floating* (Talmy 2000b: 49–53)).

As for manner adverbials, the Estonian reference grammar (Erelt et al. 1993: 88–91) states that they add some qualitative information to the event expressed and give an answer to the *how*-question. In addition to that, instrumental adverbials and companion adverbials are distinguished in a case of which the possibility to include these adverbials into manner adverbials is admitted (Erelt et al. 1993: 66–68).

As for English, Quirk et al. (1985: 556–566) write about manner adjuncts without giving their definition, but they provide a number of examples of what they consider to be manner adjuncts. Mittwoch et al. (2014: 670) define manner adjuncts as elements that “characteristically describe how, in what way, the process expressed in the VP [Verb Phrase] is performed”. By means of formal features, manner adjuncts may be expressed as noun, prepositional or adverb phrases, but also as clauses, such as comparisons (Quirk et al. 1985: 577; Mittwoch et al. 2014: 670–673). Typically, manner adjuncts are differentiated from means and instrument adjuncts (Quirk et al. 1985: 556–566; Mittwoch et al. 2014: 670–675). In addition, speed and result are viewed as “blends of manner with some other relation” (Quirk et al. 1985: 560). Such expressions have also been called as adverbials of ‘manner plus’ (Virtanen 2008).

There is also some doubt on whether all manner adverbials are actually adverbials or whether some of them are, in fact, depictive secondary predicates (Winkler 1997; Müller 2004; Schultze-Berndt & Himmelmann 2004; Himmelmann et al. 2005; Müller 2008; Lindström & Metslang to appear). The current study does not address this issue and concentrates only on a semantically defined category of manner.

As for the semantic features of manner of motion expressions, these are discussed in more detail in only a few studies. Slobin et al. (2014) analyse manner expressions (which they call ‘modifiers’) of human gait in several languages and divide the manner features into the categories of attitude of the mover (e.g., *happily*[14]), rate (e.g., *quickly*), effort (e.g., *laboriously*), posture (e.g., *hunched over*), steps (e.g., *bouncing*), and instrument (e.g., *with a cane*), most of which also have subcategories. Kopecka (2010: 237–238), examining Polish motion descriptions, finds that the main semantic features of manner expressions (modifiers) are attitude, velocity, vehicle, posture, slowness, suddenness, effort, unsteadiness, walking, softness, noise (or silence), rhythm, and leaping.

The semantic features of manner expressions can be typical and less typical. Following the list of the manner features of motion verbs (e.g., Cardini 2008; Slobin et al. 2014), the typical manner features are (i) the main or accompanying movements (e.g., *joostes* ‘running’), but also the descriptions of parts of the body conducting the motion (e.g., *jalgsi* ‘on foot’); (ii) the relative position or posture of the mover (which, as such, determines the movements one can make; e.g., *käpuli* ‘crawling’; (iii) the physical state of the mover which, again, contributes to the general motor pattern (e.g., *purjuspäi* ‘drunkenly’).

Less typical instances consider the general appearance of the mover, such as clothes worn (e.g., *räbalais* ‘in rags’) and facial expressions (e.g., *väsinud näoga* ‘having a tired face’), or behaviour in general (e.g., *nagu hull* ‘as a mad’). Such expressions may act as clear reflections of the motor pattern, but may also provide more subtle, yet essential information about the nature of the described motion. In addition, the emotional state of the mover is relevant to the manner of motion (e.g., *kurvalt* ‘sadly’). There are also some features of which the

[14] Examples from Slobin et al. (2014: 721–722).

concept 'mannerness' could be debated in a similar way as it is with verbs; namely, the speed (e.g., *aeglaselt* 'slowly'), trajectory (e.g., *kurviliselt* 'along curves'), sound (e.g., *vaikselt* 'quietly'), and instrument (e.g., *rattaga* 'by bike').

4.4.4. Definition of 'manner', 'manner of motion verbs', and 'manner expressions'

This study defines '**manner**' by means of 'howness'. More specifically, this *how* refers to the motor pattern of the physical mover, no matter how straight or hidden the reference to this pattern may be. Table 1 below shows the manner features as specified by motion verbs or other linguistic forms. This list is not exhaustive, but it provides more clarity to the content of the concept of 'manner'. Motion verbs and other expressions that incorporate one or more of these manner features are '**manner of motion verbs**' and '**manner expressions**' respectively. However, most verbs or expressions typically incorporate more than one manner feature, and the manner features themselves also overlap (e.g., the manner features 'force' and 'effort' are rather similar). The presence of a manner feature itself is a matter of degree of 'mannerness', rather than a phenomenon of 'all or nothing'. For example, the verb *taaruma* 'stagger' provides information about the general motor pattern; accompanying body-movements; position and physical condition of the mover; trajectory and speed of motion; energy, weight, effort etc. of motion; and the emotional state of the mover.

Table 1. Manner features as attested in verbs and other expressions

Manner features[15]	**Examples of motion verbs**	**Examples of manner expressions**
general motor pattern of the mover with respect to the medium (surface): oscillation, rotation, and continuous friction	*hüppama* 'jump', *veerema* 'roll', *libisema* 'glide'	*hüpates* 'jumping', *väikeste hüpetega* 'with small jumps'
medium of motion	*ujuma* 'swim', *lendama* 'fly', *kõndima* 'walk'	*pladinal* 'sploshing', *lennates* 'flying', *tipa-tapa* 'pitter-patter'
body movements carried out by the mover in order to move; parts of the body responsible for carrying out the motion	*jalutama* 'walk, stroll', *lendama* 'fly'	*käte peal* 'on one's hands', *jalgsi* 'on foot'
accompanying body-movements; movements that are not performed for the purposes of the main motion, but which the mover conducts either because of moving or because of other causes	*lonkama* 'limp', *ukerdama* 'plod'	*longates* 'limping', *värisevate jalgadega* 'with shivering legs'

[15] The list of manner features is based mainly on Cardini (2008), Kopecka (2010), and Slobin et al. (2014).

Manner features[15]	**Examples of motion verbs**	**Examples of manner expressions**
position or posture of the mover	*kõndima* 'walk', *roomama* 'crawl'	*käte peal* 'on one's hands', *neljakäpuli* 'crawling'
physical condition of the mover	*lonkama* 'limp', *taaruma* 'stagger'	*longates* 'limping', *purjuspäi* 'drunkenly'
trajectory of motion whether straight or non-linear	*sööstma* 'shoot, dart', *keerlema* 'whirl, swirl'	*otse* 'directly', *lookeid tehes* 'with zigzags'
instrument of motion	*väntama* 'pedal', *ratsutama* 'ride, gallop'	*rattaga* 'by bike', *hobuse seljas* 'on a horse'
sound of motion	*vihisema* 'swish, whizz', *paterdama* 'pad'	*vaikselt* 'quietly', *kolinaga* 'with a rumble'
speed of motion	*kihutama* 'race, career', *lonkima* 'stroll, saunter'	*kiiresti* 'quickly', *aeglaselt* 'slowly'
energy or force of motion	*purskama* 'erupt, spurt', *hõljuma* 'float, hover'	*energiliselt* 'energetically', *hädiselt* 'poorly'
weight of motion	*trampima* 'trample', *tippima* 'trip'	*raske sammuga* 'at a heavy pace', *tippsammul* 'at a tripping pace'
effort of motion	*sibama* 'scurry', *rühkima* 'forge, plod'	*kergelt* 'lightly', *suurivaevu* 'drudgingly'
continuity of motion	*liuglema* 'slide', *karglema* 'frisk'	*voolavalt* 'flowingly', *äkiliste liigutustega* 'abruptly'
harmony of motion	*kulgema* 'run, proceed', *karglema* 'frisk'	*väärikalt* 'with dignity', *kohmakalt* 'clumsily'
steadiness of motion	*sammuma* 'walk, step', *taaruma* 'stagger'	*ühtlase sammuga* 'at a steady pace', *taarudes* 'staggering'
rhythm of motion	*sammuma* 'walk, step', *kiikuma* 'swing'	*rütmiliste liigutustega* 'with rhythmic movements'
the appearance of the mover	*tilbendama* 'move in a dangling manner', *hõljuma* 'float, hover'	*räbalais* 'in rags', *tähtsa näoga* 'with a proud face'
emotional state or attitude of the mover	*ruttama* 'hurry, rush', *keksima* 'jump happily with small steps'	*õnnelikult* 'happily', *kiirustades* 'hurriedly', *tähtsa näoga* 'with a proud face'

4.5. Constructional concepts

Language is not a mere compilation of unrelated units. On the contrary, “Language is never, ever, ever, random” (Kilgarriff 2005: 263). When analysing combinations of linguistic units, the ultimate goal of the current study, constructional concepts are the most pertinent. I apply several non-linguistic and comparatively everyday concepts when explaining my study expectations as well as in reporting the results. These include ‘pattern’, ‘structure’, ‘combination’, and ‘co-occurrence’. I make only a modest reference to the ‘construction’ in a similar way as I do for construction grammar even though the study clearly deals with constructional phenomena.

4.5.1. Background and elaboration

The widely accepted definition of ‘**construction**’ suggests that we have a construction “if one or more of its properties are not strictly predictable from knowledge of other constructions existing in the grammar” (Goldberg 1995: 4). More precisely, “C is a CONSTRUCTION iff$_{def}$ C is a form-meaning pair $<F_i, S_i>$ such that some aspect of F_i or some aspect of S_i is not strictly predictable from C’s component parts or from other previously established constructions” (Goldberg 1995: 4). These definitions are rather restrictive. A more flexible definition in identifying constructions is given by Goldberg (2006: 3) where constructions are “conventionalized pairings of form and function”. As such, we can posit constructions even if “they [patterns] are fully predictable as long as they occur with sufficient frequency” (Goldberg 2006: 5).

Even though it has been precisely defined[16], the term ‘construction’ may still appear as being too ambiguous to be useful in detecting constructions in a language. In general, though, researchers working in a constructional framework seem to have few difficulties in finding constructions in a language. This may be due to two reasons. First, it is possible that constructions are intuitively very easy to establish. Second, it might also be that researchers tend to focus on the prime examples of constructions rather than on the grey area beyond the prototypical instances. For example, it is easy to capture what the English ditransitive construction is, but it would be much more difficult to establish what constructions are used in English to express transfer. It is also relatively safe to posit a construction via some kind of replacement test. For instance, if a non-motion verb is used in a sentence which clearly describes motion (as in the famous napkin example: *Sam sneezed the napkin off the table* (Goldberg 1995: 29)), one can easily conclude that we are dealing with the motion construction, as the motion meaning must ultimately come from the construction.

[16] In fact, one could also say that these are only seemingly precise definitions of construction as the exact content of the main concepts ‘predictability’, ‘components’, and ‘previously established constructions’ is somewhat vague.

However, the determination about whether a combination of linguistic units is a construction may be a challenge if a motion verb is used in a context that itself also expresses motion. This may be even more difficult if the type of language allows a variety of morphosyntactic patterns all of which could apply for the intransitive motion construction. Moreover, if one tackles any kind of linguistic text, it would be comparatively difficult to establish all the constructions that are present, and to differentiate between constructions and non-constructions (which would then result in some sort of free combinations). In fact, if 'language *is* the inventory of its constructions' (Fried & Östman 2004a: 13), then we would not expect to find non-constructions at all.

Despite such problems, the constructional nature of a language is beyond doubt (see, for example, Fillmore 1982; Goldberg 1995; 2006; Croft 2001; Tomasello & Brooks 1999; Fried & Östman 2004b; Östman & Fried 2005). Generally speaking, the current study also investigates constructional phenomena as "A CONSTRUCTION may be defined as a general pattern of combination found in syntax" (Lockwood 2002: 3). In this study, significant co-occurrences of units in motion clauses are what the hypotheses suggest and the results present. Whether these co-occurrences can be analysed as constructions filling the criteria of the strict, classical definitions, is a matter of dispute. Consequently, in the analysis of language data, I generally avoid using the term 'construction'.

4.5.2. Selection and definition of constructional concepts: 'pattern', 'structure', 'combination', and 'co-occurrence'

As the term 'construction' may be confusing and bring along connotations that may not be needed, nor justified regarding this study, I mostly utilise the terms '**pattern**', '**structure**', '**combination**', and '**co-occurrence**' to refer to any kinds of findings with regard to an internal arrangement of motion clauses, whether on the semantic or formal level. These concepts are free from the rather restrictive content the term 'construction' might imply (see the discussion above) and allow the statistical assessment of the significance of any found combinations.

4.6. Attentional concepts

Many terms are circulating in the field of linguistics that, one way or another, are connected to attentional phenomena. This tendency can be seen as two sides of the same coin. On the one side, it suggests that attention has a major role to play in the structure of language. On the other side, the structure of language itself is convenient to describe with reference to the attentional concepts, such as 'attention' itself, 'salience', 'foregrounding' and 'backgrounding', 'prominence', 'profiling', 'trajector', and 'landmark'. In the current study, I use a selection of these terms in the formulation of the hypotheses and main assumptions, and in reporting and interpreting the results.

4.6.1. Background and elaboration

The terms ‘attention’, ‘salience’, ‘prominence’, ‘foreground’ and ‘background’, ‘figure’ and ‘ground’ are non-linguistic terms that have a bearing on the general cognitive abilities and mechanisms. These terms have been defined in cognitive psychology as follows. ‘**Attention**’ is “the process by which organisms select a subset of available information upon which to focus for enhanced processing … and integration” (Ward 2008: 1538). A more detailed definition of attention is as follows:

> *Sustained concentration on a specific stimulus, sensation, idea, thought, or activity, enabling one to use information-processing systems with limited capacity to handle vast amounts of information available from the sense organs and memory stores*
> (Colman 2015: 62)

‘**Salience**’ (also *saliency*) is the “protruding or jutting-out property of a physical structure; hence figuratively the prominence, conspicuousness, or striking quality of a stimulus” (Colman 2015: 668). ‘**Foreground**’ is a “front plane” of units one directs its attention to, while ‘**background**’ consists of “segmented perceptual units constituting a surface of items lying in a depth plane” (Mazza et al. 2005: 202). The ‘**figure**’ in Gestalt psychology is something that is “harder, more strongly structured, and more impressive… impressiveness depending upon the density of the energy within the area” (Koffka 1935: 189), while the ‘**ground**’ is the framework (Koffka 1935: 177), something that is “*behind* the small figure” (Koffka 1935: 178), and is more easily “disturbed or expelled from the actual field of vision than a figured part” (Koffka 1935: 190). Though similar, the concepts of foreground and background are not regarded identical to the figure and ground. This is because the background is argued to entail more than a non-differentiated ground; the background does entail details and different degrees of depths (Mazza et al. 2005: 202).

In cognitive linguistics, many of these and other similar concepts are widely used. However, they are rarely defined presumably due to the intuitively clear content. The term ‘**salience**’, often encountered in linguistic studies, exemplifies this tendency. It does seem to be a term that is easy to understand on intuitive grounds, but it is hardly ever described in more detail (for a rare exception, see Schmid 2007: 119–120).

The importance of attentional phenomena in language is, nevertheless, frequently stressed in linguistics, and forms the very core of the most prominent approaches of cognitive linguistics (see Miller & Johnson-Laird 1976; Langacker 1987: 114–116; Talmy 1996; 2000a: 255–405; and for a review of major concepts Croft & Cruse 2004: 46–54). In addition, the terms ‘Figure’ and ‘Ground’, ‘profile’ and ‘base’, ‘landmark’ and ‘trajector’ are used as linguistic terms reflecting attentional phenomena behind language. I give established definitions for these terms in the paragraphs below.

The '**Figure**' is "performed by the concept that needs anchoring" (Talmy 2000a: 311). It "is a substructure perceived as "standing out" from the remainder (the '**Ground**') and accorded special prominence as the pivotal entity around which the scene is organized and for which it provides a setting" (Langacker 1987: 120). With regard to motion, the Figure "is a moving or conceptually movable entity whose path, site, or orientation is conceived as a variable, the particular value of which is the relevant issue" (Talmy 2000a: 312). The Ground is, thus, the so-called "remainder" (Langacker 1987: 120) which is "performed by the concept that does the anchoring" (Talmy 2000a: 311). Taking motion, the Ground "is a reference entity, one that has a stationary setting relative to a reference frame, with respect to which the Figure's path, site or orientation is characterized" (Talmy 2000a: 312).

The '**profile**' is "The entity designated by a semantic structure. It is a substructure within the base that is obligatorily accessed, functions as the focal point within the objective scene, and achieves a special degree of prominence (resulting in one level of figure/ground organization)" (Langacker 1987: 489). The '**base**' is "The cognitive structure against which the designatum of a semantic structure is profiled; the ground with respect to which the designatum is the figure" (Langacker 1987: 486). The '**trajector**' is "the figure within a relational profile" (Langacker 1987: 217, 494). The '**landmark**' refers to "Other salient entities in a relational predication"[17] (Langacker 1987: 217, 231), and is "A salient substructure other than the trajector of a relational predication or the profile of a nominal predication" (Langacker 1987: 490).

Finally, '**salience**' can be tackled from two angles as explained by Schmid (2007: 119–120). Firstly, there is a 'cognitive salience', which is a linguistic salience. In this case, the term 'salience' refers to "the activation of concepts in actual speech events" (Schmid 2007: 119). This is elaborated as follows:

> *Irrespective of how a cognitive unit has been activated, it is said to be salient if it has been loaded, as it were, into current working memory and has thus become part of a person's center of attention. Since the use of concepts that are already activated requires minimal cognitive effort, a high degree of cognitive salience correlates with ease of activation and little or no processing cost. Currently inactive concepts, on the other hand, are nonsalient.*
>
> (Schmid 2007: 119)

Secondly, there is an 'ontological salience', which can be understood as a non-linguistic phenomenon that "is not related to temporary activation states of concepts but to more or less stable properties of entities in the world. The idea is that by virtue of their very nature, some entities are better qualified to attract our attention and are thus more *salient* in this sense" (Schmid 2007: 120).

[17] In Langacker's approach, the predication is understood as the "semantic pole of a linguistic expression" (1987: 491).

The idea behind the attentional concepts in the study of language is, thus, comparable to the concepts that are not strictly related to language. In the expression of any scene, some aspects are more important (salient, prominent) due to the nature of cognitive processing in general. Typically, the important aspects of the scene are expressed. This idea is also embedded in Talmy's (1996; 2000a: 255–309) approach to the windowing of attention, in that aspects that are expressed are given attention (i.e., they are windowed), whereas aspects that are not expressed do not capture attention (i.e., they are gapped). If the spatial settings of a motion are expressed, these expressions are treated as the windows of attention to these particular parts of the path (Talmy 2000a: 265–271).

4.6.2. Selection and definition of attentional concepts: 'attention', 'windowing', 'salience', 'foregrounding', and 'backgrounding'

Language featuring of attention-driven and attention-directing properties can be analysed by means of attentional concepts. A selection of these concepts is applied in the current study. More specifically, I utilise the concepts 'attention', 'windowing', 'foregrounding', and 'backgrounding' following the explications taken from cognitive psychology and from Talmy's (1996; 2000a: 255–309) approach to the windowing of attention. '**Attention**' is a non-linguistic term in that it refers to "the process by which organisms select a subset of available information upon which to focus for enhanced processing … and integration" (Ward 2008: 1538). The term '**windowing**' brings attention and language together in that it specifies that attention given aspects of a scene are windowed (i.e., given the nature of the current study, they are expressed) in a language. Simultaneously, the windowed aspects direct attention to important aspects of the scene. As such, these terms allow the comparisons of patterns of attention with patterns of motion clauses. I use the terms '**salience**', '**foregrounding**' and '**backgrounding**' when discussing the semantics of motion verbs. The semantics of verbs is often a matter of degrees of different semantic features. Semantic features that are strongly present in the meaning of a verb are salient or foregrounded, whereas those that are modestly present are less salient or backgrounded.

5. MATERIALS

The material consists of 9500 actual motion clauses in Estonian. It represents 95 frequent Estonian motion verbs each occurring in 100 actual motion clauses. The clauses with higher frequency verbs (N = 47) originate from the fiction subcorpus of the Balanced Corpus of Estonian[18]. The clauses with less frequent verbs (N = 48) originate from the newspaper subcorpora of the Estonian Reference Corpus[19]. The procedure of selecting the motion verbs and extracting the corpus data is described in the following sections.

5.1. Selection of motion verbs

In total, 95 motion verbs are studied in this thesis. They were selected using the following three-stage process. First, I created a list of all verbs regardless of their meaning, and based on the main monolingual dictionary, dictionary of Standard Estonian ÕS 2006 (Erelt et al. 2006; henceforth ÕS 2006). Then, I manually extracted motion verbs from all the verbs. Finally, I selected the motion verbs for analysis in this study on the basis of their general frequencies in the corpora.

5.1.1. Creation of the list of all verbs

Initially, a list of all verbs in Estonian was needed in order to start the process of selecting suitable motion verbs. As a source of the verbs, I used the main Estonian monolingual dictionary, the dictionary of Standard Estonian, which aims to represent contemporary standard written Estonian vocabulary (ÕS 2006: 5). From the electronic version of the dictionary[20], I extracted semi-automatically all verbs by using the indications of inflectional types in the dictionary.

Estonian is a language of rich morphology and verbal morphology includes both suffixing as well as various stem alternations (for a short overview of verbal morphology see Section 7.1). Based on these morphological features, verbs fall into different inflectional types. In the dictionary of Standard Estonian, each word has an indication about its inflectional type. Altogether, the dictionary lists 69 inflectional types (ÕS 2006: 17–26), in which verbs belong to 21 types (ÕS 2006: 24–26). The indications of these 21 types were the basis for extracting verbs from the online-version of ÕS 2006.

In total, there were approximately 7600 verbs in the dictionary of Standard Estonian. This number is an approximation because of the nature of the extraction

[18] Available at: http://www.cl.ut.ee/korpused/grammatikakorpus/.
[19] Available at: http://www.keeleveeb.ee/.
[20] Available at: http://www.eki.ee/dict/qs/ and http://www.keeleveeb.ee/.

method (some verbs belong to several inflectional types due to their parallel forms and were, hence, duplicated in the list) and the way verbs are presented in the dictionary (some verbs are collapsed into one entry).

5.1.2. Creation of the list of motion verbs

From the list of all verbs, I manually extracted all 506 motion verbs. Since there are no distinctive structural features that would help to identify motion verbs, manual extraction was necessary, and was based on the semantics of the verbs.

The only 'half-formal' criterion in the selection of motion verbs that I employed was a morphosyntactic one in that the verb had to be an intransitive one expressing non-causative motion. That is, I did not include verbs that are typically used as transitive (causative) ones (e.g., *lükkama* 'push' and *tõmbama* 'pull') onto the list of motion verbs. The clausal patterns of these verbs differ from that of non-causative ones, and cannot be analysed on similar grounds (see also Halliday 1967; Hopper & Thompson 1980; Næss 2007).

Naturally, motion verbs can have various clausal patterns, and some verbs can occur both in intransitive and transitive constructions. The verb *pöörama* 'turn' is a case in point as it can be used equally well as a transitive (e.g., *pööras lehte* [PART] '(s)he turned the sheet') or as an intransitive one (e.g., *pööras majja* [ILL] '(s)he turned into the house'). Such verbs that allow both transitive and intransitive constructions (e.g., *pöörama* 'turn') were included on the list of verbs. However, in the later extraction of corpus sentences, causative uses of these verbs were excluded. When the transitivity of a verb was difficult to establish, I relied on the two main monolingual dictionaries of Estonian, ÕS 2006 and the defining dictionary of Estonian (Langemets et al. 2009; henceforth EKSS) to clarify such borderline cases.

In addition, I disregarded on formal and semantic grounds some other motion verbs expressing non-causative motion. These are *ületama* 'cross', *läbima* 'go through', and *mööduma* 'pass'. These three verbs can be seen as trajectory verbs which have characteristic semantics in that they window the medial portion of the path (Taremaa 2013). More importantly, they possess distinctly different constructions than directional and manner of motion verbs. Namely, the verbs *ületama* 'cross' and *läbima* 'go through' do not express caused motion, but occur as transitive verbs; the landmark with these verbs is always marked as a grammatical object in Estonian (e.g., *ületas tee* [GEN] '(s)he crossed the road', *läbis metsa* [GEN/PART] '(s)he went through the forest'). The verb *mööduma* 'pass', on the other hand, is used in constructions where the landmark is inflected for elative (e.g., *möödus majast* [ELA] '(s)he passed the house'). In other words, these three motion verbs exhibit comparatively fixed constructions, whereas other motion verbs do not. Due to significantly different constructions, these three verbs could not have been analysed on similar grounds with other typical (intransitive) motion verbs in Estonian and were excluded from the study.

Thus, verbal semantics was the main basis of dividing verbs into motion and non-motion verbs. Needless to say, deciding upon a verb's meaning is not a trivial task. Moreover, it is almost impossible to rely only on the meaning of the verb itself without taking into consideration the typical contexts, both situational as well as sentential ones, where the verb is used. Although each lexical unit in a language exhibits some characteristic semantic features, it is nevertheless not used in isolation. As a consequence, and when deciding what a specific verb depicts, one is influenced simultaneously by the meaning of the verb itself, the constructions where this verb occurs, and the situations to which this verb or construction can refer to. Therefore, when extracting motion verbs expressing actual motion, I considered both the meaning of the verb and the typical contexts where it is used.

The semantic criterion in detecting motion verbs was that of actual motion. First, the possible mover whose motion a specific verb could express had to be a physical, visible entity. Second, the hypothetical, linguistically described environment where this possible mover could be found had to be some physical environment regardless of whether the possible mover changes its location in space or keeps its general location. In other words, verbs referring to both translational as well as self-contained motion were included.

5.1.2.1. Borderline cases of motion verbs

Clearly, when deciding on the semantic properties of words, several difficulties arise. Although, in most cases, I could rely on my intuitions as a native speaker of the language, I often had to consult monolingual dictionaries to establish which verbs could be identified as motion verbs. This was because the meaning of less frequent and less prototypical verbs, but also dialectical verbs (some of which the dictionary contains), can be unclear. To resolve this problem, I used a similar approach as Cardini (2008) in his study of Italian and English motion verbs. Namely, if the verb entry in the Estonian monolingual dictionaries, ÕS 2006 and EKSS (2009), contained information that it is used as a motion verb, then I considered the verb as a motion verb.

If, however, the meaning of the verb remained ambiguous, fuzzy, or somehow unclear in terms of its 'motionness', I disregarded this verb. But even in fuzziness there are degrees of it, so that some fuzzy verbs were, nevertheless, analysed as motion verbs, whereas others were not. When considering prototypical and less prototypical motion verbs, it is obvious that the boundaries between (less prototypical) motion verbs and other types of verbs is to some extent arbitrary.

There were some types of verbs which coalesce into the fictional periphery of motion verbs. Sound verbs (i.e., verbs expressing any kind of sounds such as *rääkima* 'talk', *helisema* 'ring', *kahisema* 'rustle', and *vihisema* 'whistle') epitomise this (see also Goldberg 1995: 62; Rohde 2001: 255–258). There are clearly some sound verbs which are not motion verbs, and are probably never used in any kind of actual motion constructions (e.g., *rääkima* ‘talk’). There are also verbs which express motion, and have presumably nothing to do with sound (e.g., *suunduma* ‘head’). However, there are also a number of verbs which express both sound and motion, and there can be a sound verb that can also express motion. In these cases, I relied on dictionaries; if the verb was either explained as expressing motion or illustrated by a motion sentence, then it was included in the study. This approach may not be reliable because the word entries reflect the opinions of the authors of the dictionaries. However, the unreliability of selecting such verbs based on dictionary definitions has no effect on this study as these verbs are used infrequently. Only motion verbs that are used frequently passed the latter selection process.

In addition to sound verbs, there are other types of verbs which are difficult to differentiate from motion verbs, such as various activity verbs (e.g., *write* and *rake*) and dance verbs (e.g., *waltz* and *twist*). For example, most physical activities involve motion, and verbs referring to such activities may be viewed as motion verbs. In fact, the term ‘activity’ is vague in itself as explicated in Section 4.2.1.2 in the context of motion activity. However, I disregarded verbs involving motion that are used only to accomplish the activities themselves. Here, the importance is on the activity itself; the concept of motion in itself is secondary and unimportant. Thus, I classified verbs, such as *riisuma* ‘rake’, *tikkima* ‘embroider’, and *kirjutama* ‘write’, as non-motion verbs. Similarly, I analysed dance verbs such as *tvistima* ‘twist’ as non-motion verbs. However, this is a highly debatable point as the nature of dancing has motion at the very heart of it.

I also excluded verbs of communication (e.g., *noogutama* ‘nod’ and *lehvitama* ‘wave’). These verbs do depict motion of some specific part of the body (in this case, the head and the hand respectively) of the potential mover, but motion as such is not of primary importance. What are of primary importance here are these communicative signals.

Overall, I extracted a total of 506 motion verbs. As the majority of the data was to be coded manually, it was deemed impractical to conduct a thorough corpus analyses on each of the verb. Furthermore, as many of the 506 verbs are used infrequently[21] and the available Estonian corpora are somewhat limited in size, collecting a sufficient sample with these verbs would have been virtually impossible. Thus, I only conduct a detailed analysis on 95 motion verbs in this thesis. In the following section, I explain the procedure I followed to select these verbs.

5.1.3. Selection of motion verbs

Taken together, 95 motion verbs expressing actual motion were chosen for the analysis of the thesis. I considered four methods for selection: (i) random choice,

[21] To illustrate, more than half of these verbs (N = 268) do not occur in the frequency list which is based on the Balanced Corpus of Estonian (the frequency list is available at: http://www.cl.ut.ee/ressursid/sagedused1/failid/lemma_kahanevas.txt).

(ii) selection based on the form-driven classification of motion verbs, (iii) selection based on the semantic classification of motion verbs, and (iv) selection based on the frequencies of verbs. From these possibilities, I chose the latter, frequency-based selection. I explain below the rationale for this decision.

Random choice may be a reliable tool in order to select a representative sample of verbs. However, this procedure would not guarantee that the verbs occurred sufficiently frequently. As mentioned earlier, many motion verbs occur in the data sources too infrequently for statistical analyses to be conducted on them. In addition, a random selection of motion verbs may not result in a truly representative sample. This is because it is highly debatable whether randomly selected verbs actually represent the whole group of motion verbs. Therefore, it was more logical that formal or semantic criteria had to be applied in order to narrow down the list of verbs.

Classification of motion verbs based on their formal structure (i.e., the structural properties of motion verbs themselves) would only be possible to some extent regarding the derivational composition of many motion verbs in Estonian (Kasik 2015: 108–182). However, derivation suffixes do not separate motion verbs into clear-cut categories, nor are all verbs derivational. For these reasons, I did not classify motion verbs into form-based categories.

The semantic classification of motion verbs also failed despite the fact that selection based on semantic classes would yield a good representation of different types of motion verbs. Dividing motion verbs into general categories, i.e., directional and manner of motion verbs, is achievable in most cases (see Section 5.1.1.1). However, it seemed almost impossible to divide verbs into more subtle categories based on just one person's intuitions.

This was mainly due to manner of motion verbs, which constitute 472 of the 506 motion verbs, being exceedingly complex in terms of their meaning. A manner of motion verb can lexicalise a number of manner features (Cardini 2008; Kopecka 2010; Slobin et al. 2014; see also Section 4.4.2) all of which could be taken as a basis for verb classification. As a result, there could be many possible classifications of manner of motion verbs depending on the manner feature taken as the separator. For instance, manner of motion verbs can be divided into groups based on the typical motion pattern of limbs, the speed of motion, the effort put into motion and so forth (for a detailed overview of manner features see Section 4.4). Moreover, as semantics of such motion verbs is inherently fuzzy, that is, various semantic fields blend into each other, deciding on a verb's most prominent meaning is comparatively difficult, and certainly not reliable if only based on one person's intuitions. Thus, prior classification of motion verbs into meaningful categories was unachievable.

As infrequent motion verbs could not be examined by the methods of corpus linguistics due to difficulties with material collection, and that a balanced selection of motion verbs on semantic criteria was highly complicated, I decided to choose verbs based on their general frequency. For this, I used the 'frequency list' which is based on the Balanced Corpus of Estonian[22]. The Balanced Corpus of Estonian contains a subcorpus of fiction, and this was the source of half of the data extraction.

Choosing high-frequency verbs represented in this frequency list had several benefits. Firstly, it yielded a sample of motion verbs that are a sufficiently representative selection of motion verbs. This is because they are the most commonly used verbs to express motion, at least according to the Balanced Corpus of Estonian. Secondly, as text corpora in Estonian and, in particular, fiction ones, are rather small in size (the fiction subcorpus of the Balanced Corpus of Estonian contains only five million words), corpus searches with frequent verbs maximised the possibility to collect a sufficient amount of data. However, no corpus and frequency list can ever totally represent the entire language (Glynn 2010: 11–12), and the use of specific verbs in an adequate manner. However, this frequency list is the most representative available, and was appropriate for this study.

Amongst the 506 verbs classified as motion verbs, only 238 occurred in the frequency list of the Balanced Corpus of Estonian containing 15 million words. In other words, more than half of the motion verbs appear nine or less times on the corpus[23]. Descriptive statistics (see Table 2) show that the frequency of these 238 verbs varies greatly in that the minimum frequency is 10 and the maximum is 48966. The distribution of frequency is highly skewed, suggesting a Zipf-curve typical for frequencies of words (Li 1992). It is also important to note that the median is 62. This means that half of the 238 verbs have a frequency lower than this.

Table 2. Descriptive statistics for frequencies of motion verbs as attested in the frequency list of words based on the Balanced Corpus of Estonian

Descriptive Statistic	Value
Mean	769.7
1st Quartile	29.0
Median	62.0
3rd Quartile	282.0
Standard Deviation	4038.4
Kurtosis	103.8
Skew	9.8
Minimum	10
Maximum	48966
N	238

[22] The frequency list is available at: http://www.cl.ut.ee/ressursid/sagedused1/failid/lemma_kahanevas.txt. The list is based on the Balanced Corpus of Estonian consisting of fiction, newspaper and science text subcorpora; 15 million words in total.

[23] The frequency list does not contain any words which occur less than 10 times in the Balanced Corpus of Estonian.

The frequency of motion verbs in the frequency list was, thus, the basis for the verb selection[24]. To start with, I chose the fourth quartile verbs (i.e., those with frequencies higher than 282, fourth quartile frequency 282 excluded; see Table 4 in Section 5.2.2) to constitute the body of this thesis. These verbs (N = 59) appeared to be slightly biased towards similar semantics as they mainly express rather Goal-oriented, smooth, and fast motion (see Table 4), and, as such, may exhibit somewhat similar clausal patterns. Verbs expressing slower and difficult motion have lower frequencies as can be seen in Table 4. Therefore, I expanded the sample of verbs by including all verbs starting from the median value (i.e., with frequencies higher than 62 occurrences, median frequency 62 excluded). In other words, half of the motion verbs (i.e., 118 verbs) occurring in the frequency list were initially included in the study. Consequently, in this thesis from now onwards, I refer to the first group of verbs (frequency > 282) as 'fourth quartile verbs', and to the second group of verbs (frequency > 62) as 'third quartile verbs'. As not all these 118 verbs occurred in the corpora sufficiently frequently, only 95 motion verbs out of the 118 expressing actual motion are analysed in the thesis. Given the difficulties of verb selection as described above, these 95 motion verbs represent all the motion verbs in Estonian as far as is practically possible.

5.2. Extraction of corpus data

In this section, I elaborate on the selection of data sources, and then give a detailed explanation of the procedure for motion clause extraction.

5.2.1. Selection of material sources

The aim of the thesis is to reveal the typical patterns of physical motion clauses in Estonian. Furthermore, I restricted the study to the written language only. I did not investigate the spoken language, because the spoken language corpus in Estonian is far too limited to cover a large number of motion verbs; many of which are of low frequency.

As for written language corpora in Estonian, there were many different genres to choose from, such as fiction, newspapers, science, new media, and other more specific ones. The data of the study represents texts of fiction and

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[24] It should be noted, though, that the frequency list for selecting motion verbs is based on the Balanced Corpus of Estonian. More importantly, it represents words regardless of their senses and usage contexts. This means that even though a motion verb can be listed as a high-frequency word, it may not occur in a sufficient number of actual motion contexts. That is, a verb may be used to refer to abstract, non-physical motion instead. The verb *kulgema* 'run, proceed' is a prime example. It is a comparatively frequent verb (836 occurrences), but expresses mainly fictive motion (e.g., *tee kulges läbi metsa* 'the path ran through the forest') and many other abstract domains of motion. Actual motion clauses are comparatively infrequent with this verb.

newspapers. I did not create my own corpus, as the available corpora were sufficient to reach my research goals. Two corpora were used: the subcorpus of Fiction in the Balanced Corpus of Estonian for queries with the fourth quartile verbs, and the newspaper corpora of the Estonian Reference Corpus for queries with the third quartile verbs.

I chose the fiction subcorpus for frequent verbs for two reasons. First, in fiction, it is more likely to find descriptions of real, visually detectable motion activities than in other genres where the language use is much more figurative. Second, many higher-frequency verbs have a tendency to be used more frequently in figurative expressions in newspaper texts than in fictional ones[25]. This would have made the data elicitation very time-consuming, as the selection of actual motion sentences would have to be done manually.

The main reason for selecting the newspaper corpora over the fiction corpus for less frequent verbs is that the available fiction corpus, being small in size (5 million words)[26], would have been too limited to attain a sufficient number of clauses with the third quartile motion verbs. The newspaper corpora contain 182 million words and are, thus, a much more appropriate source for lower-frequency verbs than the fiction one. Furthermore, lower frequency verbs are less often used in figurative contexts. This would facilitate the extraction of actual motion clauses from the newspaper corpora.

There are two main disadvantages of extracting the data from the two different sources. The first reason is that it can be difficult to account for factors that influence the possible clausal patterns that set the two groups of verbs apart. Whenever differences occur between the two sets of verbs, these differences may be caused by the frequency or by the genre. The second reason is that the use of motion verbs may be heterogeneous across two genres in terms of typical situational contexts. Presumably, due to the characteristic areas where motion verbs are used in newspapers (i.e., more frequently in sports reports), the use of motion verbs can be overly restricted to particular contexts. This, in turn, may affect the typical patterns of motion clauses in newspapers.

The overview of the corpora used in this thesis is provided in Table 3. The fiction corpus represents texts from 64 Estonian authors. As for newspapers, Postimees and Päevaleht are the main broadsheets in Estonia. (SL) Õhtuleht is a daily newspaper, and is also a tabloid. Eesti Ekspress and Maaleht are weekly newspapers with the former being an investigatory and the latter an agricultural newspaper. Valgamaalane and Lääne Elu have a much smaller circulation and are local newspapers.

[25] Based on personal observations.

[26] The Estonian Reference Corpus representing fiction contains only slightly more words (5.8 million words). The subcorpus of fiction in the Balanced Corpus of Estonian containing 5 million words is based on the latter.

Table 3. Sources of the corpus data[27]

Verbs	Corpora		Sizes of the subcorpora (million words)	Size of the corpus (million words)	Publishing years
Forth quartile verbs (verbs with frequencies 283–48966; N = 47)	The Balanced Corpus of Estonian, Subcorpus of Fiction	64 Estonian authors	0.0013 to 0.1703	5.0	Since 1990
Third quartile verbs (verbs with frequencies 63–282; N = 48)	Newspaper corpora from the Estonian Reference Corpus	Daily Päevaleht	87.9	182.3	1995–2007
		Daily Postimees	32.9		1995–2000
		Weekly Eesti Ekspress	7.5		1996–2001
		Daily (SL) Õhtuleht	45.5		1997–2007
		Weekly Maaleht	4.3		2001–2004
		Local newspaper Valgamaalane	2.5		2004–2008
		Local newspaper Lääne Elu	1.8		2000–2008

5.2.2. Extraction of motion clauses

From the corpora (see above), I extracted 100 actual motion clauses per motion verb. The only restriction was that the verb had to be used as a finite verb. For technical reasons, the sentences with the fourth quartile verbs (i.e., fiction data) are taken from the webpage of Research Group of Computational Linguistics (University of Tartu) [28]. The sentences with the third quartile verbs (i.e., the newspaper data) are taken from the dictionary portal Keeleveeb[29].

After extracting sentences from the corpora, I randomised them in a verb-based manner and took the first 100 actual motion sentences occurring in this randomised list. However, 22 verbs from the initial 118 verbs did not yield a sufficient number of actual motion clauses (i.e., 100 sentences) and, thus, were excluded from the study. In addition, the verb *rippuma* 'hang' was excluded as

27 The table is based on the information available at: http://www.cl.ut.ee/korpused/segakorpus/index.php?lang=en, http://www.cl.ut.ee/ressursid/sagedused1/failid/lemma_kahanevas.txt, http://www.cl.ut.ee/korpused/grammatikakorpus/ilukirjeldus.php?lang=en (accessed 12 January 2016).

28 Available at: http://www.cl.ut.ee/korpused/grammatikakorpus/.

29 Available at: www.keeleveeb.ee.

a posture, rather than a motion verb. As a result, 95 motion verbs from the 118 remained. The number of actual motion sentences was hence 9500. The list of the third and fourth quartile verbs, both included (indicated by bold) and excluded ones (indicated by grey), can be found in Table 4. In the procedure of data coding, only motion clauses were considered. That is, if complex sentences occurred, only the clauses that contained the motion verb were analysed, not the entire sentences. For this reason, and for the remainder of the thesis, I make reference to motion clauses only.

Table 4. Frequencies of the third and fourth quartile motion verbs. Verbs in bold are included in the study

Frequency group	Verb			Number of occurrences based on the frequency list[30]	100 actual motion clauses available	Corpora used
Fourth quartile verbs	(1)	***tulema***	**'come'**[32]	**48966**	**yes**	The Balanced Corpus of Estonian, Subcorpus of Fiction
	(2)	***minema***	**'go'**	**34760**	**yes**	
	(3)	***käima***	**'walk, go'**	**13680**	**yes**	
	(4)	***sõitma***	**'drive'**	**6659**	**yes**	
	(5)	***tõusma***	**'rise, ascend'**	**5639**	**yes**	
	(6)	***astuma***	**'step, tread'**	**5586**	**yes**	
	(7)	***liikuma***	**'move'**	**3808**	**yes**	
	(8)	***langema***	**'fall, come down'**	**3462**	**yes**	
	(9)	***pöörama***	**'turn'**	**2968**	**yes**	
	(10)	***jooksma***[31]	**'run'**	**2930**	**yes**	
	(11)	***lahkuma***	**'leave'**	**2919**	**yes**	
	(12)	*lähtuma*	'start from'	2687	no	
	(13)	***kukkuma***	**'fall'**	**2438**	**yes**	
	(14)	***saabuma***	**'arrive'**	**2321**	**yes**	
	(15)	***pöörduma***	**'turn'**	**2302**	**yes**	
	(16)	***keerama***	**'turn'**	**1945**	**yes**	
	(17)	***lendama***	**'fly'**	**1859**	**yes**	
	(18)	***vajuma***	**'sink'**	**1416**	**yes**	
	(19)	***kõndima***	**'walk'**	**1298**	**yes**	
	(20)	***kerkima***	**'rise'**	**1221**	**yes**	
	(21)	***ronima***	**'climb'**	**1159**	**yes**	
	(22)	***hüppama***	**'jump'**	**1151**	**yes**	
	(23)	***lähenema***	**'approach'**	**1022**	**yes**	
	(24)	***jalutama***	**'walk, stroll'**	**927**	**yes**	
	(25)	***väljuma***	**'exit'**	**861**	**yes**	
	(26)	***tormama***	**'rush, dash'**	**850**	**yes**	
	(27)	***tungima***	**'force, intrude'**	**844**	**yes**	
	(28)	*kulgema*	'run, proceed'	836	no	
	(29)	***voolama***	**'flow'**	**779**	**yes**	
	(30)	*rippuma*	'hang'	762	NA	
	(31)	***kiirustama***	**'hurry, rush'**	**757**	**yes**	
	(32)	***kihutama***	**'race, career'**	**740**	**yes**	

[30] The frequency list is available at: http://www.cl.ut.ee/ressursid/sagedused1/failid/lemma_kahanevas.txt.

[31] The Estonian verb *jooksma* 'run' can also mean 'flow' (e.g., *vesi jookseb* 'the water is running'). This meaning of 'flow' refers to actual motion. However, clauses containing this meaning are not included in the data due to their low occurrences.

[32] English translations are mainly taken from the Estonian-English dictionary (Mägi 2006).

Frequency group	Verb			Number of occurrences based on the frequency list[30]	100 actual motion clauses available	Corpora used
	(33)	***naasma***	**'return'**	**670**	**yes**	
	(34)	***libisema***	**'glide'**	**633**	**yes**	
	(35)	***ujuma***	**'swim'**	**630**	**yes**	
	(36)	***laskuma***	**'descend'**	**604**	**yes**	
	(37)	*kalduma*	'tilt, deviate'	595	no	
	(38)	***sisenema***	**'enter'**	**576**	**yes**	
	(39)	***kargama***	**'jump, spring'**	**572**	**yes**	
	(40)	***pugema***	**'creep, crawl'**	**562**	**yes**	
	(41)	*rändama*	'travel'	554	no	
	(42)	***värisema***	**'shake, tremble'**	**544**	**yes**	
	(43)	***suunduma***	**'head'**	**526**	**yes**	
	(44)	*taanduma*	'withdraw'	471	no	
	(45)	*kõikuma*	'rock, swing'	420	no	
	(46)	*siirduma*	'migrate'	403	no	
	(47)	***hiilima***	**'sneak'**	**400**	**yes**	
	(48)	***võpatama***	**'jump, wince'**	**394**	**yes**	
	(49)	***ruttama***	**'hurry, rush'**	**387**	**yes**	
	(50)	*kallama*	'pour; turn'	386	no	
	(51)	*keerutama*	'twirl'	371	no	
	(52)	***sööstma***	**'shoot, dart'**	**352**	**yes**	
	(53)	***veerema***	**'roll'**	**349**	**yes**	
	(54)	***sammuma***	**'walk, step'**	**340**	**yes**	
	(55)	*nihkuma*	'shift'	330	no	
	(56)	***pudenema***	**'fall off, crumble'**	**319**	**yes**	
	(57)	***varisema***	**'cave, crumble'**	**319**	**yes**	
	(58)	*vehkima*	'brandish'	296	no	
	(59)	***eemalduma***	**'move away'**	**283**	**yes**	
Third quartile verbs	(60)	***marssima***	**'march'**	**282**	**yes**	Newspaper corpora from the Estonian Reference Corpus
	(61)	***valguma***	**'pour'**	**282**	**yes**	
	(62)	***keerlema***	**'whirl, swirl'**	**266**	**yes**	
	(63)	***tõttama***	**'hurry'**	**262**	**yes**	
	(64)	***hõljuma***	**'float, hover'**	**255**	**yes**	
	(65)	***rabelema***	**'flounder, flutter'**	**233**	**yes**	
	(66)	***trügima***	**'push, scramble'**	**230**	**yes**	
	(67)	***roomama***	**'crawl'**	**210**	**yes**	
	(68)	***paiskuma***	**'be thrown, shoot'**	**209**	**yes**	
	(69)	***hulkuma***	**'wander'**	**207**	**yes**	
	(70)	***sukelduma***	**'dive'**	**197**	**yes**	
	(71)	***lipsama***	**'slip, sneak'**	**192**	**yes**	
	(72)	***eralduma***	**'detach, separate'**	**185**	**yes**	
	(73)	***lehvima***	**'flow, flutter'**	**175**	**yes**	
	(74)	***purskama***	**'erupt, spurt'**	**174**	**yes**	
	(75)	***viskuma***	**'fling, tumble'**	**165**	**yes**	
	(76)	***tiirlema***	**'circle, spin'**	**155**	**yes**	
	(77)	***lonkima***	**'stroll, saunter'**	**151**	**yes**	
	(78)	***lippama***	**'scamper'**	**151**	**yes**	
	(79)	*punuma*	'scurry'	139	no	
	(80)	***ratsutama***	**'ride, gallop'**	**133**	**yes**	
	(81)	***pöörlema***	**'revolve'**	**128**	**yes**	
	(82)	***loksuma***	**'splash, spill'**	**124**	**yes**	
	(83)	***tuiskama***	**'drift, sweep'**	**117**	**yes**	
	(84)	***põikama***	**'dodge, swerve'**	**117**	**yes**	
	(85)	***tiirutama***	**'spin, twirl'**	**116**	**yes**	
	(86)	*kaugenema*	'recede'	112	no	
	(87)	***väntama***	**'pedal'**	**112**	**yes**	
	(88)	***lonkama***	**'limp'**	**109**	**yes**	

Frequency group	Verb			Number of occurrences based on the frequency list[30]	100 actual motion clauses available	Corpora used
	(89)	***kolama***	**‘loaf, loiter’**	**103**	**yes**	
	(90)	***komberdama***	**‘stumble, hobble’**	**101**	**yes**	
	(91)	***suusatama***	**‘ski’**	**101**	**yes**	
	(92)	***hüplema***	**‘bob, bobble’**	**100**	**yes**	
	(93)	***tammuma***	**‘stamp, tread’**	**100**	**yes**	
	(94)	***rühkima***	**‘forge, plod’**	**96**	**yes**	
	(95)	*lainetama*	‘surge, wave’	96	no	
	(96)	*lükkuma*	‘shift, budge’	95	no	
	(97)	*ringlema*	‘circle’	95	no	
	(98)	***tõmblema***	**‘twitch’**	**91**	**yes**	
	(99)	***sõudma***	**‘row’**	**91**	**yes**	
	(100)	***prantsatama***	**‘fall with a crash’**	**84**	**yes**	
	(101)	***liuglema***	**‘slide’**	**82**	**yes**	
	(102)	***uitama***	**‘stroll’**	**82**	**yes**	
	(103)	*vankuma*	‘waggle’	80	no	
	(104)	***õõtsuma***	**‘sway’**	**78**	**yes**	
	(105)	***koperdama***	**‘blunder’**	**73**	**yes**	
	(106)	***kiikuma***	**‘swing’**	**73**	**yes**	
	(107)	***nihelema***	**‘fidget’**	**71**	**yes**	
	(108)	*värelema*	‘flicker, quiver’	71	no	
	(109)	*lenduma*	‘volatilise’	71	no	
	(110)	*käänama*	‘turn’	69	no	
	(111)	*vappuma*	‘shake’	69	no	
	(112)	***rappuma***	**‘bump’**	**69**	**yes**	
	(113)	***purjetama***	**‘sail’**	**67**	**yes**	
	(114)	***tatsama***	**‘toddle’**	**66**	**yes**	
	(115)	***vihisema***	**‘swish, whizz’**	**66**	**yes**	
	(116)	***ukerdama***	**‘plod’**	**66**	**yes**	
	(117)	*looklema*	‘wind’	65	no	
	(118)	***sibama***	**‘scurry’**	**64**	**yes**	

5.2.2.1. Borderline cases of actual motion clauses

When extracting motion clauses, the aim was to select clauses where some actual, visibly detectable motion was depicted. To put it differently, the described mover had to be some concrete entity that was described as changing its position or orientation in the spatial environment. Both translational as well as self-contained motion expressions were included.

Motion verbs can be used to describe various kinds of concrete as well as abstract situations. Some verbs have a strong tendency of being used in many ways and are therefore highly polysemeous (e.g., *minema* ‘go’ and *käima* ‘walk, go’). Other verbs, however, can only be used in limited contexts (e.g., *suusatama* ‘ski’). Although the wide range of senses or usage contexts that motion verbs exhibit would be of research interest, the current study focuses only on actual motion.

It is not always possible to establish which clauses depict actual motion and which could be conceived as somewhat figurative. These difficulties manifest themselves mainly in four levels as outlined in the following discussion.

(i) The expressed mover is not concrete enough.

Whereas both a bird and time can fly, the expression of the bird is an instance of actual, and time of abstract motion. Consequently, I limited the possible mover to be only a physical, visible entity. Nevertheless, there were some interim cases, such as liquids, molecules, and other small non-visible particles as well as air, wind etc. From these, I included descriptions of liquid movers (e.g., tears, tap water, and waves) in the study because their movement is visibly perceivable. As for small particles one cannot see (e.g., molecules and electrons), such motion clauses were excluded. In addition, I also omitted expressions of the movement of the air and the movements of small particles in the air as they can refer to both visible as well as invisible motion.

(ii) The environment where motion is expressed to occur is not spatial or at least not in its physical sense.

If the whole spatial environment of expressed motion was not concrete, but to some degree abstract, I analysed the clauses as non-actual motion ones. This concerned also clauses where the mover was expressed as a physical entity, and the verb was used as if it referred to physical motion. That is, the phrase *kõndis läbi unenäo* '(s)he walked through his/her dreams' would have been disregarded because one can walk through his/her dreams, but no physical motion occurs. The only exceptions of this criterion were the expressions of time which simultaneously imply the spatial settings of motion. This can be illustrated by the clause *jooksis läbi külma novembriöö* '(s)he ran through the cold night of November' which refers to the time when the motion occurs. Simultaneously, it creates a spatial image of the space where the mover is located. Such time expressions, rarely occurred in the corpus material of the study, were later tagged as if they were spatial expressions.

(iii) The motion verb is not used to refer to actual motion.

Descriptions where the verb was not used in its physical meaning were excluded. This means that the verb would not refer to physical motion even though the mover and/or spatial circumstances may be physical and literally expressed. To exemplify this, the verb *tammuma* 'stamp, tread' may refer to situations where no progress, either spatial or mental, is achieved. Naturally, it is not possible to have strict rules on how to differentiate between concrete and somewhat abstract uses of verbs. This means that it is often a matter of intuition in deciding upon the abstractness of the verb uses. As such, and being aware of the non-scientific nature of this kind of procedure, I followed my intuition as a native speaker in classifying verbs as being either concrete or abstract in their use.

(iv) The general meaning of the motion description does not refer to actual motion.

This concerns various constructions, including instances of fictive motion. In principle, this means that I omitted all descriptions where the actual mover did not coincide with the thing expressed as a mover. For instance, in *tee läks Tartusse* ‘the road went to Tartu’ the static road is expressed as if it was moving. In *linn lähenes meile* ‘the city came closer to us’, the actual movers are expressed as static, whereas the city is expressed as a moving entity. In the same vein, I excluded descriptions of the sun as in *päike vajus metsa taha* ‘the sun sank behind the forest’.

In addition to these semantic criteria, I also applied some formal ones. Namely, I excluded the serial verb constructions where a motion verb was used as one of the verbs. In such constructions in Estonian, two or more finite-form verbs are combined (e.g., *lähen käin poes* ‘I’m going to the store’ (Lit. ‘I go I walk in the store’)). Such serial verb constructions exhibit different properties to the ones with one finite verb (Tragel 2017) which does not allow the analysis of these constructions on a similar basis to constructions with one finite verb.

All descriptions written in a dialect were also excluded. Slang uses did not occur, but would have been disregarded on the same grounds. In addition, when the corpus sentence was not sufficient to determine whether actual motion is expressed or not, it was excluded. It was only deemed necessary to conduct extra corpus searches to understand the precise meaning of a particular expression on a few occasions.

All in all, the decision on the meaning of motion clauses was done separately for each sentence and on a clause basis. In the final coding of motion clauses, only the clause where the finite form of a particular motion verb occurs is analysed. Altogether, the thesis represents 95 Estonian motion verbs, and each is used in 100 clauses that depict actual motion. Thus, the total number of analysed motion clauses is 9500. Due to the careful data selection, these clauses provide the best conceivable representation of the expression of motion in Estonian fiction and newspaper texts.

6. METHOD

The thesis applies various statistical techniques to examine the linguistic corpus material. As a prerequisite, corpus clauses are tagged for a number of features (i.e., variables) to allow automatic quantification. This tagging is conducted using Excel worksheet where each line represents one clause and each column a variable. All the variables have specific values and these values are assigned to a particular clause by entering this value into a relevant cell in this column. Such annotated data can then be used as an input for statistical analyses. This methodology is widely used in linguistics to operationalise language (see, for example, Geeraerts et al. 1994; Gries 2003; Divjak & Gries 2006; Bresnan et al. 2007; Glynn 2010; Klavan 2012). For the statistical analyses of the current study, I make use of the open source statistical environment RStudio (RStudio Team 2015).

6.1. Coding schema

The variables annotated with regard to motion clauses fall into five general groups: (i) variables for the general information about each clause, (ii) main variables for the semantics of motion verbs, (iii) variables for the semantics of other expressions in the clause, (iv) variables for morphosyntactic features of the other expressions in the clause, and (v) variables of minor importance. In the following overview, only variables primarily related to the hypotheses (i.e., variables (ii), (iii), and (v)) are discussed. It should be noted that morphosyntactic variables (iv) are tagged with respect to spatial and manner variables to characterise these semantic variables from a formal perspective (see Sections 8.2.2 and 8.3). A detailed overview of these formal variables would not converge with the main aims of the study and, thus, is not provided in this section.

6.1.1. Variables of verb-related features

Motion verbs feature a number of semantic characteristics. Distinguishing between these characteristics is a challenge, and has often an arbitrary nature. This is because many motion verbs, particularly manner of motion verbs (see Section 4.4), may be semantically complex. Even though it is difficult to operationalise in a very precise manner, it is still possible to establish the general semantic features of motion verbs.

There are four general semantic variables that each motion verb is tagged for: the general semantic type (variable labelled as VerbType), the type of motion (MotionType), the general direction of motion (HorVert), and the speed of motion (VerbSpeed). These are semantic features that motion verbs possess (although the possible usage contexts of the verbs clearly influence the assignment of such features to these verbs as discussed in Section 4.2.1.1). The following sections explicate the content of these categories. The analyses of the 95 motion verbs as a direct consequence of these features are in Section 8.1.

6.1.1.1. Verb

Values: *the individual motion verbs*

This variable represents the 95 motion verbs (for the full list of the verbs see Table 4 in 5.2.2). As the verbs that are included in the study are discussed in Section 5, this variable is not further explicated here.

6.1.1.2. VerbType

Values:	SourceVerb	= source verb
	GoalVerb	= goal verb
	ManMotVerb	= manner of motion verb
	NeutralVerb	= neutral verb

Motion verbs are commonly divided into directional verbs (also known as path verbs) and manner of motion verbs as discussed in Sections 3.2.3.2, 4.3.1.2, and 4.4.2. The same general approach is taken here to monitor any possible differences between directional (e.g., *sisenema* ‘enter’) and manner of motion verbs (e.g., *jooksma* ‘run’). I define ‘directional verbs’ as verbs that express mainly spatial, and ‘manner of motion verbs’ as verbs that express primarily manner information about motion (see also Sections 4.3 and 4.4). However, I do not hold the view that directional and manner of motion verbs have a complementary relationship as implied in Talmy’s typology (1985; 2000b) and advocated, for example, by Levin and Rappaport Hovav (2010; 2013). Instead and as discussed in Sections 3.2.3.3 and 4.3, I suggest that all manner of motion verbs have some content of directionality, albeit often backgrounded. Similarly, directional verbs can be attributed manner features, if only implicitly.

As directional verbs, in turn, are predicted to behave differently when they express either the origin or the destination of motion, they are further divided into source and goal verbs. ‘**Source verbs**’ (e.g., *väljuma* ‘exit’) are motion verbs that specify the starting point of motion. ‘**Goal verbs**’ (e.g., *sisenema* ‘enter’) are verbs that depict the destination of motion. In addition, I consider the verbs *minema* ‘go’ and *tulema* ‘come’ as goal verbs, and not as neutral verbs (Özçalışkan & Slobin 2000; Stefanowitsch & Rohde 2004). I define ‘**manner of motion verbs**’ on the basis of several semantic features discussed in Section 4.4.4. The standard definition of manner of motion verbs is that these verbs express *how* the mover moves during motion (e.g., *jooksma* ‘run’, *veerema* ‘roll’). No prior distinction between different types of manner of motion verbs is made due to their semantic complexity (see Section 4.4). The hyperonym of motion verbs – namely, *liikuma* ‘move’ – is tagged as a ‘**neutral verb**’ as it can be regarded as a verb that does not entail specific information about space or manner (see also Cifuentes Férez 2010: 242, 247).

6.1.1.3. MotionType

Values:	SelfContMotion	= verb of self-contained motion
	TranslMotion	= verb of translational motion
	BothMotions	= verb of both self-contained and translational motion

A motion verb can depict motion when the mover keeps its general location or changes its position in space. Following Talmy (2000b: 25–26), I call the former type of motion as self-contained and the latter as translational motion. Although motion verbs can be divided into those that express either self-contained or translational motion, many of these can be used to express both. Thus, three levels of motion type are coded. Motion verbs primarily depicting motion in one place are tagged for '**self-contained motion**' (e.g., *värisema* 'shake, tremble'), verbs depicting the change of location for '**translational motion**' (e.g., *jooksma* 'run'), and verbs referring to both self-contained and translational motion for '**both motions**' (e.g., *hüppama* 'jump'). Assigning these labels is not problem-free as acknowledged in Section 4.2.1.1. However, this information is essential when conducting statistical analyses and interpreting clausal patterns of motion verbs.

6.1.1.4. HorVert

Values:	HorVerb	= verb of horizontal motion
	VertVerb	= verb of vertical motion
	HorVertVerb	= verb of both horizontal and vertical motion interpretation; verb of directionally ambiguous motion

As explained in Section 3.3.3.2, motion being expressed as being horizontal and/or vertical has an influence on at least the aspectual properties of motion clauses. Consequently, horizontal and vertical direction are annotated with regard to motion verbs. Again, in principle, no discrete categories can be postulated and an interim category is introduced for verbs that exhibit both horizontal and vertical, or directionally ambiguous motion features (e.g., *hüppama* 'jump'). In addition, verbs expressing self-contained motion and many verbs expressing both motions are coded as 'HorVertVerb' with respect to this variable. Taken together, the variable has three levels: '**HorVerb**' for verbs expressing mainly motion along the horizontal or unspecified axis (e.g., *kõndima* 'walk', *minema* 'go'), '**VertVerb**' for verbs expressing dominantly motion along the vertical axis (e.g., *kukkuma* 'fall', *kerkima* 'rise'), and '**HorVertVerb**' for verbs expressing motion along both axis (e.g., *hüppama* 'jump', *ronima* 'climb'). The latter label is also assigned to verbs that depict no distinct direction at all (e.g., *värisema* 'shake, tremble').

6.1.1.5. VerbSpeed

Values: *standardised numeric values*

Any physical motion is definable via spatial and temporal characteristics. Putting these concepts together, a concept of speed emerges. As all verbs in the study express physical motion, they comprise information about the speed of motion they depict which, in turn, might have an influence on how space is described in motion clauses. For instance, if a verb that expresses fast motion combines with spatial expressions, it may have a stronger tendency to combine with Goal expressions (e.g., *tormas majja* '(s)he dashed into the house') than a verb that expresses slow motion (e.g., *uitas majja* '(s)he strolled into the house'). After all, why move slowly when reaching the destination is the objective.

Additionally, the speed of motion expressed by a verb may allow us to account for the semantic diversity of manner of motion verbs. As explained in Sections 4.4 and 5.1, this diversity is otherwise highly difficult to operationalise. However, most manner features could presumably be accessed via speed information. For example, difficult, laborious, non-linear motion implies slow motion (e.g., *komberdama* 'stumble, hobble'), whereas easy, effortless, comparatively straight motion implies fast motion (e.g., *lippama* 'scamper').

The semantic features of motion verbs introduced so far (i.e., VerbType, MotionType, and HorVert) are annotated on an intuitive basis. I made this kind of annotation for practical reasons as one cannot have all the variables tagged on empirical grounds, particularly within such a large data set. However, the semantic feature of speed of motion (i.e., VerbSpeed) could not have been annotated based on one person's intuitions. This is because implicit knowledge about the semantics of motion verbs had to be accessed, and for that, my intuition was deemed insufficient.

Thus, I conducted an experiment with Kairi Kreegipuu to collect the speed ratings of motion verbs. The participants ($N = 178$) were asked to indicate the speed of motion expressed by a sole motion verb. Each verb was presented separately on a computer screen. Below the verb, a continuous rating scale was given on the screen. To rate the speed of motion as expressed by a verb, participants were asked to mark the speed on the continuous scale. The scale ranged from 'very slow' (presented as the left extreme of the scale) to 'very fast' (presented as the right extreme of the scale). Unknown to the participants, 'very slow' corresponded to 0 and 'very fast' to 100 (i.e., the scale ranged between 0 to 100). The verbs tested in the experiment coincided with the ones of the current study. I standardised the evaluations of speed by participants ($m = 0$, $sd = 1$). After that, the mean values of standardised evaluations were calculated for each motion verb. These mean values are used in this study as the indications of motion speed, and vary from −1.34 (very slow) to 1.68 (very fast motion; see Section 8.1.4 for the main results of the experiment).

For clarity or computational reasons, the continuous variable VerbSpeed is replaced with the binned categorical variable **BinnedSpeed** in several analyses in Sections 9.1.4, 9.2.1, and 9.4.4. This categorical variable was obtained by clustering the speed ratings into three groups of verbs. For the clustering, I used K-means clustering technique, which allows the group items to be based on the natural breaks of the continuous variable. The resulting variable BinnedSpeed has three levels: 'slow' (verbs of slow motion), 'medium' (verbs of medium motion), and 'fast' (verbs of fast motion).

6.1.2. Variables of spatial and manner expressions

In the previous sections, I discussed the verb semantic variables. In the following sections, I present the variables that correspond to other important expressions in motion clauses that capture spatial and manner information.

6.1.2.1. Spatial variables

With regard to actual motion, spatial information is essential. In this respect, three spatial categories are typically discussed in the literature: Source, Trajectory/Path, and Goal. Here, I take a much more detailed approach in order to conduct a much deeper analysis. Six spatial variables are coded: Source, FromDirection, Location, Trajectory, Direction, and Goal. Each clause is tagged for either 'containing' or 'not containing' locative expressions of these categories. As several expressions of the same spatial category may occur within the same clause, values indicating two or three instantiations are also coded (i.e., '2yes' and '3yes'). However, in the later stages of data analysis presented in the results' sections, these labels of multiple expressions are recoded as 'yes' values, turning the variables into binary ones. That is, a motion clause either contains or does not contain a spatial expression of a given category, captured by the labels 'yes' and 'no' respectively. For example, clauses that contain an expression that fulfils the semantic criteria given by the definition of Source carry the label 'yes' for the respective variable (e.g., *ta väljus majast* '(s)he exited the house'), whereas those not containing such expressions have the label 'no' (e.g., *ta väljus* '(s)he exited').

Each spatial variable has also a counterpart variable specifying the formal features of a particular spatial expression. These morphosyntactic variables are not introduced here. The overview of the main formal manifestations of spatial categories in Estonian can be found in Section 7.2. The description of the data in terms of the formal features of spatial categories is presented in Section 8.2 to provide a more detailed characterisation of the categories themselves. I discuss each of the six spatial categories one by one. The categories Source and FromDirection correspond to the initial, Location and Trajectory to the medial, and Direction and Goal to the final portion of the path.

6.1.2.1.1. Source

Values: no = Source expression absent from a motion clause
yes = Source expression present in a motion clause

Source stands for expressions which describe the place where motion begins (e.g., *ta väljus majast* '(s)he exited the house'). This kind of definition is very common in linguistics and indicates the comparatively homogeneous nature of the category. As an example, Source has been defined as "the place from which something moves" (Fillmore 1971: 376) or "the object from which motion proceeds" (Jackendoff 1987: 378; 1992: 46). It has also been described as the "origin of the motion" (Frawley 1992: 172, 173), "point of origin of displacement" (Frawley 1992: 220), or "end-of-path location/state of the Figure" (Aske 1989: 6). To put it simply, Source is an "initial location" (Slobin 2005: 4). Similarly as with FromDirection (see below), Source is understood here to refer to the initial portion of the path.

6.1.2.1.2. FromDirection

Values: no = FromDirection expression absent from a motion clause
yes = FromDirection expression present in a motion clause

FromDirection is defined here as the direction from which motion proceeds (e.g., *tuli maja poolt* '(s)he came from the direction of the house'). It is similar to Source in referring to the initial portion of the path, but is different in indicating not only the departure place, but also the direction of it. Furthermore, the departure place may be unknown or unimportant to know, while only the movement away from something is expressed. The category, FromDirection, is rarely distinguished in linguistic studies (for a rare exception, see Jackendoff 1983: 165). In the current study, at least in the stage of annotating the data, the distinction is made similarly to the categories, Direction and Goal (see below).

6.1.2.1.3. Location

Values: no = Location expression absent from a motion clause
yes = Location expression present in a motion clause

Location is meant to cover expressions referring to a general area or a concrete place where motion is carried out (e.g., *jooksis õues* '(s)he ran in the garden'). This understanding is based on the studies where Location has been explained as a category "which identifies location or spatial orientation of the state or action identified by the verb" (Fillmore 1968: 25; 2003: 49). It has also been defined as a "thematic relation associated with the NP expressing location, in a sentence with a verb of location" (Jackendoff 1972: 31), "the 'location' (i.e., the path or one-dimensional region) in which the activity took place" (Aske 1989: 6), "the *fixed site* of a motion event" (including the medium) (Frawley 1992: 174), and "the fixed spatial organization of a situation" (Frawley

1992: 220). As such, and in the current study, Location is understood to capture the expressions of the medium or surroundings of having a static, and not a dynamic meaning (compare, for example, *jooksis* *vees* [Location] '(s)he ran in the water' with *jooksis* *läbi vee* [Trajectory] '(s)he ran through the water'). Together with Trajectory, Location refers to the medial portion of the path.

There are two types of location expressions that are analysed as instantiations of a single category: the general or scene setting location where the motion is conducted (e.g., *jooksis* *õues* '(s)he ran in the garden'), and the relative location to something else in the case where the location of the mover is defined by some other participant or smaller entity not acting as a general location of motion (e.g., *jooksis* *minu järel* '(s)he ran behind me'). In other words, no distinction is made between the so-called outer (covering the location of the whole event) and inner location/locative (corresponding more narrowly to the location of the mover) (see also Starosta 1978; Andrews 1985: 69–70; Brunson 1993).

6.1.2.1.4. Trajectory

Values:	no	= Trajectory expression absent from a motion clause
	yes	= Trajectory expression present in a motion clause

Trajectory is the area in which the mover covers when moving from one spatial point to the other (e.g., *jooksis* *mööda teed* '(s)he ran along the road'). In the literature, the category has also been called path (Johnson 1987; 1989; Lakoff 1989; Oakley 2007), route (Jackendoff 1987; Bohnemeyer et al. 2007; Zlatev et al. 2010; Pajusalu et al. 2013), journey (Slobin 1996), and medium (Slobin 1996; 2005). Often, Trajectory is subsumed under the category Path and no difference is made between the two (Talmy 1985; 2000b). For the sake of clarity, I use the term 'Trajectory' to refer to this spatial category. I only use 'Path' with a capital letter when discussing the components of Talmy's (2000b) motion event, and 'path' with a small letter when discussing the windowing of attention (Talmy 1996; 2000a) or the segmentation of the 'path' (see also Slobin 2004: 17).

Importantly, Trajectory, together with Location, is considered here to refer to the medial portion of the path. The expressions of the medium are taken as those of Trajectory when being dynamic (see also Location above). Typically, Trajectory (or however named) is characterised as something "lying between source and goal" (Slobin 1996: 202). It has also been described as the "trajectory of theme" (Frawley 1992: 175), or "the 'location' (i.e., the path or one-dimensional region) in which the activity took place" (Aske 1989: 6). These definitions are in concordance with the definition of the Trajectory as pursued here (see above). The definition of the Path in the motion event model would also define Trajectory: "the path followed or site occupied by the Figure object with respect to the Ground object" (Talmy 2000b: 25).

6.1.2.1.5. Direction

Values: no = Direction expression absent from a motion clause
yes = Direction expression present in a motion clause

Direction is a category that is comprised of expressions depicting motion towards something when the destination place or reaching it may be unknown or unimportant to know (e.g., *jooksis edasi* '(s)he ran on', *jooksis maja poole* '(s)he ran towards the house'). Typically, Direction defined in this way is not distinguished from Goal. This is presumably because both of them refer to the final portion of the path or, if distinguished, it may be understood in terms of *Directions* and would cover both FromDirection and Direction. In the case of Directions, "the reference object or place does not fall on the path, but would if the path were extended some unspecified distance" (Jackendoff 1983: 165). In the current study, the two are differentiated in that FromDirection refers to the initial, and Direction to the final portion of the path.

6.1.2.1.6. Goal

Values: no = Goal expression absent from a motion clause
yes = Goal expression present in a motion clause

Goal stands for expressions that depict the place where motion ends (e.g., *jooksis majja* '(s)he ran into the house'). This definition is similar to those given in the literature. For instance, Goal has been described as the place or object "to which something moves" (Fillmore 1971: 376), "to which something is directed" (Fillmore 2003: 151), or "to which motion proceeds" (Jackendoff 1987: 378; 1992: 47). It has also been explicated as the "destination of the motion" (Frawley 1992: 172, 173), "end-of-path location/state of the Figure" (Aske 1989: 6), or simply "final location" (Slobin 2005: 4). Together with Direction, Goal refers to the final portion of the path.

6.1.2.2. MannerInstrument

Values: no = manner expression absent from a motion clause
yes = manner expression present in a motion clause

Exploiting the notorious *how*-definition, the variable MannerInstrument[33] can be described as a variable that covers expressions that specify how motion is conducted. More specifically, a manner expression is an expression which depicts at least one of the following features: main body movements (e.g., *jalgsi* 'on foot'), accompanying body-movements (e.g., *longates* 'limping'), position or posture of the mover (e.g., *neljakäpuli* 'crawling'), physical condition of the

[33] For clarity reasons, and because the manner feature of instrument is also discussed separately from the category of manner in some analyses (see Sections 8.3.2 and 9.2.1), the variable is labelled as 'MannerInstrument'.

mover (e.g., *purjuspäi* 'drunkenly'), trajectory of the mover (e.g., *otse* 'directly'), medium (e.g., *ujudes* 'swimming'), instrument or vehicle (e.g., *rattaga* 'by bike'), sound (e.g., *vaikselt* 'quietly'), speed (e.g., *aeglaselt* 'slowly'), energy or force (e.g., *energiliselt* 'energetically', *hooga* 'at a dash'), weight (e.g., *raske sammuga* 'at a heavy pace'), effort (e.g., *kergelt* 'lightly'), continuity (e.g., *voolavalt* 'flowingly'), harmony (e.g., *väärikalt* 'with dignity'), steadiness (e.g., *ühtlase sammuga* 'at a steady pace'), rhythm (e.g., *rütmiliste liigutustega* 'with rhythmic movements'), appearance of the mover (e.g., *tähtsa näoga* 'with a proud face'), emotional state or attitude of the mover (e.g., *rõõmsalt* 'happily').[34] The expression of these and some borderline features are discussed at length in Sections 4.4 and 8.3.

6.1.3. Other variables

If only briefly, the study addresses some other variables in addition to the main variables introduced so far. These are the variables of morphosyntactic features of spatial and manner expressions, the variable for verbal particles, the other semantic variables, and the variables of meta-information. The morphosyntactic features are not discussed here. The overview of the data with respect to these formal features can be found in Section 8. Other variables of semantics and meta-information are explicated below and examined in Section 9.3. The variable for directional verbal particles (labelled as '**DirVerbParticle**') stands for verbal particles (e.g. *kõndis* <u>*tagasi*</u> '(s)he walked <u>back</u>'), and is analysed in the frame of the expression of manner information in Section 9.2.2.

Variables that stand for other semantic units of motion clauses are as follows: MoverAnimacy, Purpose, Result, Time, Cause, Co-mover, and Distance. The category '**MoverAnimacy**' specifies whether the expression of the mover (i.e., syntactically the subject of the clause) refers to an animate, inanimate, or vehicle mover (e.g., <u>*tüdruk*</u> *kõndis* 'the <u>girl</u> walked', <u>*pall*</u> *veeres* 'the <u>ball</u> rolled', <u>*auto*</u> *keeras* 'the <u>car</u> turned' respectively). '**Purpose**' indicates the final situation or activity that the mover is aiming to reach (e.g., *läks* <u>*sööma*</u> '(s)he went <u>to eat</u>'). '**Result**' represents expressions that describe the final state (other than spatial) of the mover (e.g., *vaas kukkus* <u>*katki*</u> 'the vase fell <u>into pieces</u>'). '**Time**' expressions are expressions that specify the temporal location of motion (e.g., *jooksis* <u>*eile*</u> '(s)he ran <u>yesterday</u>'). '**Cause**' specifies the immediate reason why motion is carried out (e.g., *hüppas* <u>*ehmatusest*</u> '(s)he jumped <u>from fright</u>'). '**Co-mover**' refers to movers who accompany the main mover (e.g., *jooksis* <u>*koos sõbraga*</u> '(s)he ran <u>with a friend</u>'). '**Distance**' shows the area the mover covers when moving (e.g., *jooksis* <u>*kilomeetri*</u> '(s)he ran a kilometre'). MoverAnimacy is a variable of three values. All other variables are binary ones in that the clause either contains or does not contain the respective expression of the category.

[34] The list of the manner features is based on Cardini (2008), Kopecka (2010), and Slobin et al. (2014).

In addition, the verb semantic variable '**VerbAnimacy**' is included. It specifies whether the verb itself expresses primarily animate motion (e.g., *kõndima* 'walk'), inanimate motion (e.g., *voolama* 'flow'), or is ambiguous with regard to animacy (e.g., *kukkuma* 'fall' can typically refer to both animate and inanimate motion). The labels of these values are 'AnimVerb', 'InanimVerb', and 'AmbigVerb'. Although this variable specifies the semantics of motion verbs, it is not discussed together with other verb semantic variables, VerbType, MotionType, HorVert, and VerbSpeed. This is because VerbAnimacy is not directly linked to the spatial information a motion verb entails. Rather, it associates more clearly with manner of motion.

Variables of meta-information include the '**Genre**' of the text, which is either 'fiction' or 'journal', and '**Frequency**' of the verb based on the frequency list[35]. As explained in Section 5.2, the two variables overlap in that fiction corpora are used with high frequency verbs (verbs of the fourth quartile) and newspaper corpora with lower frequency verbs (verbs of the third quartile).

6.2. Statistical tools

One of the major challenges of large and complex data is to present the structure of the data as accurately as possible, while also remaining reader-friendly. Statistical tools are becoming progressively better for analysing complex linguistic data to reveal patterns and associations that test hypotheses that would otherwise be impossible to determine (see also Hatch & Farhady 1982; Butler 1985; Oakes 1998; Baayen 2008; Tagliamonte & Baayen 2012; Gries 2013; Janda 2013; Glynn 2010; Gómez 2013). However, the use of these intricate statistical methods may produce results that would be incomprehensible to the reader.

To reach the objectives of the current study, I apply a mixture of statistical techniques, both univariate (monofactorial) and multivariate (multifactorial), exploratory and hypothesis testing. Univariate techniques assess the association between two variables. In contrast, multivariate techniques account for associations between multiple variables. Explorative techniques are techniques that make no prior assumptions when evaluating the possible associations in the data (Everitt 2006: 146). Hypothesis testing techniques are techniques that assess whether the data are in concordance with the expectations formed prior to the statistical analysis (Everitt 2006: 195). The data are analysed by applying a selection of these techniques. This allows the data to be assessed from different angles, which, in turn, would reduce the complexity of the data to a manageable amount.

[35] The frequency list is available at: http://www.cl.ut.ee/ressursid/sagedused1/failid/lemma_kahanevas.txt. The list is based on the Balanced Corpus of Estonian consisting of fiction, newspaper and science text subcorpora, 15 million words in total.

The data itself is mainly categorical with two variables being continuous. This means that most variables included in the analysis consist of values of which the labels refer to the members of the category (see also Agresti 1996: 1−3). In these cases, such occurrences can only be counted. The continuous variable VerbSpeed is comprised of numeric values that originate from the experiment described in Section 6.1.1.5 above. The data are also highly complex with many variables being presumably intra-connected (see also Gries 2013: 247). The latter phenomenon is known as multicollinearity or interaction between variables, meaning that the independent variables jointly explain the variation of the dependent variable (Everitt 2006: 202).

As for univariate techniques, I apply the Chi-square test for significance testing when examining categorical variables (see Sections 9.1, 9.2, 9.3, and 9.4), and generalised linear modelling when one of the two variables is the continuous variable VerbSpeed (see Section 9.1.4. and 9.4). It should be noted that I apply the generalised linear modelling technique (specifically, binary logistic regression) only as a tool for significance testing when dealing with the continuous variable, VerbSpeed, and its associations with spatial variables. Although a variety of tests are available for continuous data, none of these are appropriate, as the assumptions for these tests are not met.

As for multivariate techniques, I use both exploratory techniques and hypothesis testing techniques (also known as 'unsupervised' and 'supervised' techniques respectively (Baayen 2008: 118)). For exploratory techniques, I apply correspondence analysis (see Sections 9.1.1, 9.1.2, and 9.1.3) and cluster analyses (see Section 9.4.1). To conduct the hypothesis testing, I apply conditional random forests and conditional inference trees (see Section 9). The aim of random forests and classification trees is similar to regression models in trying to predict what contributes to the variation of a particular variable. Whereas regression modelling is widely used in linguistics (see also Baayen 2008: 165−302; Johnson 2010), these modelling techniques may not be appropriate due to the highly multicollinear structure of the data (Strobl, Malley, et al. 2009; Tagliamonte & Baayen 2012). The current study is a prime example of such studies where random forests and conditional inference trees provide more reliable, and also more easily interpretable results. One disadvantage of using these statistical techniques is that the fixed and random effects are not accounted for. That is, factors that are constant across the data (such as the type of verb, the speed of verb, or the author or genre of the text) are analysed on the same basis as of the other variables (such as Location and Goal).

The following overview discusses the statistical methods that are applied in the study. Each technique is described by means of an example data. These data are taken from the main data of the thesis (see Sections 5 and 6.1), but constitute only two variables (the Verb and Goal), and only clauses with the verbs *tulema* 'come', *minema* 'go', and *kõndima* 'walk'. That is, the variable Verb has three levels in the example dataset. The variable Goal is a binary one with 'yes' and 'no' values. The 'yes' value indicates the presence of Goal expressions in a particular clause (e.g., *ta jooksis majja* '(s)he ran into the house'); the 'no' value indicates the absence of Goal expressions from a clause (e.g., *ta jooksis* '(s)he ran'). In exemplifying the explorative techniques (namely, correspondence analysis and cluster analysis), an additional three categories are included: Source, Location, and Direction, all of which are similarly to Goal binary ones. In presenting the regression technique as a tool of significance testing, the continuous variable VerbSpeed is also included. In the examples, Verb is the independent variable and is assumed to predict the Goal, which is the dependent variable. In total, the example dataset consists of 300 clauses. In all calculations, I apply various packages of R (RStudio Team 2015).

6.2.1. The Chi-square test

As a monofactorial test for independence, **the Chi-square test**, also known as Pearson's goodness-of-fit test, is pertinent when examining categorical data. The Chi-square test compares two variances, by putting the actual found frequencies against hypothetical ones. These hypothetical frequencies are expected frequencies. If these were true, there would be no associations in the data. The greater the deviances of the real frequencies from the expected ones, the more likely are the results significant (for the Chi-square test see, for example, Agresti 1996: 34–41; Everitt 2006: 76; Crawley 2007: 301–306). To illustrate this, the observed and expected frequencies of the example data are given in Table 5.

Table 5. Observed and expected frequencies of the example dataset

Verb	Observed frequencies		Expected frequencies	
	Goal expression absent (= no)	Goal expression present (= yes)	Goal expression absent (= no)	Goal expression present (= yes)
kõndima 'walk'	91	9	70	30
minema 'go'	52	48	70	30
tulema 'come'	68	32	70	30

The association between Verb and Goal is significant as the p-value is smaller than 0.05: $\chi^2(2, N = 300) = 36.84$, $p < 0.001$. That is, the results of the Chi-square test indicate that the proportions found in the data are those without chance. In other words, there are significant associations within the data. However, the Chi-square test does not give much information about the nature or strength of the co-variance. For this reason, the results of the Chi-square test are presented alongside the effect sizes (namely, with values of **Cramér's V**) to evaluate the strength of associations (see also Everitt 2006: 106). The values of Cramér's V range from 0 to 1 with zero indicating no and one perfect association. Values ranging between 0.1 and 0.3 show weak, values between 0.3 and 0.5 moderate, and those bigger than 0.5 strong associations (Cohen 1988: 224–225). Regarding the example dataset, Cramér's V = 0.35 and this provides evidence that the effect size is moderate.

In addition to the effect size, I also report **Pearson's residuals** (also known as adjusted or standardised residuals) of the Chi-square test. Pearson's residuals are standardised residuals, calculated on the basis of the observed and expected frequencies (Agresti 1996: 38–39; Durrheim & Tredoux 2004: 375; Everitt 2006: 298; Hothorn & Everitt 2014: 61). The observation of these residuals allows one to establish the more precise nature of the association between the variables. If a Pearson's residual is positive and larger than +2, the two values of the variables are likely to combine with each other (i.e., they are positively associated). If they are negative and smaller than −2, the values of the variables are unlikely to combine with each other (i.e., they are negatively associated) (Agresti 1996: 38–39; Durrheim & Tredoux 2004: 375).

Pearson's residuals for the example dataset are given in Table 6. These residuals suggest that the verb *minema* 'go' has a tendency to combine with Goal expressions (3.37), whereas the verb *kõndima 'walk'* shows the opposite tendency (−3.79). In contrast, the verb *minema* 'go' is infrequently used when Goal is not expressed (−2.19), whereas the verb *kõndima* 'walk' is frequently used in clauses that lack Goal expressions (2.46). The verb *tulema* 'come' is rather insensitive to the presence or absence of Goal expressions as the residuals remain close to zero.

Table 6. Pearson's residuals for the example dataset

Verb	Goal expressions absent (= no)	Goal expressions present (= yes)
kõndima 'walk'	2.46	**−3.79**
minema 'go'	−2.19	**3.37**
tulema 'come'	−0.28	0.43

To create contingency tables and conduct the Chi-square test on the basis of these contingency tables, I use the function `CrossTable` as implemented in the package 'gmodels' (Warnes et al. 2015). For calculating the Cramér's V, I apply the function `cramersV` in the package 'lsr' (Navarro 2015). For creating bar plots, I use the functions `sjp.xtab`, `sjp.frq`, and `sjp.stackfrq` in the package 'sjPlot' (Lüdecke 2016).

6.2.2. Binary logistic regression

Although in the current study, random forests are used as a predicting technique (see rationale above), the regression technique is also applied as a tool of univariate analysis when one of the two variables is a continuous variable, VerbSpeed. As such, the technique is only used to assess whether the two variables associate significantly, and is used in Section 9.1.4.

Regarding the example dataset of the three verbs, the spine plot is given in Figure 1. It shows the amount of clauses across the verbs of different speeds where Goal is or is not expressed. The speed ratings of the three verbs are

−0.28 for *kõndima* 'walk', −0.23 for *minema* 'go', and −0.20 for *tulema* 'come'. The figure shows that verbs that are rated as expressing slightly faster motion (i.e., the two goal verbs *minema* 'go' and *tulema* 'come') combine more frequently with Goal expressions than the manner of motion verb. The difference is significant: Nagelkerke's $R^2 = 0.079$, df = 1, $p < 0.001$.

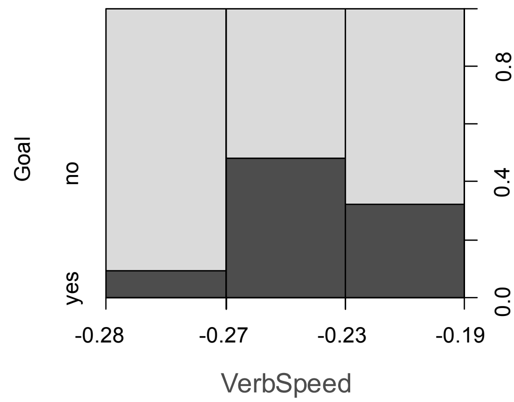

Figure 1. Spineplot of verb speed ratings (VerbSpeed) across clauses with (= yes) and without (= no) Goal expressions

To assess the strength of the association, I apply the index of concordance C (also known as the C-index or C-statistic). This index varies from 0.5 to 1.0 and shows the performance of the model. According to Hosmer and Lemeshow (2013: 177), 0.5 shows that modelling is random and 1.0 shows that it is perfect. In the current example, the index of concordance C is 0.62. This suggests that the association is weak and that important factors are absent from the model.

In conducting generalised linear models with a binary dependent variable, I make use of the function `lrm` in the package 'rms' (Harrell Jr 2015a). Additionally, in characterising the variable VerbSpeed, I provide descriptive statistics (see Section 8.1.4 and 8.2.1). For that, I apply the function `describe` in the package 'psych' (Revelle 2015). Spineplots are created by using the function `spineplot`, and boxplots are created by using the function `boxplot` in the package 'graphics' (R Core Team 2015).

6.2.3. Correspondence analysis

Correspondence analysis is an explorative technique used on categorical data. Explorative techniques assume no previous knowledge about the structure of the data meaning that, at least theoretically, no predictions are made about the patterns in the data (Everitt 2006: 146; Baayen 2008: 118). Correspondence analysis is a distance reducing technique. That is, on the basis of frequencies, distances between rows and between columns are calculated, and the multi-dimensionality is reduced to two dimensions, but keeping the information as accurate as possible (Everitt 2006: 101–102; Greenacre 2007). The results of correspondence analysis are graphically presented in figures of scatterplots. This allows significant clusters in the data to be visually observed. In the current study, I apply correspondence analysis to illustrate the distribution of verbs (on the basis of their semantic properties) with respect to spatial variables (see Sections 9.1, 9.2, and 9.3).

The graphical results of the correspondence analysis of the example data are presented in Figure 2. In addition to Verb and Goal, the variables Source and Location are included to allow the multifactorial analysis in the first place. In the scatterplot, the values of Verb (i.e., the three motion verbs) are scattered with respect to the variables Location and Goal. It can be seen that only the verb *minema* 'go' has a strong tendency to combine with Goal expressions, whereas the verb *kõndima* '*walk*' prefers combinations with Location expressions, and *tulema* 'come' is somewhat inclined towards Source. The results also show that goal verbs (shown in black in Figure 2) differ from the manner of motion verb (shown in yellow).

Along both axes in Figure 2, the proportions of the variation in the data that the two most important factors are capable of accounting for are presented. Regarding the example, Factor 1 describes 87.8%, while Factor 2 describes 12.2% of the variation. As the data are small, the two factors describe the whole data (100%). With large data, the overall percentage of the described variation tends to be smaller. Figure 2 shows that the two goal verbs have negative Factor 1 values, and the manner of motion verb has positive Factor 1 values. This indicates that the difference between the goal verbs and the manner of motion verb is substantial. The goal verb *tulema* 'come' has the highest Factor 2 value, followed by the manner of motion verb *kõndima* 'walk', which is slightly higher than the other goal verb *tulema* 'come'. This shows that the manner of motion verb *kõndima* 'walk' is more similar to the verb *minema* 'go' than to the verb *tulema* 'come'.

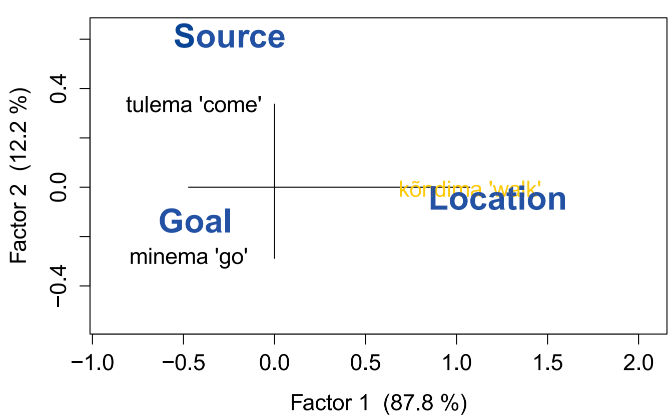

Figure 2. Correspondence analysis of the example dataset with four variables: Verb, Source, Location, and Goal. Large dark blue labels stand for the spatial variables. Smaller labels refer to particular motion verbs: black = goal verbs, yellow = manner of motion verbs

In principle, two methods of correspondence analysis are possible. These are correspondence analysis based on contingency data, and multiple correspondence analysis based on raw categorical data. For the purposes of clarity, I only use correspondence analysis conducted on the basis of contingency tables, and make use of the `corres.fnc` function in 'languageR' (Baayen 2013).

6.2.4. Cluster analysis

In addition to correspondence analysis, I apply cluster analysis. More specifically, I use one type of cluster analysis, which is a method known as **hierarchical agglomerative cluster analysis** (Anderberg 1973: 131–155; Everitt 2006: 9; Kaufman & Rousseeuw 2009: 199–252). The aim of this technique is to find clusters in the data and organise the clusters hierarchically. Hierarchical cluster analysis is a so-called bottom-up analysis which proceeds from single points to larger and larger clusters until all points are covered (Anderberg 1973: 131; Everitt 2006: 9). The output of the hierarchical agglomerative clustering is a dendrogram which represents similar units as branches of a tree. I use this technique to provide additional support for the patterns found with other techniques (see Section 9.4.1). At the same time, the results of clustering, as a side-product of the study, contribute to the existing, often intuitive classifications of motion verbs in linguistics.

The dendrogram of the example dataset is presented in Figure 3. It shows that verbs similar in clausal patterns share the same branch and are closely situated in the dendrogram. That is, the directional verbs *minema* 'go' and *tulema* 'come' are 'leaves' of the same branch, whereas the manner of motion verb *kõndima* '*walk*' is situated apart from them.

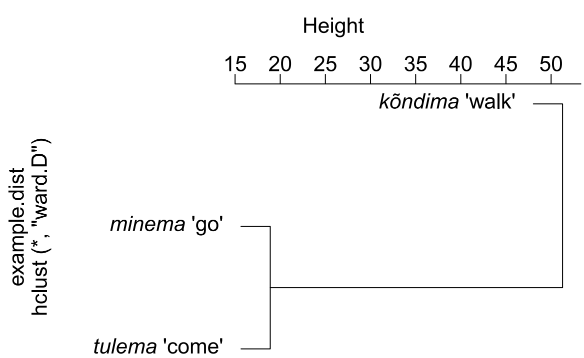

Figure 3. Hierarchical agglomerative cluster analysis of the example data: classification of the three verbs on the basis of the variables Source, Location, and Goal

There are also a number of ways to conduct hierarchical agglomerative cluster analysis in R. In this study, I apply the functions `dist` and `hclust` implemented in the R base package 'stats' (R Core Team 2015).

6.2.5. Conditional random forests

Random forests is a technique used to predict the outcome of some variable on the basis of other variables (Breiman 2001; Everitt 2006: 329). With regard to this general purpose, random forests are similar to modelling techniques. However, random forests are inherently different to regression models in that the outcome is reached by randomly growing a number of tree-structured models from which, by means of 'voting', the important variables that contribute to the variation of the dependent variable are selected and ranked (Breiman 2001).

Mathematically, there are different ways in how random forests are seeded, grown, and taken care of. In the current study, I apply **conditional random forests** (Hothorn, Buehlmann, et al. 2006; Strobl et al. 2007; Strobl et al. 2008). Conditional random forests are built on conditional inference trees (see Section 6.2.6) and, as such, have been argued to be less biased, and more reliable with regard to complex data than other models of random forests built on other classification and regression trees (Strobl et al. 2008; Strobl, Hothorn, et al. 2009).

On the basis of conditional random forests, one can calculate relative variable importances in predicting the dependent variable. The plotted result (see Figure 4) should be interpreted as follows. The relative importances of variables decrease when moving down along the vertical axis and from right to left along the horizontal axis. The vertical line indicates the significance of predictor variables. Variables that fall to the right of it are significant; variables that occur to the left or on the line are insignificant in terms of the model. As the variables are represented on a relative scale, large visual gaps between dots indicate significant differences between variables in their predictive contribution.

For instance, when predicting the Goal from Verb, Source, and Location on the basis of the example data, the following result may be stated (see Figure 4). Firstly, only Verb is significant, while Location and Source are not. Secondly, Verb is situated far apart from the other two variables. This suggests that it is the main variable on the basis of which classifications are performed.

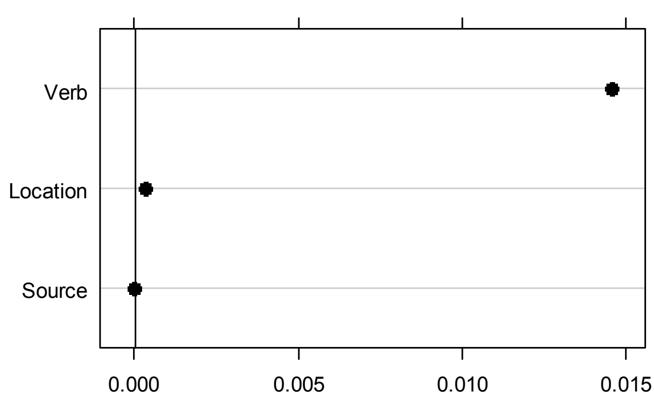

Figure 4. Conditional variable importance in predicting Goal on the basis of the example data (predictors to the right of the vertical line are significant): Goal ~ Source + Location + Verb

To evaluate how well the chosen variables can actually explain the variability of the dependent variable, I again calculate the index of concordance C in a similar way as I did with the models of binary logistic regression. In the example model above, the index of concordance is C = 0.73 which indicates satisfactory performance (Hosmer Jr et al. 2013: 177). This, in turn, shows that important variables that affect the expression of Goal are missing from the model. It should be noted, however, that the index of concordance C can be applied only to binary dependent variables. While this is true for most random forests grown in the current study (see Section 9.1), the final models exhibit a dependent variable of six values (see Section 9.4.4), and in this case, the C-index is not calculated.

To grow conditional random forests, I use the `cforest` function in the package ‘party’ (Hothorn et al. 2015; see also Hothorn, Buehlmann, et al. 2006; Strobl et al. 2007; Strobl et al. 2008). To calculate variable importances, I apply the function `varimp` in the same package. For the index of concordance C, I use the function `somers2` in the package ‘Hmisc’ (Harrell Jr 2015b).

Three parameters are important to specify when conducting the analysis of random forests (Strobl, Malley, et al. 2009): the number of trees created (i.e., argument called *ntree*), the number of randomly selected independent variables being the basis for each split in the tree (i.e., *mtry*), and the minimum amount of data to perform a split (i.e., *minsplit*).

As for the number of trees, I choose the standard number of trees (*ntree* = 500). The number of trees has been associated with the stability and reliability of random forests models in that the more trees there are, the more stable the results are (Strobl, Malley, et al. 2009). In addition, the more variables that are involved, the more trees should be grown. However, the increase of the number of created trees has its flipside in that it creates a high computational cost. This means that conducting this analysis would be an extremely slow process. As it has also been shown that such an increase would, in fact, produce only slight differences in results (Oshiro et al. 2012), I retain the standard 500 trees in all models of random forests in the study.

In specifying the number of preselected variables, I follow the widely accepted practice that this number should be a square root of the number of independent variables (Strobl et al. 2008). For example, if the model of random forests is grown with 9 independent variables, *mtry* = 3. In the example where the variable Verb is predicted on the basis of variables Source, Location, and Goal, this is set to *mtry* = 2. The final parameter *minsplit* specifies the amount of data when performing a split. In this, I follow Strobl et al. (2009) and fix this parameter to five (*minsplit* = 5).

6.2.6. Conditional inference trees

Conditional inference trees are effective tools to capture the structure of complex data which suffer from a high degree of multicollinearity (Hothorn, Hornik, et al. 2006; Tagliamonte & Baayen 2012; Lohmann 2013). The technique is non-parametric (Hothorn, Hornik, et al. 2006) and, hence, makes no assumptions about the distribution of the data. In other words, one can apply this tool to data of any structure. I describe below how classification trees are extremely useful in analysing language data; particularly for constructional analysis where many variables are in play, all of which may or may not be highly collinear with each other. All these variables can be fully accounted for when creating conditional inference trees to predict one response variable.

Conditional inference trees are formed by applying an algorithm that recursively splits the data based on significance testing (Hothorn, Hornik, et al. 2006; Tagliamonte & Baayen 2012). As a result, all variables that contribute to the variation of the predicted variable are presented in figure trees, so that variables that associate with the pattern of the predicted variable are observable. The tree-shaped figure or dendrogram that results is comparatively easy to interpret, and is also informative and accurate.

The conditional inference tree of the example data in predicting Goal is presented in Figure 5. Random forests above provided that Verb is of first and only importance in distinguishing between the clauses with and without Goal expressions (see Figure 4 above). The conditional inference tree supports this finding by presenting only one split in the data based on Verb (see Node 1). More specifically, the manner of motion verb *kõndima 'walk'* is different to goal verbs *minema* 'go' and *tulema* 'come' in having extremely few clauses with Goal expressions, while 40% of clauses with goal verbs accommodate Goal expressions. Source and Location, that were insignificant in the model of random forests, are not present in the conditional inference tree either.

It should be noted that when interpreting the trees, spatial expressions do not necessarily occur in motion clauses. For example, in the example dataset, only 89 clauses out of 300 contain Goal expressions. This explains why the tree shows that the majority of clauses are assigned the 'no' value for Goal.

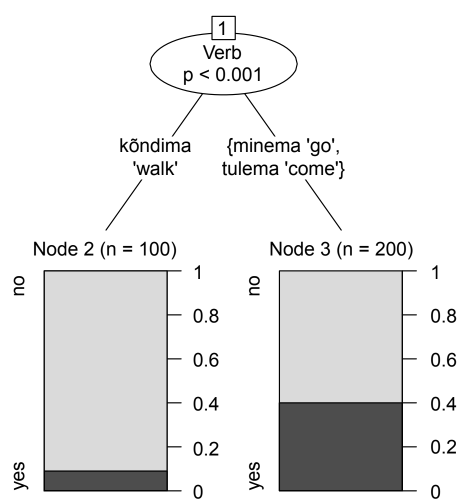

Figure 5. Conditional inference tree of predicting the presence (= yes) or absence (= no) of Goal expressions on the basis of the other variables in the example dataset: Goal ~ Source + Location + Verb

The conditional inference trees are particularly useful when the data are more complex. For instance, the inclusion of another factor (Direction) is presented in Figure 6. It shows that the variable Direction is important and that clauses of goal verbs fall into two categories on the basis of the presence or absence of Direction expressions (see Node 3). Most importantly, the tree indicates that Goal is most likely expressed if a goal verb is used in a clause where Direction is not described (see Node 4), as in *ta tuli linna* '(s)he came to the city'. Goal verbs are less likely to combine with Goal expressions, if Direction is also expressed (see Node 5), as in *ta tuli linna tagasi* '(s)he came back to the city'.

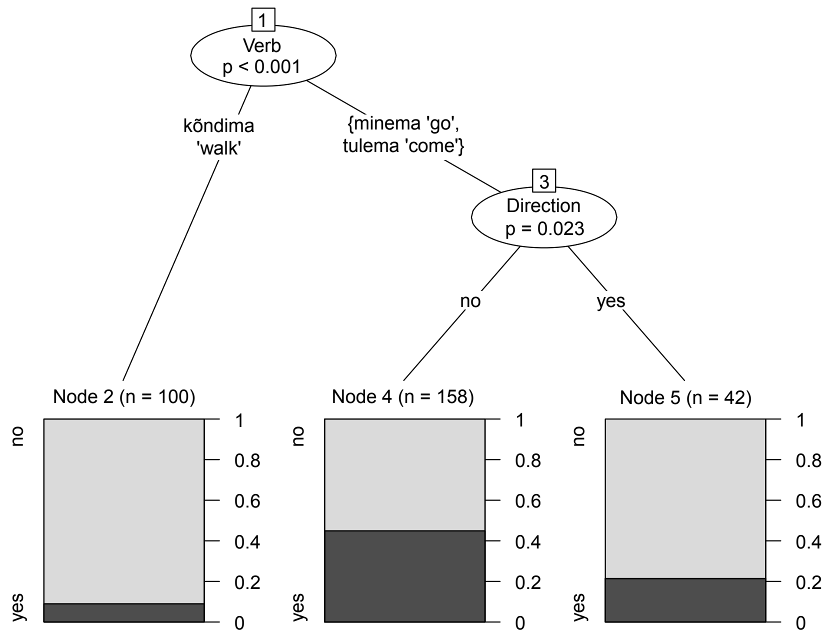

Figure 6. Conditional inference tree of predicting the presence (= yes) or absence (= no) of Goal expressions on the basis of the other variables in the example dataset: Goal ~ Source + Location + Direction + Verb

Finally, I use the `ctree` function implemented in R package 'party' (Hothorn et al. 2015; see also Hothorn, Hornik, et al. 2006) to create conditional inference trees.

7. THE ESTONIAN LANGUAGE

Estonian is a Finno-Ugric language spoken as a native language by approximately 900 000 people in Estonia[36]. The following main characteristics of Estonian are outlined below (for a more detailed overview of Estonian grammar, see Tauli 1973; 1983; Erelt et al. 1993; 1995; Erelt 2003a). First, the basic word order of Estonian is subject-verb-object (SVO), but the word order is comparatively flexible. Second, the morphology of Estonian is rich and it combines agglutinative (i.e., suffixing) and fusional strategies. As for the main morphological categories, nouns are inflected for case and number; verbs are inflected for person, number, tense, mood, and voice. In addition to that, Estonian distinguishes between three degrees of quantity to encode different grammatical and lexical meanings. Finally, Estonian has no grammatical gender.

The current section tackles the principal morphosyntactic inventory that can be employed to express motion in Estonian. However, the list of these formal devices should not be considered as exhaustive. In addition, although the terms grammatical and lexical are used, no concrete boundary between the two is neither assumed, nor established. Instead and in line with cognitive linguistics (Langacker 1987: 3), a continuum between grammar and lexicon is assumed. The following overview is structured into three sections that address the formal manifestations of motion verbs, spatial expressions, and manner expressions.

7.1. Formal properties of motion verbs

On formal grounds, motion verbs are no different to other verbs in Estonian. This means that there are no structural means to differentiate between motion verbs and other verbs. In other words, the difference is purely semantical. Thus, motion verbs possess the same grammatical features as verbs in general in Estonian and are inflected for person, number, tense, mood, and voice. In Estonian reference grammars (Tauli 1973: 90–95; 1983: 27–32; Erelt et al. 1995: 223–252; Viitso 2003: 52–63), three persons (the first, second, and third), two numbers (the singular and plural), five tenses (the present and past simple, present and past perfect, general past), five moods (the indicative, conditional, imperative, quotative, and jussive), and two voices (the personal and impersonal) are distinguished. In addition to inflectional suffixes, various morphophonological alternations may occur, such as gradation, gemination, and suppletion (for an overview, see Viitso 2003: 25–32).

Although there are no formal means to distinguish motion verbs from other verbs, many verbs have forms that provide information about semantic classes

[36] According to the Population and Housing Census 2011 available at: http://pub.stat.ee/px-web.2001/I_Databas/Population_census/PHC2011/01Demographic_and_ethno_cultural_characteristics/04Ethnic_nationality_Languages_Dialects/04Ethnic_nationality_Languages_Dialects.asp (accessed 3 September 2015).

of verbs in Estonian. These are derivational verbs which by means of derivational patterns behave as, for example, instrumental, causative, or iterative verbs (Erelt et al. 1995: 428–456; Viitso 2003: 69–77; Kasik 2014: 51–92).

7.2. Morphosyntactic inventory to express spatial categories

Spatial expressions in Estonian may occur as (i) case-inflected noun phrases, (ii) adpositional phrases (either prepositional or postpositional), or (iii) adverbs (Erelt et al. 1993: 71–76). In the following sections, all these three strategies are discussed with respect to the six spatial variables of the study: Source, FromDirection, Location, Trajectory, Direction, and Goal.

7.2.1. Case-inflected noun phrases

Nouns and noun phrases are inflected for case and number in Estonian. There are fourteen cases all of which have both the singular and plural forms (Tauli 1973: 40–41; Viitso 2003: 32). Three of the cases are called grammatical (or abstract) cases: nominative, genitive, and partitive. The rest of the cases are semantic (also known as concrete or adverbial) cases: illative, inessive, elative, allative, adessive, ablative, translative, terminative, essive, abessive, and comitative (Erelt et al. 1995: 49–61; Viitso 2003: 32–51; Erelt et al. 2007: 240–253). Needless to say, all cases can be used in a wide diversity of situational and grammatical contexts (for more detailed overviews of the Estonian case system, see Tauli 1973: 40–90; Erelt et al. 1995: 48–63, 194–222; Viitso 2003: 32–51).

There are seven cases in contemporary Estonian of which their primary function is to convey spatial information. These cases are mainly treated as spatial cases in Estonian reference grammars, and can be divided into separative (elative and ablative), locative (inessive and adessive), and lative ones (illative and allative) (Tauli 1983: 100–102; Erelt et al. 1995: 54–59; see also Pajusalu et al. 2013: 49–61). These spatial cases may also be divided into interior local cases or internal cases (illative, inessive, and elative) and exterior local cases or external cases (allative, adessive, and ablative) (Tauli 1983: 93–97; Erelt et al. 1995: 54–59; Viitso 2003: 33). In addition to the six spatial cases, the terminative case also conveys spatial meaning (Erelt et al. 1995: 59; 2003b: 99) and it features lative properties.

These cases are illustrated in the constructed examples below. The elative and ablative cases are separative cases, as illustrated by *majast* ‘from the house’ and *põllult* ‘from the field’ in a constructed example (1). They function as specialised Source cases expressing “the place from where one betakes oneself or transfers something/somebody” (Tauli 1983: 101). The locative cases (inessive and adessive) can be seen as cases of Location as one of their main functions is to express “the place where the action of V [verb] takes place” (Tauli 1983: 101), as shown by *majas* ‘in the house’ and *teel* ‘on the road’ in

(2). The illative and allative, being lative cases, have a function to express Goal; that is, they describe “the place the action of V is directed towards” (Tauli 1983: 100), as *majja* ‘into the house’ and *tänavale* ‘onto the street’ in (3). In addition to the six spatial cases, the terminative case also conveys spatial meaning (Erelt et al. 1995: 59; 2003b: 99) and features lative properties, as shown by *majani* ‘until the house’ in (3).

(1) Source: *Ta lahku-s maja-**st** / põllu-**lt**.*
(s)he leave-PST.3SG house-**ELA** / field-**ABL**
‘(S)he left the house/ the field.’

(2) Location: *Ta jooks-i-s maja-**s** / tee-**l**.*
(s)he run-PST-3SG house-**INE** / road-**ADE**
‘(S)he was running in the house / on the road.’

(3) Goal: *Ta suundu-s* ***majja*** */ tänava-**le** / maja-**ni**.*
(s)he head-PST.3SG **house**.**ILL** / street-**ALL** / house-**TERM**
‘(S)he headed into the house / onto the street / as far as the house.’

FromDirection, Trajectory, and Direction lack their own case-marking in contemporary Estonian. If expressed by cases, the same spatial cases occur. Otherwise, other constructional strategies are used to express these categories.

Regarding the cases, FromDirection would mainly use the separative ones (e.g., *suunast* ‘from the direction of’, as in (4)), Trajectory takes the elative case (e.g., *trepist* ‘along the stairs’, as in (5)), and Direction takes the lative cases (e.g., *majale* ‘towards the house’, as in (6). These formal manifestations are only possible if the lexical content supports the interpretation of the three spatial categories.

(4) FromDirection: *Ta lähene-s maja* ***suuna-st****.*
(s)he approach-PST.3SG house.GEN **direction**-**ELA**
‘(S)he approached from the direction of the house.’

(5) Trajectory: *Ta jooks-i-s* ***trepi-st*** *alla.*
(s)he run-PST-3SG **stairs**-**ELA** down.LAT
‘(S)he ran down the stairs.’

(6) Direction: *Ta lähene-s* ***maja****-**le**.*
(s)he approach-PST.3SG **house**-**ALL**
‘(S)he approached the house.’

7.2.2. Adpositions and adverbs

In addition to case-marking, Estonian makes use of adpositional phrases and adverbs to convey spatial meanings (Rätsep 1978: 29–31, 44–47, 52–53; Tauli 1983: 109–126; Erelt et al. 1993: 136–139; Erelt 2003b: 116–118; Pajusalu et al. 2013: 49–61). Spatial meanings in the current study are captured by the six spatial variables. All these variables may be expressed as adpositional phrases and adverbs. Moreover, many adpositions and adverbs in Estonian have three forms which correspond to spatial cases. That is, there are separative, locative, and lative forms of many adpositions and adverbs to distinguish between the three main spatial relations (e.g., *eest* 'from in front of', *ees* 'in front of', and *ette* 'in front of').

As for adpositional phrases, Source, FromDirection, Location, Direction, and Goal are typically expressed by postpositional phrases (Rätsep 1978: 44–46). These are exemplified by phrases *maja eest* 'from in front of the house' in (7), *maja poolt* 'from the direction of the house' in (8), *tänava peal* 'on the street' in (9), *maja poole* 'towards the house' in (11), and *maja taha* 'behind the house' in (12). Trajectory may be expressed both by prepositional and postpositional phrases as shown by *mööda teed* 'along the path' and *teed mööda* 'along the path' in (10).

(7) Source:
Ta tul-i ***maja eest*** / ***kaugelt*** / ***sealt.***
[PostpP] [Adv] [DemAdv]
(s)he come-PST.3SG **house.GEN in.front.of.SEP / far.SEP / there.SEP**
'(S)he came from in front of the house / from a long way / from there.'

(8) FromDirection:
Ta tul-i ***maja poolt*** / ***eest****.*
[PostpP] [Particle/Adv]
(s)he come-PST.3SG **house.GEN direction.SEP / in.front.of.SEP**
'(S)he came from the direction of the house / from in front.'

(9) Location:
Ta jooks-i-s ***tänava peal*** / ***taga*** / ***vasakul.***
[PostpP] [Particle/Adv] / [Adv]
(s)he run-PST-3SG **street.GEN on.LOC** / **behind.LOC** / **left.LOC**
Lit. '(S)he was running on the street/ behind / left.'

(10) Trajectory:
Ta jooks-i-s ***mööda tee-d*** / ***tee-d mööda*** /
[PrepP] [PostpP]
(s)he run-PST-3SG **along path-PART** / **path-PART along** /
mööda / ***minu-st mööda****.*
[Particle] [NP+Particle]
past / **I-ELA past**
'(S)he ran along the path / along the path / past / past me.'

(11) Direction:
Ta läks ***maja poole*** / ***edasi.***
[PostpP] [Particle]
(s)he go.PST.3SG **house.GEN towards** / **forward**
'(S)he went towards the house / forward.'

(12) Goal:

Ta	*läks*	***maja***	***taha***	/ ***väga***	***lähedale***	/ ***sinna.***
		[PostpP]		[Adv]		[DemAdv]
(s)he	go.PST.3SG	**house.GEN**	**behind.LAT**	/ **very**	**close.LAT**	/ **there.LAT**

'(S)he went behind the house / very close / there.'

All these six categories can also be encoded as adverbs which may be the same lexemes as those functioning as adpositions (Rätsep 1978: 45). In this case, these are typically verbal particles, such as *eest* 'from in front', as in (8); *taga* 'behind', as in (9); *mööda* 'past', as in (10); and *edasi* 'forward', as in (11). In addition to these, free adverbs (including demonstrative adverbs) may also be used as illustrated by *sealt* 'from there', as in (7); *vasakul* 'left', as in (9); and *väga lähedale* 'very close to' and *sinna* 'there', as in (12). It should also be noted that it may be difficult to differentiate between verbal particles and free adverbs. For instance, *taga* 'behind', as in (9), can be interpreted as a verbal particle and/or as a free adverb.

Furthermore, distinguishing between adverbs and adpositions may be difficult, because the same lexical item can behave as an adposition or as an adverb (mostly as a verbal particle) in Estonian[37] as illustrated by the two uses of *mööda* 'along, past' in (10). Adverbs, in turn, may occur as verbal particles or free adverbs. If they are verbal particles, then they are components of phrasal verbs as illustrated by *jooksis mööda* '(s)he ran past' in (10). Such verbal particles may be seen as 'satellites' in Talmy's (2000b: 102) terminology (see Section 4.3.1.3 for the discussion of satellites).

According to Estonian linguistic tradition, adpositions are used together with nouns which are typically inflected for genitive or partitive (Erelt et al. 1995: 33–39). Most adpositions in Estonian function as postpositions and some as prepositions. Some adpositions can have both functions such as *mööda* 'along; past', as in (10). Adverbs, on the other hand, occur in a sentence without noun phrases or, if nouns are present, these are inflected for semantic cases (Erelt et al. 1995: 23–26, 32–33), as *jooksis minust mööda* '(s)he ran past me' in (10). Whether a particular lexeme in a particular clause could be interpreted as an adposition, free adverb, or verbal particle, may often be a matter of dispute due to the absence of strict borders between word classes (see also Veismann 2009). However, as the investigation of morphosyntax is not the primary objective of the current study, and as different formal labels do not change the main outcomes of the study, I follow Estonian reference grammars and tradition in tagging the morphosyntactic variables.

[37] Similiar situations are well-known also with respect to other languages (e.g., Van Staden et al. 2006).

7.3. Morphosyntactic inventory to express manner

The linguistic inventory I introduce below corresponds to the semantic and formal criteria used in the definition of manner as in Sections 4.4 and 6.1.2.2. Five principal formal means to express manner (including instrument) relevant to motion are outlined: (i) adverbs, (ii) noun phrases, (iii) adpositional phrases, (iv) gerund constructions (i.e., *des*- and *mata*-constructions; also known as converbs), and (v) comparative constructions.

Firstly, adverb phrases are used in Estonian to express how something happens, including how some entity moves (Erelt et al. 1993: 89; Veski 1982: 15–28; Erelt 2013: 20; Kasik 2014: 203–207). This is illustrated by *väga kiiresti* 'very fast', as in (13). Amongst such adverbs are also ideophonic expressions which indicate the sound originating in the contact between the mover and the surface, such as *tolksti* 'with a plock sound' in (14).

(13) *Ta* *jooks-i-s* ***väga*** ***kiiresti***.
(s)he run-PST-3SG **very** **fast**
'(S)he ran very fast.'

(14) *See* *kukku-s* ***tolksti***.
it fall-PST.3SG **plock**
'It fell down suddenly.' (Lit. 'It fell a plock sound')

Secondly, nouns and noun phrases inflected for inessive (e.g., *kägaras* 'in a crouched manner', as in (15)), elative (e.g., *kõigest jõust* 'with all his/her strength', as in (16)), adessive (e.g., *kiirel sammul* 'with fast steps', as in (17)), comitative (e.g., *kiirete hüpetega* 'with fast leaps', as in (18)), and abessive (e.g., *hirmuta* 'without fear', as in (19)) may express manner (Erelt et al. 1993: 89–90; Vainik 1995: 46–48, 135–144). It should be noted, though, that none of these cases are specialised for manner, and they are mainly used to express other meanings (e.g., spatial ones).

(15) *Ta* *kõndi-s* ***kägara-s***.
(s)he walk-PST.3SG **crouch-INE**
'(S)he walked with his/her body crouched.'

(16) *Ta* *vänta-s* ***kõige-st*** ***jõu-st***.
(s)he pedal-PST.3SG **all-ELA** **strength-ELA**
'(S)he pedalled with all his/her strength.'

(17) *Ta* *rutta-s* ***kiire-l*** ***sammu-l***.
(s)he hurry-PST.3SG **fast-ADE** **step-ADE**
'(S)he hurried with fast steps.'

(18) *Ta* *liiku-s* ***kiire-te*** ***hüpe-te-ga***.
(s)he move-PST.3SG **fast-PL.GEN** **leap-PL-COM**
'(S)he was moving with fast leaps.'

(19) *Ta* *jooks-i-s* ***(ilma)*** ***hirmu-ta***.
(s)he run-PST-3SG **without** **fear-ABE**
'(S)he ran without fear.'

Thirdly, adpositional phrases, both prepositional (e.g., *vastu tahtmist* 'against his/her will', as in (20)) and postpositional ones (e.g., *käte peal* 'on his/her hands', as in (21)) can be used to express manner with the postpositional ones being more typical (Erelt et al. 1993: 91, 138).

(20) *Ta* *sisene-s* ***vastu*** ***tahtmis-t***.
(s)he enter-PST.3SG **against** **will-PART**
'(S)he entered against his/her will.'

(21) *Ta* *kõndi-s* ***käte*** ***peal***.
(s)he walk-PST.3SG **hand.PL.GEN** **on**
'(S)he walked on his/her hands.'

Fourthly, gerunds (i.e., *des*-and *mata*-constructions) as exemplified by *kiirustades* 'hurrying' and *kargule toetudes* 'leaning on a crutch' in (22), and *ruttamata* 'without a hurry' and *häält tegemata* 'without making a sound' in (23) may provide information about how some activity is carried out (Erelt et al. 1993: 91).

(22) *Ta* *lahku-s* ***kiirusta-des*** / ***kargu-le*** ***toetu-des.***
(s)he leave-PST.3SG **hurry-GER** / **crutch-ALL** **lean-GER**
'(S)he left in a hurry / leaning on a crutch.'

(23) *Ta* *jaluta-s* ***rutta-mata*** / ***hääl-t*** ***tege-mata.***
(s)he stroll-PST.3SG **hurry-GER** / **voice-PART** **make-GER**
'(S)he was strolling leisurely / quietly.' (Lit. '(S)he was strolling without hurrying / without making a sound.')

Finally, comparative constructions are also listed in Estonian grammars as those that can convey manner information (Erelt et al. 1993: 90). These are illustrated by *nagu jänku* 'like a bunny' in (24) and *kui haab tuules* 'like an aspen in the wind' in (25).

(24) *Ta* *hüple-s* ***nagu*** ***jänku***.
(s)he hop-PST.3SG **like** **bunny**
'(S)he was hopping like a bunny.'

(25) *Ta* *värise-s* ***kui*** ***haab*** ***tuule-s.***
(s)he tremble-PST.3SG **like** **aspen** **wind-INE**
'(S)he trembled like an aspen in the wind.'

However, there are also some other constructions that can be used to express *how*-information and which are analysed here as instantiations of manner expressions. For instance, expressions of quantity (e.g., *100 kilomeetrit tunnis*

‘100 kilometres per hour’, as in (26)) may be used to specify the velocity of motion which, in turn, is seen here as a manner feature.

(26)	*Ta*	*sõit-i-s*	***100***	***kilomeetri-t***	***tunni-s.***
	(s)he	drive-PST-3SG	**100**	**kilometre-PART**	**hour-INE**
	‘(S)he drove at 100 kilometres per hour.’				

In addition, verbless clauses can convey manner information. Verbless clauses, also known as ‘absolute nominative constructions’, are treated in Estonian linguistics as reduced clauses which lack a verb (Erelt et al. 1993: 271–272; Erelt 2003b: 123). Typically, they consist of two units: one unit is inflected for nominative (and, hence, possesses properties of grammatical subject), and the other unit can have various forms, such as adverbs, case inflected noun phrases, or adpositional phrases (Erelt et al. 1993: 271–272; Erelt 2003b: 123). As for semantics, a verbless clause of manner may specify the posture of the mover (e.g., *jalad koos* ‘legs together’, as in (27)) or a part of the body contacting the surface (e.g., *pea ees* ‘head first’, as in (28)). In addition, I consider somewhat idiomatic instances following the same pattern (combination of the noun inflected for nominative and, here, postpositional phrase) as verbless clause constructions, as exemplified by *õlg õla kõrval* ‘shoulder to shoulder’ in (29). Another reason for including verbless clauses that specify the posture of the mover into manner expressions is because most such reduced clauses occur in the middle of the main clause indicating one, rather than two events.

(27)	*Ta*	*hüppa-s*	***jala-d***	***koos***	*trepi-st*	*üles.*
	(s)he	jump-PST.3SG	**leg-PL.NOM**	**together**	stairs-ELA	up
	‘(S)he jumped up the stairs, holding his/her legs together’ (Lit. ‘(S)he jumped, legs together, up the stairs.’)					

(28)	*Ta*	*prantsata-s*	***pea***	***ees***	*põranda-le.*
	(s)he	fall.with.a.crash-PST.3SG	**head.NOM**	**ahead**	floor-ALL
	‘(S)he fell head first onto the floor.’				

(29)	*Nad*	*trügi-si-d*	***õlg***	***õla***	***kõrval.***
	they	push-PST-3PL	**shoulder.NOM**	**shoulder.GEN**	**beside.LOC**
	‘They were pushing through shoulder to shoulder.’				

Lastly, some fixed expressions, such as *jalalt jalale* ‘from leg to leg’, as in (30), may express manner-related information, and are analysed here as such.

(30)	*Ta*	*tammu-s*	***jala-lt***	***jala-le.***
	(s)he	tread-PST.3SG	**leg-ABL**	**leg-ALL**
	‘(S)he was treading from leg to leg.’			

Overall, manner in Estonian can be expressed in various ways with the treatment above only detailing the core formal strategies of manner. Thus, this list of these formal means should not be taken as a complete one.

8. RESULTS: CHARACTERISATION OF THE DATA

The aim of this study is to test the consistent windowing hypothesis. This hypothesis suggests that motion verbs exhibit clausal patterns in which spatial and manner expressions represent similar semantic domains as verbs. To test this hypothesis, corpus data was collected for 95 motion verbs and tagged firstly for variables that stand for semantic features of verbs, and then for variables that stand for spatial and manner expressions in motion clauses. The current section characterises the data with respect to these main variables (i.e., VerbType, MotionType, HorVert, VerbSpeed, Source, FromDirection, Location, Trajectory, Direction, Goal, and MannerInstrument) and is structured as follows. Firstly, I describe the distribution of motion verbs on the basis of their semantic features. Then, I tackle the expression of spatial categories in the data both from the viewpoint of general frequencies as well as of the formal manifestations of tagged spatial expressions. Finally, I discuss the expression of manner-related information with an emphasis on the morphosyntactic forms of tagged Manner and Instrument expressions.

8.1. Motion verbs and their semantic features

Motion verbs that occur in corpus clauses are tagged for four main semantic variables: the type of verb (VerbType), type of motion (MotionType), general direction of motion (HorVert), and speed of motion (VerbSpeed). All of these variables are discussed in Section 6.1.1. The objective of the current section is to characterise the 95 motion verbs included in the study with respect to these four semantic variables.

8.1.1. Verb type

Four general types of verbs are distinguished in the dataset: source, goal, neutral, and manner of motion verbs. The distribution of verbs according to their type is given in Table 7 alongside the other verb semantic variables. Amongst the studied 95 motion verbs, manner of motion verbs are the most frequent (N = 75; see Table 7). Goal verbs[38] and source verbs (i.e., directional verbs) are represented in a more modest way (N = 15 and N = 4 respectively). In addition, there is one verb, *liikuma* 'move', labelled as a neutral verb.

[38] Note that the verbs *minema* 'go' and *tulema* 'come' are analysed as goal verbs in this study. These could also have been analysed as neutral ones similarly to the verb *liikuma* 'move' (see, for example, Özçalışkan & Slobin 2000; Fekete et al. 2013; Nikanne & van der Zee 2013). However, because of the deictic nature of these two verbs (Fillmore 1997: 77−102; Pajusalu 2004: 53–57) and that the current study is concerned with physical motion clauses where *minema* 'go' and *tulema* 'come' are used to depict actual, directional motion, they are treated as goal verbs here.

Most literature concerning motion verbs have treated directional and manner of motion verbs as distinct categories (Talmy 1985; 2000b; Levin 1993). However, interim cases of verbs expressing both directional as well as manner of motion features are sometimes also reported (Aske 1989; Rohde 2001; Cifuentes Férez 2010; Goldberg 2010; Kopecka 2010; Cardini 2012) as detailed in Section 3.2.3.3. In this thesis, this strict complementary view which treats directional and manner of motion verbs as discrete groups of verbs (Levin 1993; Rappaport Hovav & Levin 2010; Levin & Rappaport Hovav 2013) is not taken. After all, whenever motion is conducted, it is conducted in some manner, and whenever translational motion is expressed, this information about translation has to be present regardless of whether a directional or manner of motion verb is used. Nevertheless, I hold that in most cases, directional and manner of motion verbs can be easily differentiated, but not on the basis of some absolute criterion. Instead, I would submit that directional verbs foreground mainly spatial information, and manner of motion verbs foreground manner information. As such, both of these types of verbs allow implicit or more explicit inference about directional and manner information. Furthermore, this inference is present to differing degrees regarding different motion verbs.

However, two groups of verbs, here analysed as goal verbs, could also be seen as manner of motion verbs: turning verbs (e.g., *keerama* 'turn') and verbs of vertical motion (e.g., *kukkuma* 'fall'). Turning verbs express a change of direction (i.e., *keerama* 'turn', *pöörama* 'turn', and *pöörduma* 'turn'), but, simultaneously, provide information about the trajectory of motion. If the trajectory is analysed as a manner feature in the vein of Cardini (2008), these verbs could be claimed to be manner of motion verbs as they do provide knowledge about the shape of the trajectory.

Verbs of vertical motion (i.e., *kerkima* 'rise', *tõusma* 'rise, ascend', *kukkuma* 'fall', *langema* 'fall, come down', and *laskuma* 'descend') comprise a different kind of manner information. This information has to do with gravity and force dynamics. In the case of upward motion, it is conducted against gravity; in the case of downward motion, motion is controlled by gravity. As such, these verbs express the effort or ease of motion (i.e., force dynamics) and could be analysed as manner of motion verbs based on manner features as elaborated on in Section 4.4. However, these five verbs of vertical motion are coded as goal verbs in this study because they seem to incorporate more salient directional than manner features. The other verbs of vertical motion (i.e., *prantsatama* 'fall with a crash', *pudenema* 'fall off, crumble', *sukelduma* 'dive', *vajuma* 'sink', and *varisema* 'cave, crumble') are coded as manner of motion verbs as they seem to detail manner features in a foregrounded way. However, and aside from these latter verbs, all verbs of vertical motion could also be categorised as manner of motion verbs due to their force dynamic meanings (see also Section 9.1.4 for the empirical evaluation of these coding decisions, and 10.7 for further discussion).

Table 7. Distribution of the 95 motion verbs based on their semantic properties

Verb type (VerbType)	Motion type (MotionType)	Horizontal and vertical motion (HorVert)		
		horizontal motion	**horizontal and vertical motion**	**vertical motion**
source verbs	translational motion	(1) *lahkuma* 'leave', (2) *väljuma* 'exit', (3) *eemalduma* 'move away', (4) *eralduma* 'detach, separate'		
goal verbs	translational motion	(1) *lähenema* 'approach', (2) *minema* 'go', (3) *naasma* 'return', (4) *saabuma* 'arrive', (5) *sisenema* 'enter', (6) *suunduma* 'head', (7) *tulema* 'come'		(1) *kukkuma* 'fall', (2) *langema* 'fall, come down', (3) *laskuma* 'descend'
	both motions (translational and self-contained motion)	(1) *keerama* 'turn', (2) *pöörama* 'turn', (3) *pöörduma* 'turn'		(1) *kerkima* 'rise', (2) *tõusma* 'rise, ascend'
neutral verb	both motions (translational and self-contained motion)		(1) *liikuma* 'move'	
manner of motion verbs	translational motion	(1) *astuma* 'step, tread', (2) *hiilima* 'sneak', (3) *hulkuma* 'wander', (4) *jalutama* 'walk, stroll', (5) *jooksma* 'run', (6) *kihutama* 'race, career', (7) *kiirustama* 'hurry, rush', (8) *kolama* 'loaf, loiter', (9) *komberdama* 'stumble, hobble', (10) *koperdama* 'blunder', (11) *kõndima* 'walk', (12) *käima* 'walk, go', (13) *lendama* 'fly', (14) *libisema* 'glide', (15) *lippama* 'scamper', (16) *lipsama* 'slip, sneak', (17) *liuglema* 'slide', (18) *lonkama* 'limp', (19) *lonkima* 'stroll, saunter',	(1) *paiskuma* 'be thrown, shoot', (2) *purskama* 'erupt, spurt', (3) *ronima* 'climb', (4) *valguma* 'pour', (5) *viskuma* 'fling, tumble', (6) *voolama* 'flow'	(1) *prantsatama* 'fall with a crash', (2) *pudenema* 'fall off, crumble', (3) *sukelduma* 'dive', (4) *vajuma* 'sink', (5) *varisema* 'cave, crumble'

Verb type (Verb-Type)	Motion type (MotionType)	Horizontal and vertical motion (HorVert)		
		horizontal motion	**horizontal and vertical motion**	**vertical motion**
		(20) *marssima* 'march', (21) *pugema* 'creep, crawl', (22) *purjetama* 'sail', (23) *põikama* 'dodge, swerve', (24) *ratsutama* 'gallop', (25) *roomama* 'crawl', (26) *ruttama* 'hurry, rush', (27) *rühkima* 'forge, plod', (28) *sammuma* 'walk, step', (29) *sibama* 'scurry', (30) *suusatama* 'ski', (31) *sõitma* 'drive', (32) *sõudma* 'row', (33) *sööstma* 'shoot, dart', (34) *tatsama* 'toddle', (35) *tormama* 'rush, dash', (36) *trügima* 'push, scramble', (37) *tuiskama* 'drift, sweep', (38) *tungima* 'force, intrude', (39) *tõttama* 'hurry', (40) *uitama* 'stroll', (41) *ujuma* 'swim', (42) *ukerdama* 'plod', (43) *veerema* 'roll', (44) *vihisema* 'swish, whizz', (45) *väntama* 'pedal'		
	both motions (translational and self-contained motion)		(1) *hüplema* 'bob, bobble', (2) *hüppama* 'jump', (3) *kargama* 'jump, spring'; (4) *hõljuma* 'float, hover', (5) *keerlema* 'whirl, swirl', (6) *kiikuma* 'swing', (7) *lehvima* 'flow, flutter',	

Verb type (Verb-Type)	Motion type (MotionType)	Horizontal and vertical motion (HorVert)		
		horizontal motion	**horizontal and vertical motion**	**vertical motion**
			(8) *loksuma* 'splash, spill', (9) *pöörlema* 'revolve', (10) *rappuma* 'bump', (11) *tammuma* 'stamp, tread', (12) *tiirlema* 'circle, spin', (13) *tiirutama* 'spin, twirl', (14) *õõtsuma* 'sway'	
	self-contained motion		(1) *nihelema* 'fidget', (2) *rabelema* 'flounder, flutter', (3) *tõmblema* 'twitch', (4) *võpatama* 'jump, wince', (5) *värisema* 'shake, tremble'	

8.1.2. Motion type

A motion verb can depict motion which occurs in one place (the self-contained motion in Talmy's terms) or it can depict motion in which the location of the mover changes (the translational motion; see Talmy 2000b: 25–26, 35–36). Moreover, some verbs can express both the self-contained and translational motion. Regarding the 95 motion verbs (see Table 7), I treat 70 verbs as expressing translational (e.g., *astuma* 'step, tread'), 5 verbs as self-contained (e.g., *nihelema* 'fidget'), and 20 as both translational and self-contained motion (e.g., *hüppama* 'jump').

These latter 20 verbs are ambiguous in terms of expressing self-contained or translational motion, as both interpretations are possible. Jumping verbs (e.g., *hüppama* 'jump') typify this as they describe motion in which the mover can either jump in one spot or change his/her location by a particular manner, which in this example is jumping. Based on this ambiguity, one could suggest a continuum of motion verbs (see Figure 7 for an illustration). At one extreme, there are verbs that express self-contained motion (labelled as 'SelfCont-Motion'), whilst at the other extreme, there are verbs that describe translational motion (labelled as 'TranslMotion'). The two extremes are connected by verbs, which are somewhat ambiguous in being either verbs of self-contained motion or verbs of translational motion. Hence, there is the category 'BothMotions' which contains verbs that can express both self-contained and translational motion.

Self-contained motion ⟷ Translational motion

nihelema 'fidget' *rabelema* 'flounder, flutter' *tõmblema* 'twitch' *võpatama* 'jump, wince' *värisema* 'shake, tremble'	*hõljuma* 'float, hover' *õõtsuma* 'sway' *kiikuma* 'swing' *rappuma* 'bump' *pöörlema* 'revolve' *tiirlema* 'circle, spin' *tiirutama* 'spin, twirl' *keerlema* 'whirl, swirl' *tammuma* 'stamp, tread' *lehvima* 'flow, flutter'	*hüppama* 'jump' *hüplema* 'bob, bobble' *kargama* 'jump, spring'	*keerama* 'turn' *pöörama* 'turn' *pöörduma* 'turn'	*kerkima* 'rise' *tõusma* 'rise, ascend'	*uitama* 'stroll' *hulkuma* 'wander' *kolama* 'loaf, loiter' *ukerdama* 'plod' *komberdama* 'stumble, hobble' etc.	*marssima* 'march' *jooksma* 'run' *ujuma* 'swim' *sukelduma* 'dive' *suunduma* 'head' *minema* 'go' *väljuma* 'exit' etc.
SelfCont-Motion	BothMotions				TranslMotion	

Figure 7. The continuum of motion verbs with respect to MotionType

Although there are still occasional arbitrary decisions in their categorisations, verbs that are not described in the defining dictionary of Estonian (i.e., EKSS; 2009) as expressing translational motion are labelled as verbs encoding self-contained motion (see the left-hand side of the continuum in Figure 7; e.g., *nihelema* 'fidget'). Verbs at the other extreme (i.e., *uitama* 'stroll', *marssima* 'march' and so forth) express clearly translational motion. Verbs which depict aimless motion (e.g., *hulkuma* 'wander') are treated here as verbs of translational motion even though these are sometimes argued to express self-contained motion (e.g., Zlatev et al. 2010). All the verbs in the middle of the continuum are tagged as verbs expressing both self-contained and translational motion (i.e., Both-Motions). From this group, I have derived four subgroups as described below.

Firstly, there are verbs which could also be tagged for self-contained motion. This is because these verbs, although explained in the defining dictionary of Estonian (i.e., EKSS; Langemets et al. 2009) as having also translational motion properties, most likely occur rather infrequently in such directional contexts. For example, the verbs *hõljuma* 'float, hover' and *rappuma* 'bump' typically express motion in one place, but can also be used to express translational motion (e.g., *ta rappus kodu poole* '(s)he was bumping towards home').

Secondly, there are jumping verbs (e.g., *hüppama* 'jump') which could equally describe jumping with, or without, a change of location. Thirdly, there are verbs expressing the change of direction (e.g., *keerama* 'turn') which can refer to the change of position with translocation (e.g., *keeras kõrvalteele* '(s)he turned to the side-road') as well as without translocation (e.g., *keeras ringi* '(s)he turned around').

Lastly, there are two verbs, *kerkima* ‘rise’ and *tõusma* ‘rise, ascend’, which can be interpreted as the closest ones to translational motion. They express upward motion and can be used to describe the change of location (e.g., *lennuk tõusis kõrgemale* ‘the plane rose higher’). However, they can also be used to describe the change of posture achieved via upward motion in which the mover keeps his/her general location (e.g., *tõusis püsti* ‘(s)he stood up’).

Even though the precise placement of motion verbs in this continuum is debatable as such a continuum has been based on intuition, the three-way categorisation is still a reasonably accurate categorisation. As such, this method is sufficient for use in this study.

8.1.3. Horizontal and vertical motion

All verbs are tagged for the general direction of motion labelled as ‘HorVert’ (see Table 7). More specifically, 59 verbs are analysed as expressing horizontal (e.g., *kõndima* ‘walk’; labelled as ‘HorVerb’) and 10 as vertical motion (e.g., *kukkuma* ‘fall’; labelled as ‘VertVerb’). In addition, 26 verbs are considered to form an interim category (verbs labelled as ‘HorVertVerb’). This category constitutes verbs that depict both horizontal and vertical motion (e.g., *hüppama* ‘jump’, *ronima* ‘climb’), or are otherwise ambiguous with respect to the general direction. For example, verbs of self-contained motion (i.e., verbs that express motion in one place, such as *värisema* ‘shake, tremble’) could not be analysed with respect to motion along the vertical or horizontal axes and are, thus, also assigned a label ‘HorVertVerb’.

Once again, a continuum may be established ranging from verbs of horizontal motion to verbs of vertical motion. Moreover, motion verbs can typically be used flexibly. This is particularly true for verbs that have been analysed here as verbs of horizontal motion, but could also be easily used in motion clauses which refer to vertical motion (e.g., *läks maa alla* ‘(s)he went beneath the earth’). Verbs of vertical motion seem to have a more restricted usage and are consequently comparatively easy to detect. Even so, there are still boundary cases between vertical and horizontal motion on a verb level, as epitomised by the verb *sukelduma* ‘dive’. In diving, vertical motion is the aim and may be conducted as such. Nevertheless, verticality can also be reached via diagonal motion downwards. Diagonal motion, in turn, implies motion along the vertical and horizontal axes simultaneously. Consequently, the verb *sukelduma* ‘dive’ could be analysed as having features of both horizontal and vertical motion. In this study, the verb *sukelduma* ‘dive’ is, nevertheless, analysed as expressing vertical motion due to its main meaning of reaching some lower parts of the water.

8.1.4. Motion speed

In addition to the three variables (VerbType, MotionType, and HorVert) motion verbs are also tagged for another semantic variable specifying the speed of motion (i.e., VerbSpeed). That is, every motion verb in this study is assigned a numeric indicator of the speed of motion according to the results of an experiment where participants were asked to indicate the possible speed of motion a motion verb depicts (see Section 6.1.1.5 for a more detailed overview of the experiment). The results were then standardised by the participants ($m = 0$, $sd = 1$) and the mean values of these standardised assessments were calculated for every motion verb. These mean values are the values of the variable VerbSpeed and indicate the relative speed of motion as expressed by a motion verb. The smaller the value, the slower the motion the verb depicts, and the larger the value, the faster the motion.

The descriptive statistics of the variable VerbSpeed can be found in Table 8 and the values of VerbSpeed across verbs (i.e., the standardised mean speed ratings of the verbs) in Figure 8. Two important observations about the variable can be made. First, speed ratings across verbs are comparatively evenly distributed as there are no large gaps in speed values, and a clear linear tendency can be observed (see Figure 8). Second, fast motion is comparatively faster than slow motion is slow. That is, and based on the minimum and maximum values of the speed (see Table 8 and Figure 8), very slow motion (min = –1.34; *lonkima* 'stroll, saunter') does not seem to be as intense as very fast motion (max = 1.68; *kihutama* 'race, career'). This difference may also be because there are three verbs that are ranked as expressing very fast motion: *kihutama* 'race, career', *sööstma* 'shoot, dart', and *tormama* 'rush, dash'. These three verbs deviate disproportionately from the general linear line as compared to all the other verbs (see Figure 8). This suggests that verbs of fast motion are not evenly distributed.

Table 8. Descriptive statistics for the variable VerbSpeed

Descriptive Statistic	Value
Mean	−0.03
1st Quartile	−0.56
Median	−0.15
3rd Quartile	0.58
Standard Deviation	0.77
Kurtosis	−0.93
Skew	0.18
Minimum	−1.34
Maximum	1.68
N	95

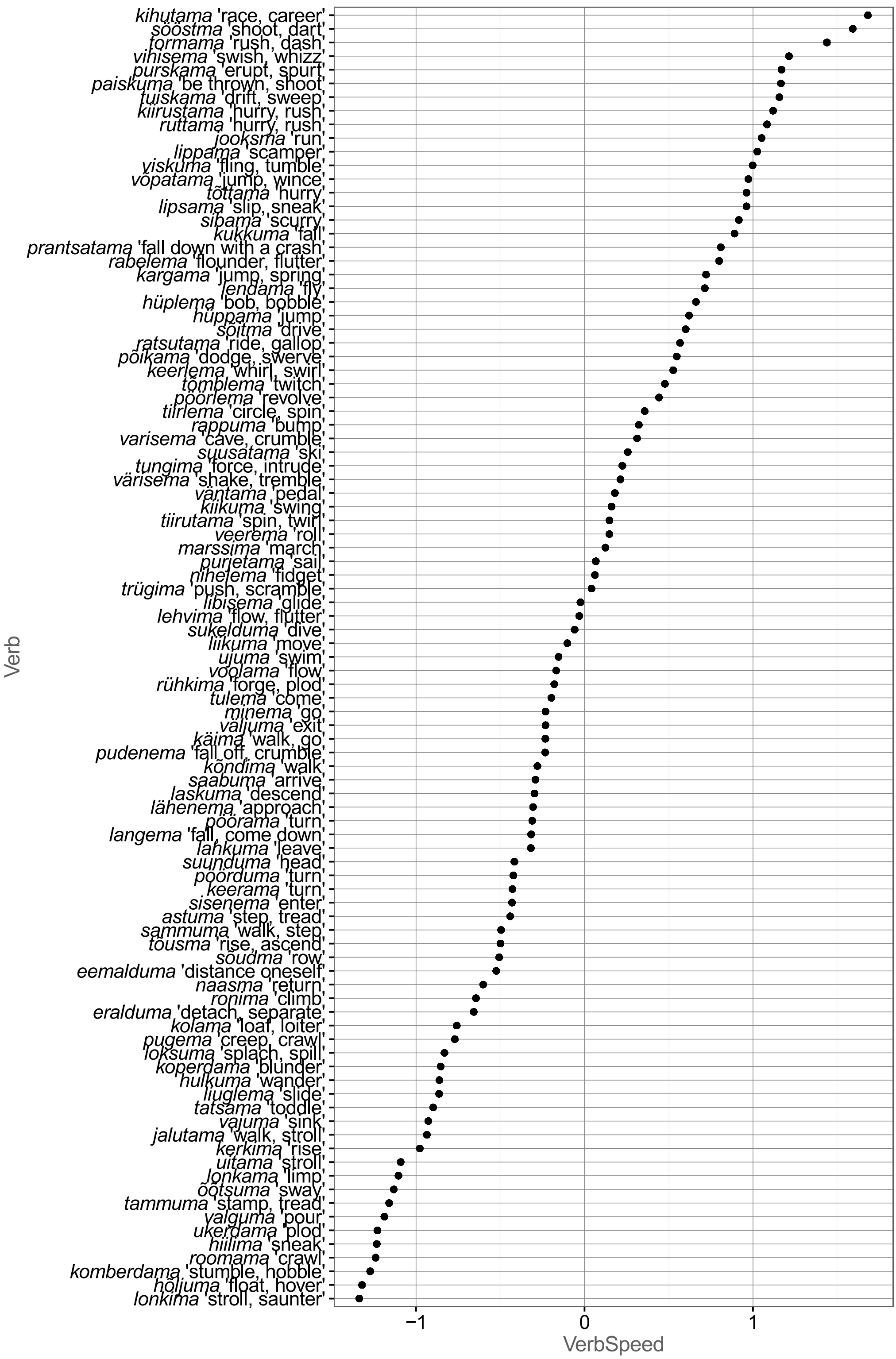

Figure 8. Standardised mean speed ratings across motion verbs

8.1.5. Summary and discussion

The discussion of the semantic characteristics of the studied 95 motion verbs yields that, as for VerbType, MotionType, and HorVert, motion verbs are unevenly represented. More specifically, manner of motion verbs expressing horizontal translational motion form a large body of the verbs that are analysed in this thesis. Verbs comprising other combinations of these three semantic features are represented in the data modestly.

The bias towards manner of motion verbs can be attributed to the typological type of Estonian as a satellite-framed language (Talmy 2000b: 27, 60; Tragel & Veismann 2008: 516; Seinberg 2011; Pool & Pajusalu 2012; Nelis & Miljan 2016). Satellite-framed languages, in turn, employ extensively manner of motion verbs (Talmy 1985; 2000b; Slobin 1996; 2004; 2006; Cardini 2008; Malt et al. 2008; Kopecka 2010; 2014; Slobin et al. 2014). Nevertheless, directional verbs form a significant proportion of the verbs analysed in this study because directional verbs are mostly high-frequency motion verbs (see Section 5). In other words, although the number of manner of motion verbs overrides the number of directional verbs, directional verbs are used in Estonian much more frequently than manner of motion verbs.

The finding that verbs tend to express translational and not self-contained motion suggests the typicality of translational motion, and that human motion is also typically translational. Furthermore, it was found that verbs of horizontal motion are much more frequent than those of vertical motion, and this can be explained by the fact that typical human motion is horizontal, rather than vertical. It should be pointed out, however, that these three features of motion verbs are coded on intuitive grounds and verbs can also receive somewhat different interpretations with respect to their semantic content.

With regard to the speed values as attributed to depicted motion, verbs are comparatively evenly distributed. This suggests that speed information may be highly relevant in describing the meaning of different motion verbs. Unlike the three semantic variables VerbType, MotionType, and HorVert, the variable VerbSpeed is tagged on the basis of the rating experiment and may, thus, be somewhat more accurate than the three other variables.

The association between the variable VerbSpeed and the other three semantic features of motion verbs (VerbType, MotionType, and HorVert) are discussed in the context of the main results of clausal patterns in Section 9.1.4. Clausal patterns of motion verbs with respect to variables VerbType, MotionType, and HorVert are examined in Sections 9.1.1., 9.1.2, and 9.1.3 respectively.

8.2. Spatial categories: general distribution and morphosyntactic realisation

Six spatial categories are included in the study: Source, FromDirection, Location, Trajectory, Direction, and Goal. Source and FromDirection correspond to the initial, Location and Trajectory to the medial, and Direction and Goal to the final portion of the path. It should be noted that these six categories examined here are not the only spatial categories that a motion description may constitute. For instance, expressions of distance refer to spatial meanings, and expressions of purpose may refer to spatial meanings. However, only the six spatial categories are the main focus of this study, and only some of the other categories are briefly discussed in Section 9.3. Consequently, the terms '**spatial expression**' and '**spatial category**' are only used to refer to the six spatial categories. This ultimately means that when reporting clauses with no overt spatial expressions, these clauses might actually contain some indications about the spatial settings beside the motion verb itself.

Each motion clause is tagged for the six spatial variables. If a clause contains the expression of the spatial category, it has the 'yes' value, and if it does not contain the expression, it has the 'no' value. In other words, spatial variables are binary ones. Initially, if there was a multiple expression of a category in a clause, the '2yes' and '3yes' values were coded (e.g., *jooksis [õues] [maja ees]* '(s)he ran outside in front of the house'). In the main analysis of the study, however, these '2yes' and '3yes' values are recoded into simple 'yes' values[39] for two main reasons. Firstly from a theoretical perspective, analysing these spatial expressions as being combined categories may lack cognitive evidence because such combinations tend to refer to one place (and not to two distinct ones). Secondly from a practical viewpoint, the number of such cases is too low (altogether 354 '2yes' and 19 '3yes' values across all spatial variables) to allow reasonable statistical examination. In the final result of the annotated data, thus, each motion clause is describable in terms of the presence or absence of the expression of the spatial categories. Furthermore, the annotation of spatial categories has a semantic basis. This means that no strict one-to-one correspondences between the form and semantics are assumed, and the semantic value of a spatial expression is assigned based on the general meaning of the clause.

The following sections provide a general overview of the distribution of expressions with regard to the six spatial categories. Furthermore, they describe each spatial category from the perspective of the formal properties of the spatial expressions.

8.2.1. Distribution of expressions of spatial categories across motion clauses

The number of clauses expressing any of the spatial categories (Source, From-Direction, Location, Trajectory, Direction, or Goal) is 6994 (74%) out of a total of 9500 clauses. Conversely, none of the spatial categories are described in 2506 (26%) motion clauses. This means that a large proportion of motion clauses contain no spatial expressions referring to the six spatial categories.

[39] As an exception, when discussing formal properties of spatial expressions, the '2yes' and '3yes' values are included in order to account for both or all three spatial expressions (see Section 8.2.2).

Verbs of different types (i.e., source, goal, neutral, and manner of motion verbs) distribute unevenly across clauses with and without spatial expressions (see Figure 9). That is, manner of motion verbs have slightly more clauses with expressions of spatial categories (76%) than source verbs (63%), the neutral verb (66%), and goal verbs (66%).

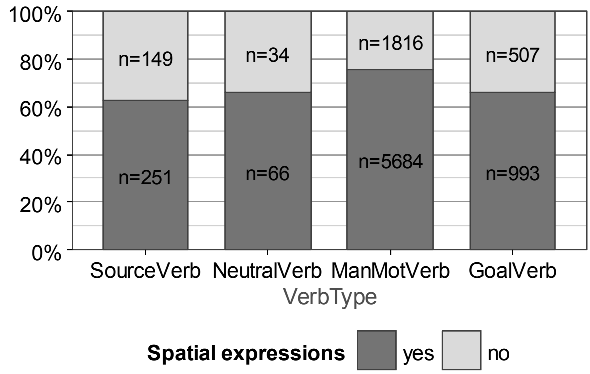

Figure 9. The presence (= yes) and absence (= no) of spatial expressions across source verbs (= SourceVerb), the neutral verb (= NeutralVerb), manner of motion verbs (= ManMotVerb), and goal verbs (= GoalVerb)

As for the type of motion, extreme differences occur (see Figure 10). Namely, verbs of translational motion typically combine with spatial expressions (80%) and verbs of self-contained motion do not (23%). Verbs expressing both motions lie somewhere in between these two types of verbs being more inclined towards co-occurring with spatial expressions (66%).

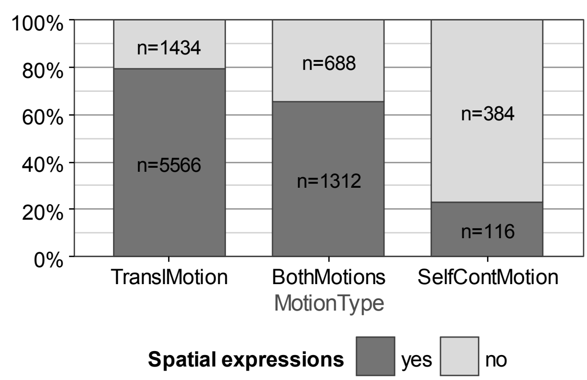

Figure 10. The presence (= yes) and absence (= no) of spatial expressions across verbs expressing translational motion (= TranslMotion), both translational and self-contained motion (= BothMotions), and self-contained motion (= SelfContMotion)

Verbs of different types (i.e., source, goal, neutral, and manner of motion verbs) distribute unevenly across clauses with and without spatial expressions (see Figure 9). That is, manner of motion verbs have slightly more clauses with expressions of spatial categories (76%) than source verbs (63%), the neutral verb (66%), and goal verbs (66%).

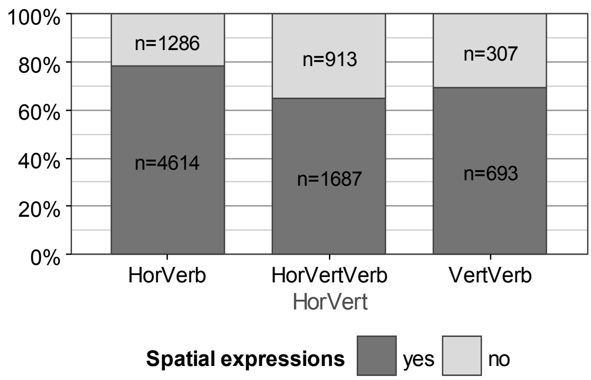

Figure 11. The presence (= yes) and absence (= no) of spatial expressions across verbs expressing horizontal (= HorVerb), ambiguous (= HorVertVerb), and vertical motion (= VertVerb)

Regarding speed information, the mean ratings of speed tend to be considerably smaller in clauses where some spatial category is expressed as compared to other clauses (see Table 9). This tendency can be inferred from differences in the mean values (m = −0.04 vs. m = 0.02), and particularly from medians which have a difference of 0.23 (m = –0.17 vs. m = 0.06). Furthermore, there is much more variation in clauses with spatial expressions (sd = 0.8) than in clauses without spatial expressions (sd = 0.68). This shows that, in general, motion verbs expressing slower motion combine more frequently with spatial expressions (regardless of the semantic category of the spatial expression) than those expressing faster motion.

Table 9. Descriptive statistics for the variable VerbSpeed in clauses with and without spatial expressions

Descriptive Statistic	Spatial expression present (= yes)	Spatial expression absent (= no)
Mean	−0.04	0.02
Median	−0.17	0.06
Standard Deviation	0.80	0.68
Minimum	−1.34	−1.34
Maximum	1.68	1.68

8.2.1.1. Combinations of spatial categories

Spatial categories (Source, FromDirection, Location, Trajectory, Direction, and Goal) can be easily combined in Estonian. This results in clausal patterns in which two or more spatial categories are depicted simultaneously. For example, the clause *Ta jooksis mööda teed järve ääre* '(S)he ran along the path to the lake' contains two spatial categories, Trajectory (*mööda teed* 'along the path') and Goal (*järve äärde* 'to the lake'). As many clauses contain such combinations of spatial expressions, the number of all clauses which express some spatial category, and the number of all spatial expressions are not equal to each other. The number of clauses which comprise at least one spatial expression is 6994; the number of all spatial expressions is 8548.

Table 10 presents the distribution of clauses with regard to the number of spatial expressions a verb combines with. The most frequent pattern (58% of all clauses) is a combination between the verb and one spatial expression (e.g., *jooksma* 'run' combines with the Goal phrase *järve äärde* 'to the lake' in *Ta jooksis järve äärde* '(S)he ran to the lake'). A quarter of a total of 9500 clauses do not express any of the six spatial categories (e.g., *Ta jooksis* '(S)he was running'). Clauses with two spatial expressions are considerably less frequent (14%; see the example above). Combinations of more than two spatial categories are rare.

Table 10. Distribution of clauses with respect to the number of spatial expressions per clause

Spatial expressions per motion clause	N of clauses	% of clauses
Motion verb + one spatial expression	5545	58.4
Motion verb + no spatial expressions	2506	26.4
Motion verb + two spatial expressions	1348	14.2
Motion verb + three spatial expressions	97	1.0
Motion verb + four spatial expressions	4	0.0
Total	**9500**	**100.0**

To provide a more detailed insight into the structure of motion clauses in terms of spatial categories, the frequencies of unique combinations of spatial variables are presented in Figure 12. Altogether 34 unique combinations of spatial variables are present in the data[40]. The first bar in the figure represents clauses with only 'no' values of spatial variables (i.e., clauses without spatial expressions; N = 2506). The following five bars show clauses that constitute a verb and one spatial expression (e.g., Verb and Goal in *Ta jooksis järve ääre* '(S)he ran to the lake'). The lower bars represent the number of clauses in which the

[40] Note that spatial variables are recoded into binary ones to indicate the presence ('yes') or absence ('no') of the expressions of spatial categories. That is, the '2yes' and '3yes' values are replaced with plain 'yes' values. Without this replacement, 66 unique combinations (e.g., Trajectory+Trajectory+Goal) were found.

verb combines with two or more spatial expressions. As a general tendency, it can be observed that the more complex the description of spatial settings, the less frequently it is used.

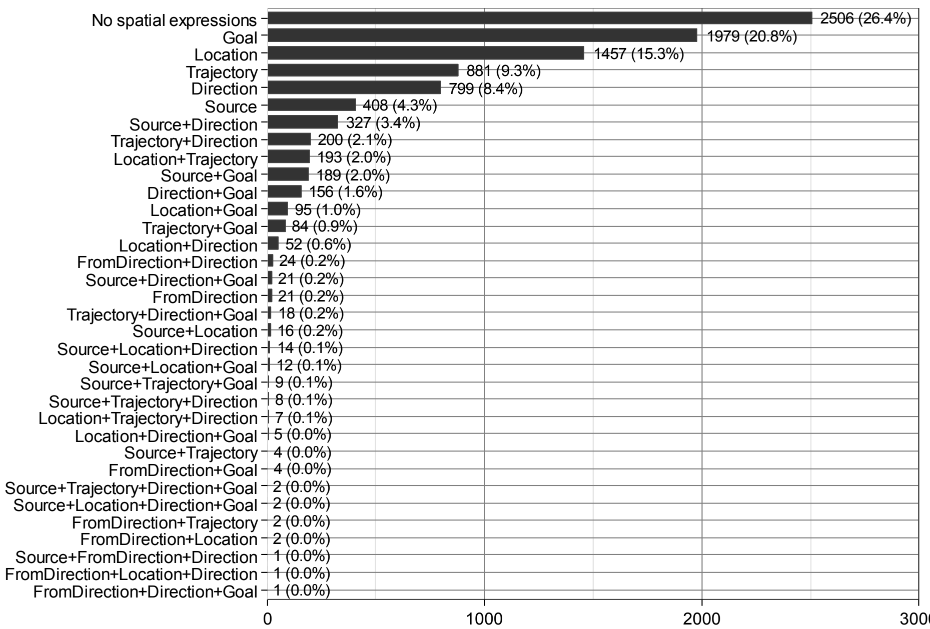

Figure 12. Frequency of unique combinations of expressions of spatial categories

Regarding the frequencies of the six spatial categories per se, Goal is expressed considerably more often than the other categories (in 27% of all clauses; see Table 11). Location, Direction, and Trajectory are encoded in considerably less clauses (20%, 17%, and 15% respectively). Source is even more modest (11%), not to mention FromDirection (< 1%).

Table 11. Number and percentage of clauses comprising expressions of spatial categories[41]

Spatial category	N of clauses	% of all 9500 clauses
Goal	2577	27.1
Location	1856	19.5
Direction	1638	17.2
Trajectory	1408	14.8
Source	1013	10.7
FromDirection	56	0.6

[41] As spatial categories can be expressed simultaneously in the same clause, the total number of clauses in the table is higher (would be 8548) than the number of clauses that contain spatial expressions (N = 6994). For this reason, the total number and percentage of clauses is not calculated.

8.2.1.2. Summary and discussion

Almost three-quarters (N = 6994) of the 9500 motion clauses contain expressions of the six spatial categories Source, FromDirection, Location, Trajectory, Direction, and Goal. Most of these clauses contain only one reference to a spatial category, but combinations of two categories are also frequent (e.g., combination of Source and Goal expressions in one clause). Combinations of more than two categories are rare. Similar finding has been presented also for English motion expressions (Rohde 2001; Stefanowitsch & Rohde 2004).

At the same time, the number of clauses where spatial categories are not expressed is substantial. This suggests that information about the spatial settings of motion emerge from other sources. It is more than likely that the meaning of the verb itself, as well as the context, is sufficient to conceptualise motion. Moreover, verbs distribute unevenly across clauses where spatial expressions do and do not occur. In other words, whether spatial expressions occur, or do not occur, in motion clauses seems to be associated with the semantics of the verb.

In particular, this considers the type of motion (MotionType) as verbs of self-contained motion (e.g., *värisema* 'shake, tremble') are considerably less likely to co-occur with spatial expressions than verbs of translational motion (e.g., *jooksma* 'run') and verbs of both motions (e.g., *hüppama* 'jump'). Other semantic features associate with the expression of spatial categories more modestly. However, and with regard to the type of verb (VerbType), manner of motion verbs combine with spatial expressions more frequently than the other verbs. In addition, if a verb expresses horizontal motion (variable HorVert), it is more likely to occur in clauses where spatial categories are described. As for the speed of motion (VerbSpeed), verbs of slow motion are more likely to combine with spatial expressions than verbs of fast motion.

When spatial information is present, the distribution of expressions of the six spatial categories Source, FromDirection, Location, Trajectory, Direction, and Goal across motion clauses is also uneven. Expressions of Goal are most frequent, followed by Location, Direction, and Trajectory. Expressions of Source are considerably less frequent and those of FromDirection rare. These general frequencies provide initial support for the *goal-over-source* principle (Ikegami 1987; Dirven & Verspoor 1998: 87–89), but as verb-specific patterns are not accounted for, this finding should be interpreted with caution.

8.2.2. Formal properties of spatial expressions

As explained in the overview of Estonian in Section 7.2, the three most common ways to convey spatial information besides the verb itself in Estonian are: (i) noun phrases inflected for (spatial) cases, (ii) adpositional phrases (both prepositional and postpositional ones), and (iii) adverbs, i.e., free adverb phrases (including demonstrative adverbs) and verbal particles[42]. In the current data, case marking is the most common strategy in expressing spatial categories, constituting roughly half of all the instances (49%). Adpositional phrases and adverbs are used in approximately a quarter of all instances (23% and 27% respectively).

Analysing formal features across spatial expressions reveals that different categories prefer different strategies (see Figure 13). Source, Location, and Goal employ mainly case-inflected noun phrases (79%, 66%, and 69% respectively). This is expected as all these categories exhibit cases which could be argued to be 'specialised' for expressing these spatial relations: ablative and elative for Source, adessive and inessive for Location, and allative, illative, and terminative for Goal. The other three categories – FromDirection, Trajectory, and Direction – in the absence of their own 'specialised' cases in contemporary Estonian, need to apply other formal means, such as adpositions and adverbs. As can be seen in Figure 13, Trajectory is often expressed by adpositional phrases (52%), and Direction by adverbs (74%). Nevertheless, all three formal strategies, including case-marking, may be applied to express all the six spatial categories.

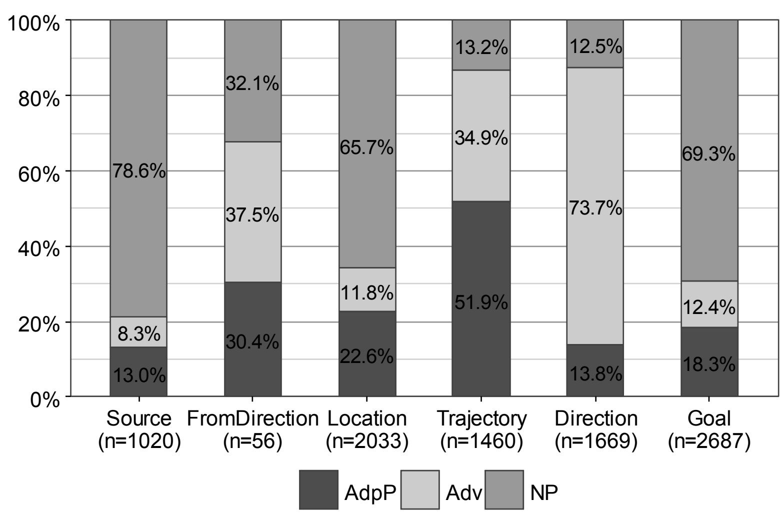

Figure 13. Formal means of expressing spatial categories

42 Please note that in this study, verbal particles are not differentiated from free adverbs. This is because in Estonian, it is very difficult to differentiate between the two types of adverbs as the two categories merge into each other and there is a lack of consensus in Estonian linguistics on the criteria of distinguishing the two. Nevertheless, in Section 9.2.2, adverbs which are clearly directional verbal particles (i.e., clear satellites) are also examined with regard to verb types for theoretical purposes. These directional verbal particles in Section 9.2.2 represent only a subset of all linguistic units that could have been interpreted as verbal particles in the data.

Source is typically marked by cases (e.g., *metsast* [ELA] 'from the forest'), but FromDirection is expressed by means of some adverb (e.g., *tagant* 'from behind'). Similarly, Location is mostly expressed with one of the locative cases (e.g., *metsas* [INE] 'in the forest'), but Trajectory is more likely to be expressed with prepositional phrases (e.g., *läbi metsa* 'through the forest'). Finally, Goal is mainly depicted by means of lative cases (e.g., *metsa* [ILL] 'into the forest'), whereas Direction tends to be expressed with an adverb, typically with a verbal particle (e.g., *läks tagasi* '(s)he went back').

In the following sections, I provide a more detailed account of the distribution and formal properties of expressions of spatial categories. Please note that all the results depend essentially on the decisions made in the coding process. For example, some units can be interpreted either as verbal particles or as adpositions in Estonian (e.g., *üle* 'over'; see Section 7.2.2). This study aims not to account for such formal issues. Thus, the coding of morphosyntactic features is based on the traditional views of Estonian grammar as attested in the monolingual dictionaries ÕS 2006 and EKSS and reference grammars of Estonian (Erelt et al. 1993; Erelt et al. 1995).

8.2.2.1. Source

Source (e.g., *majast* 'from the house') is described in 1013 of all 9500 clauses (11%). In 1006 clauses out of these 1013 clauses, only one expression of Source occurs, as in (31). In seven clauses, the reference to Source is made by two phrases as illustrated by *Pärnust Tiiu juurest* lit. 'from Pärnu from Tiiu' in (32). Altogether, there are 1020 expressions[43] analysed as instantiations of Source.

(31)	*ta*	*karga-s*	***[silla-lt]***	*alla*	*jõkke.*
	she	jump-PST.3SG	**bridge-ABL**	down.LAT	river.ILL

'(S)he jumped down from the bridge into the river.' (FC)[44]

(32)	*Egas*	*ta*	***[Pärnu-st]***	***[Tiiu***	***juurest]***	*ise*	*siia*	*ei*	*lenna-nud!*
	nor	he	**Pärnu-ELA**	**Tiiu.GEN**	**from**	himself	here.LAT	no	fly-APP

'He could not have flown here from Pärnu from Tiiu's place by himself!' (FC)

These expressions of Source are formally distributed as shown in Table 12. Noun phrases inflected for ablative and elative are the most commonly used strategies to express Source (60% and 18% respectively). Adpositional phrases (i.e., postpositional phrases) are considerably less frequent (13%). Adverbs (i.e., free adverbs and verbal particles) are used in 8% of Source expressions.

43 This number of all Source expressions is calculated as follows: 1 × 1006 + 2 × 7 = 1020. In the following sections, the same procedure is followed in calculating the number of all expressions of a particular category.

44 'FC' stands for example clauses that originate from the fiction subcorpus of the Balanced Corpus of Estonian. The list of the source texts of this corpus is available at http://cl.ut.ee/korpused/grammatikakorpus/ilukirjeldus.

Table 12. Distribution of Source expressions across formal features

General formal strategy	Form	Frequencies	Total
Noun phrases inflected for cases	NP_{ELA}	614 (60.2%)	802 (78.6%)
	NP_{ABL}	188 (18.4%)	
Adpositional phrases	PostP	133 (13.1%)	133 (13.0%)
Adverb phrases and verbal particles	Adv	85 (8.3%)	85 (8.3%)
Total			**1020 (100.0%)**

To exemplify, an elative-inflected noun phrase (i.e., *Pärnust* 'from Pärnu') is used above in (32) and an ablative-inflected noun phrase (i.e., *sillalt* 'from the bridge') in (31). A postpositional phrase (i.e., *Tiiu juurest* 'from Tiiu') can also be found in (32). The use of an adverb is exemplified by *sealt* 'from there' in (33).

(33) ... ***sealt*** *veere-vad* *välja* *apelsini-d ...*
there.SEP roll-PRS.3PL out orange-PL.NOM
'From there oranges are rolling out.' (FC)

8.2.2.2. FromDirection

FromDirection, i.e., the direction from which motion proceeds (e.g., *maja poolt* 'from the direction of the house'), is expressed in 56 motion clauses. They constitute only 0.6% of all 9500 clauses. To express FromDirection, similar strategies to the expressions of Source are found in the dataset: separative locative cases, postpositional phrases, and adverbs (see Table 13). The proportions of the three strategies are relatively similar, so compared to Source, adverbs and adpositions are more common to describe FromDirection (compare Table 12 and Table 13). Adverbs are used in 38% and postpositional phrases in 30% of FromDirection expressions. The frequent use of postpositions and adverbs can be explained by the need to specify the direction alongside the meaning of Source. As there are no cases in Estonian particularly 'specialised' to express FromDirection, cases primarily expressing Source (i.e., elative and ablative) are used (in 32% of FromDirection expressions).

Table 13. Distribution of FromDirection expressions across formal features

General formal strategy	Form	Frequencies	Total
Adverb phrases and verbal particles	Adv	21 (37.5%)	21 (37.5%)
Noun phrases inflected for cases	NP_{ELA}	16 (28.6%)	18 (32.1%)
	NP_{ABL}	2 (3.6%)	
Adpositional phrases	PostP	17 (30.3%)	17 (30.4%)
Total			**56 (100.0%)**

The use of adverbs is exemplified by the free adverb, *paremalt* 'from right', in (34), and the use of postpositional phrases by *maja poolt* 'from the direction of the house' in (35). Case-inflected noun phrases, as expressions of FromDirection, can be epitomised by *teistelt* 'from the others', as in (36), and by *idast* 'from east', as in (37).

(34) ***Paremalt*** *lähene-s* *kaubabuss ...*
right.SEP approach-PST.3SG delivery.bus
'From right, a delivery bus was approaching.' (FC)

(35) ***Maja*** ***poolt*** *õõtsu-s* *talle* *järele*
house.GEN **direction.SEP** sway-PST.3SG (s)he.ALL after.LAT
kõikse *piraka-m* *kõuts, …*
most.GEN hulking-COMP tomcat
'From the direction of the house, a huge tomcat was swaying after him/her.' (NC)[45]

(36) *Eilse-s* *põhisõidu-s* *tuiska-s* *Alonso* *stardisirge-l*
yesterday-INE main.race-INE drift-PST.3SG Alonso start.line-ADE
teiste-lt *eest …*
other-ABL in.front.of.SEP
'In yesterday's main race, Alonso drifted away from the others.' (NC)

(37) *... norralase-d* *liiku-si-d* ***ida-st*** *lään-de ...*
Norwegian-PL.NOM move-PST-3PL **east-ELA** west-ILL
'Norwegians moved from east to west.' (FC)

8.2.2.3. Location

Location (e.g., *majas* 'in the house') is expressed in 1856 of all motion clauses (20%). Amongst these 1856 clauses, 1681 comprise one expression of Location, as in (38), 158 comprise two expressions of Location, as in (39), and 17 comprise three expressions of Location, as in (40). That is, as some clauses contain more than one expression of Location, the total number of Location expressions in the dataset is 2048.

(38) *Keegi* *kõndi-s* ***[trepikoja-s]*** *...*
Someone walk-PST.3SG **staircase-INE**
'Someone was walking on the staircase.' (FC)

(39) ***[Seal]*** *nad* *kõndi-si-d* *kõik* *aeg* *neljakesi* ***[kusagil]***
there.LOC they walk-PST-3PL all time four.of.them **somewhere.LOC**
ringi ...
around
'There the four of them were walking around somewhere together all the time.' (FC)

[45] 'NC' stands for example clauses that originate from the newspaper subcorpora of the Estonian Reference Corpus. The list of the source texts of this corpus is available at http://cl.ut.ee/korpused/segakorpus/.

(40) *[Sekretäri selja taga] [akvaariumi-s] siba-b*
secretary.GEN back.GEN behind.LOC aquarium-INE scurry-PRS.3SG
*[**liiva sees**] ringi salapärane laiguline olend.*
sand.GEN inside around mysterious patchy creature
'Behind the secretary, there is an aquarium where a mysterious patchy creature is scurrying around in the sand.' (Lit. 'Behind the back of the secretary, in the aquarium, a mysterious patchy creature is scurrying around in the sand.') (NC)

There are, again, three main strategies in the encoding of Location: locative case marking, adpositions, and adverbs (see Table 14). Not surprisingly, case marking is the most frequent strategy. Noun phrases inflected for the locative cases (inessive, and adessive) constitute 65% of all Location expressions, with inessive cases being slightly more frequent than adessive cases. Adpositional phrases, primarily postpositional ones and only rarely prepositional, occur in 22% of Location expressions. Adverbs, including verbal particles and demonstrative adverbs, mark Location in 12% of instances. In addition, specific fictive motion constructions are used (0.7%).

Table 14. Distribution of Location expressions across formal features

General formal strategy	Form	Frequencies	Total
Noun phrases inflected for cases	NP_{INE}	709 (34.6%)	1335 (65.2%)
	NP_{ADE}	626 (30.6%)	
Adpositional phrases	PostP	438 (21.4%)	459 (22.4%)
	PrepP	21 (1.0%)	
Adverb phrases and verbal particles	Adv	239 (11.7%)	239 (11.7%)
Other constructions	FM	15 (0.7%)	15 (0.7%)
Total			**2048 (100.0%)**

The frequent strategy of expressing Location by case marking is exemplified by the use of inessive (e.g., *trepikojas* 'on the staircase', as in (38) above) and adessive (e.g., *sellel sillal* 'on this bridge', as in (41) below). The use of postpositional phrases was already shown above by *sekretäri selja taga* 'behind the back of the secretary', as in (40), and the example of a prepositional phrase can be found in 0 below (i.e., *keset rõdu* 'amid balcony'). Adverbs, as Location expressions, are illustrated by *ees* 'in front of' in (43) and *seal* 'there' in (39). The fictive motion expressions mostly constitute a noun inflected for elative and a locative adverb or a noun inflected for adessive or inessive (e.g., *künkast allpool* 'beneath the hillock', as in (44)).

(41) ... *kuidas ma ükspäev **selle-l silla-l** jaluta-si-n.*
how I one.day **this-ADE bridge-ADE** stroll-PST-1SG
'of how I had walked on that bridge one day' (FC)

(42) *Tatsa-b* ***keset*** ***rõdu***.
toddle-PRS.3SG **amid** **balcony.PART**
'(S)he is toddling in the centre of the balcony.' (NC)

(43) *Tema* *siba-s* ***ees*** *nii* *kiiresti, ...*
(s)he scurry-PST.3SG **in.front.of.LOC** so fast
'(S)he scurried so fast ahead.' (NC)

(44) *Ja* ***künka-st*** ***allpool*** *voola-b* *jõgi ...*
and **hillock-ELA** **beneath.LOC** flow-PRS.3SG river
'Beneath the hillock, a river is flowing.' (FC)

8.2.2.4. Trajectory

There are 1408 clauses (15%) that comprise at least one expression of Trajectory (e.g., *läbi pargi* 'through the park'). 1358 clauses contain the expression of Trajectory once, as in (45), and 51 clauses contain the expression of Trajectory twice, as exemplified in (46). Thus, they are a total of 1460 expressions of Trajectory.

(45) ... *kes* *longi-b* *aeglaselt* ***[läbi*** ***pargi]*** *...*
who stroll-PRS.3SG slowly **through** **park.GEN**
'who is strolling slowly through the park' (NC)

(46) ... *buss* *keerle-b* ***[läbi*** ***Nizza*** ***eeslinna-de]***
bus swhirl-PRS.3SG **through** **Nizza.GEN** **suburb-PL.GEN**
[kõige ***alumis-t*** ***maantee-d*** ***…pidi]***.
most.GEN **lowest-PART** **highway-PART** **along**
'The bus swhirls through the suburbs of Nizza along the lowest highway.' (NC)

In modern Estonian, there are no cases specialising in Trajectory in itself. Instead, Trajectory is expressed through a range of formal strategies that include noun phrases inflected for elative, partitive, genitive, ablative, and adessive; prepositional and postpositional phrases; and adverbs (see Table 15). Adpositional phrases are used in 52% of Trajectory expressions. Of these, prepositional phrases constitute a large body (43% of Trajectory expressions). Adverbs constitute 35% of Trajectory expressions. Often, these are the same lexemes as for adpositions (e.g., *läbi* 'through', *üle* 'over', and *mööda* 'along, past'). Case-inflected phrases constitute 13% of all Trajectory expressions with the elative case being by far the most frequent one (12% of Trajectory expressions).

Table 15. Distribution of Trajectory expressions across formal features

General formal strategy	Form	Frequencies	Total
Adpositional phrases	PrepP	625 (42.8%)	758 (51.9%)
	PostP	133 (9.1%)	
Adverb phrases and verbal particles	Adv	510 (34.9%)	510 (34.9%)
Noun phrases inflected for cases	NP_{ELA}	173 (11.9%)	192 (13.2%)
	NP_{PART}	12 (0.8%)	
	NP_{GEN}	4 (0.3%)	
	NP_{ABL}	2 (0.1%)	
	NP_{ADE}	1 (0.1%)	
Total			**1460 (100.0%)**

Despite there being no cases particularly expressing Trajectory information, there are adpositions/adverbs, such as *läbi* 'through', *üle* 'over', and *mööda* 'along, past', that serve this function. These three words themselves can occur as adpositions or adverbs (in particular, as verbal particles). In addition, whereas *läbi* 'through' and *üle* 'over' both function as prepositions when used in the function of adposition (e.g., *läbi pargi* 'through the park', as in (47), and *üle silla* 'over the bridge', as in (48)), *mööda* 'along, past' can be used either as a preposition (e.g., *mööda tänavat* 'along the street', as in (49)), or postposition (e.g., *klaasi mööda* 'by windowpane', as in (50)). The use of adverbs is exemplified by *ringi* 'around' in (51). Often, adverbs are the same lexemes as for adpositions (e.g., *läbi* 'through', as in (52); *üle* 'over', as in (53); and *mööda* 'along, past', as in (54)). When case-inflected phrases are used to express Trajectory meanings, they are mostly in the elative case, such as *trepist* 'along the stairs', as in (55).

(47) ... *kes* *longi-b* *aeglaselt* ***läbi*** ***pargi*** ...
who stroll-PRS.3SG slowly **through** **park.GEN**
'who is strolling slowly through the park' (NC)

(48) *Ivanov* *sammu-s* *vihaselt* ***üle*** ***silla*** ...
Ivanov step-PST.3SG angrily **over** **bridge.GEN**
'Ivanov stepped angrily over the bridge.' (FC)

(49) *Nad* *astu-si-d* ***mööda*** ***tänava-t*** *edasi* ...
they step-PST-3PL **along** **street-PART** forward
'They walked forward along the street on.' (FC)

(50) ... *kuid* *mõne* *tunni* *ukerda-s* *ta*
but some.GEN hour.GEN plod-PST.3SG (s)he
klaasi ***mööda*** *üles-alla* …
windowpane.PART **along** up-down
'But it/(s)he was plodding up and down along the windowglass for some hours.' (NC)

(51) ... *piirkonna-s* *tiiruta-vad* ***ringi*** *helikopteri-d.*
area-INE spin-PRS.3PL **around** helicopter-PL.NOM
'Helicopters are spinning around in this area.' (NC)

(52) *Tagasitee-l* *põiga-ti* ***läbi*** *Metsakalmistu-lt ...*
the.way.back-ADE dodge-IMPERS.PST **through** Metsakalmistu-ABL
'On the way back, they dropped round to Metsakalmistu.' (Lit. 'On their way back, they dodged through the Metsakalmistu.') (NC)

(53) ... *kuidas* *madu* *tema-st* *ranna-s* ***üle*** *rooma-s.*
how snake (s)he-ELA beach-INE **over** crawl-PST.3SG
'how a snake crawled over him/her on the beach' (NC)

(54) *Sanitar* *torma-s* *süstal* *käe-s* ***mööda***.
orderly rush-PST.3SG syringe hand-INE **pass**
'The orderly rushed pass with a syringe in his/her hand.' (FC)

(55) ... *koperda-n* ***trepi-st*** *alla ...*
blunder-PRS.1SG **stairs-ELA** down.LAT
'I'm blundering down the stairs.' (NC)

8.2.2.5. Direction

Direction (e.g., *maja poole* 'towards the house') is described in 1638 clauses (17%). One expression of Direction, as in (56), is described in 1607 clauses, and two expressions of Direction, as shown in (57), in 31 clauses. Thus, a total of 1669 expressions are analysed as Direction.

(56) ... *ning* *eemaldu-s* ***[džiibi*** ***poole]***.
and move.away-PST.3SG **Jeep.GEN** **towards**
'And (s)he moved away towards the Jeep.' (FC)

(57) *Peagi* *hiili-b* *naisekogu* ***[alla]*** ***[tagasi]***.
soon sneak-PRS.3SG woman.figure **down.LAT** **back**
'Soon a figure of a woman is sneaking back down(stairs).' (FC)

Adverbs are the main instrument to convey information about Direction (in 74% of Direction expressions; see Table 16). Postpositional phrases and noun phrases inflected for cases are used much less frequently (14% and 13% respectively). Regarding case-inflected noun phrases, the allative case is the most frequent (7%). Perhaps surprisingly, 3% of Direction expressions are inflected for inessive. The use of inessive, however, can be explained by the fact that all of these expressions contain the noun *suund* 'direction' inflected for inessive (i.e., *suunas* 'in the direction of', as in (59)). Following Estonian tradition (ÕS 2006; EKSS), these instances are analysed as nouns inflected for inessive even though *suunas* 'in the direction of' could also be interpreted as a postposition.

Table 16. Distribution of Direction expressions across formal features

General formal strategy	Form	Frequencies	Total
Adverb phrases and verbal particles	Adv	1230 (73.7%)	1230 (73.7%)
Adpositional phrases	PostP	230 (13.8%)	231 (13.8%)
	PrepP	1 (0.1%)	
Noun phrases inflected for cases	NP_{ALL}	108 (6.5%)	208 (12.5%)
	NP_{ILL}	44 (2.6%)	
	NP_{INE}	54 (3.2%)	
	NP_{PART}	2 (0.1%)	
Total			**1669 (100.0%)**

In most cases, adverbs which express Direction would be analysed as verbal particles (e.g., *alla* 'down' and *tagasi* 'back', as in (57) above). The use of postpositional phrases is exemplified by *džiibi poole* 'towards the Jeep' in (56)). The noun phrase inflected for allative is shown by *vankritele* 'towards the horsecarts' in (58) below, and the noun phrase inflected for inessive by *laua suunas* 'towards the table' in (59).

(58) ... *ja* *nad* *lähene-si-d* ***vankri-te-le*** *lõuna* *poolt.*
and they approach-PST-3PL **horsecart-PL-ALL** south.GEN direction.SEP
'and they approached the horsecarts from the south' (FC)

(59) ... *ja* *kõnni-b* *ükskõikselt* ***laua*** ***suuna-s***.
and walk-PRS.3SG indifferently **table.GEN** **direction-INE**
'and (s)he walks indifferently towards the table' (FC)

8.2.2.6. Goal

Goal (e.g., *majja* 'into the house') is the most frequently expressed spatial category. It occurs in 2576 motion clauses (27%). In 2467 clauses, there is one expression of Goal, as in (60). In 107 clauses, Goal is expressed twice, as in (61); and in two clauses, Goal is expressed thrice, as in (62). Thus, there are 2687 Goal expressions in total.

(60) *Hannes* *karga-b* ***[vette]***.
Hannes jump-PRS.3SG **water.ILL**
'Hannes jumps into the water.' (FC)

(61) *Ta ...* *välju-s* ***[alevi*** ***taha]***
(s)he exit-PST.3SG **town-GEN** **behind.LAT**
[***jõe*** ***kõrge-le*** ***kalda-le***] …
river.GEN **high-ALL** **bank-ALL**
'(S)he stepped out to the outskirts of the town to the high riverbank.' (Lit. '(S)he exited to behind the town, to a high river bank.') (FC)

(62) ... *kiirusta-s* *tema* ***[Siniaasa*** ***juurde]*** ***[katlamajja]***
hurry-PST.3SG (s)he **Siniaas.GEN** **to** **boilerhouse.ILL**
[kodumaa-armastuse ***seminari]***.
homeland-love.GEN **seminar.ILL**
'(S)he was hurrying to Siniaasa's place in the boilerhouse, to the seminar on the love for homeland.' (Lit. 'hurried he to Siniaas to the boilerhouse to the seminar on the love for homeland.') (FC)

The formal properties of Goal expressions are presented in Table 17. Noun phrases inflected for lative cases are the most frequent Goal encodings (69%), with the illative being twice as frequent (45%) as the allative (23%), and the terminative being used the least frequently (2%). Adpositional phrases (mainly postpositional ones) and adverbs are less frequent (18% and 12% respectively).

Table 17. Distribution of Goal expressions across formal features

General formal strategy	**Form**	**Frequencies**	**Total**
Noun phrases inflected for cases	NP_{ILL}	1197 (44.6%)	1860 (69.2%)
	NP_{ALL}	621 (23.1%)	
	NP_{TERM}	42 (1.6%)	
Adpositional phrases	PostP	445 (16.6%)	493 (18.3%)
	PrepP	48 (1.8%)	
Adverb phrases and verbal particles	Adv	334 (12.4%)	334 (12.4%)
Total			**2687 (100.0%)**

The use of noun phrases as Goal expressions can be seen in (60) for the illative (i.e., *vette* 'into the water'), in (63) for the allative (i.e., *tänavale* 'to the street'), and in (64) for the terminative (i.e., *märgini* 'to the buoy'). Adpositional phrases are exemplified by the postpositional phrase *voodi taha* 'behind the bed', as in (65), and by the prepositional phrase *vastu nari* 'against the bunk bed', as in (66). In (67), Goal is expressed by the adverb *siia* 'here'.

(63) ... *ja* *sa* *keera-d* ***tänava-le***, ...
and you turn-PRS.3SG **street-ALL**
'and you turn in to the street' (FC)

(64) *Paat* *libise-s* *vaikselt* ***märgi-ni*** ...
Boat glide-PST.3SG quietly **buoy-TERM**
'The boat glided quietly to the buoy.' (FC)

(65) *nupp* ... *veere-s* *lagina-l* ***voodi*** ***taha***.
knob roll-PST.3SG clatter-ADE **bed.GEN** **behind.LAT**
'The knob rolled behind the bed making a clattering sound.' (FC)

(66) *Kas* *sina* *kukku-si-d* *ka* ***vastu*** ***nari****?*
do you fall-PST-2SG too **against** **bunk.bed.PART**
'Did you fall against the bunk bed too?' (FC)

(67) *Kui* *ma* *kunagi* ***siia*** *saabu-si-n ...*
when I at.one.time **here.LAT** arrive-PST-1SG
'When I arrived here at some time ago.' (FC)

8.2.2.7. Summary and discussion

The data suggest that amongst the three main strategies to express spatial categories in Estonian, case marking is the most prominent one, even though the role of adpositional phrases and adverbs is also significant. Importantly, all spatial categories seem to have somewhat different strategies in how they are expressed.

Source, Location, and Goal prefer case marking, and this is presumably due to the existence of grammatical cases being 'designed' to express these categories. That is, elative and ablative cases encode separative (i.e., Source) meanings, inessive and adessive cases encode locative (i.e., Location) meanings, and illative and allative cases lative (i.e., Goal meanings). Furthermore, the distribution of inner and outer cases varies across the six spatial categories. Source and Goal tend to be expressed by means of the inner cases (i.e., elative and illative respectively; e.g., *Pärnust* 'from Pärnu' and *vette* 'into the water'), but Location applies frequently both the inner and outer cases (i.e., inessive and adessive; e.g., *trepikojas* 'in the staircase' and *sillal* 'on the bridge').

Conversely, FromDirection, Trajectory, and Direction make extensive use of adpositional phrases and adverbs. This can be explained by the fact that these three categories all lack their own 'specialised' cases. Trajectory expressions are frequently prepositional phrases (e.g., *läbi pargi* 'through the park') or adverbs (frequently verbal particles; e.g., *ringi* 'around'), and most Direction expressions are adverbs (mainly verbal particles; e.g., *alla* 'down'). The three categories are nevertheless also expressed by case-inflected noun phrases. FromDirection is frequently conveyed through the use of noun phrases inflected for elative (e.g., *idast* 'from east'). Trajectory and Direction are less frequently expressed through the use of noun phrases, but if they are, Trajectory tends to employ elative (e.g., *trepist* 'along the stairs') and Direction allative (e.g., *(lähenesid) vankritele* '(they approached) the horsecarts').

These findings add to the findings of formal properties of motion expressions in Estonian (Rätsep 1978; Pajusalu & Orav 2007; Pool & Pajusalu 2012; Pajusalu et al. 2013; Nelis & Miljan 2016). Moreover, the results also add to the knowledge on the distribution of case-inflected noun phrases, adpositional phrases, and adverbs across semantic domains of space in Estonian (Tauli 1973; 1983; Rätsep 1978; Erelt et al. 1993; 1995; Vainik 1995; Erelt 2003a).

8.3. Manner: occurrences and morphosyntactic realisations

The variable for manner, MannerInstrument, stands for expressions of how motion is conducted (for a detailed overview of manner features see Section 4.4). This variable refers to both manner and instrument expressions (hence, MannerInstrument) and is tagged as present in 1860 (20%) motion clauses out of a total of 9500 clauses. Amongst these 1860 clauses, MannerInstrument is expressed once in 1715 clauses, as in (68); twice in 138 clauses, as in (69); and thrice in 7 clauses, as in (70). This makes a total of 2012 expressions of MannerInstrument. Note that similarly to spatial variables, the respective ‘2yes’ and ‘3yes’ values are later reanalysed as simple ‘yes’ values.

(68)	*Ta*	*kõndi-s*	***[paljajalu]***.
	(s)he	walk-PST.3SG	**barefoot**

‘(S)he walked barefoot.’ (FC)

(69)	... *ja*	*tõtta-b*	***[kahe-le***	***kepi-le***	***toetu-des]***	***[kärmelt]***
	and	hurry-PRS.3SG	**two-ALL**	**crutch-ALL**	**lean-GER**	**quickly**
	foto-t	*too-ma*.				
	photo-PART	bring-INF				

‘and, leaning on two crutches, (s)he hurries quickly to bring the photo’ (NC)

(70)	... *ja*	*ta*	*kõndi-s*	***[pisut***	***sissepoole***	***pööra-tud***
	and	(s)he	walk-PST.3SG	**slightly**	**inward.LAT**	**turn-PPP**
	kinganina-de-ga],	***[ettevaatlikult],***	***[ikka***	***tipa-tapa]***.		
	shoe.toe-PL-COM	**cautiously**	**ever**	**pitter-patter**		

‘and (s)he walked cautiously pitter-patter, toes slightly inward’ (FC)

There are a number of manner features, such as body movements, effort, rhythm, and speed, as discussed in Section 4.4. The following sections elaborate on this semantic heterogeneity of the variable MannerInstrument, as well as presenting the formal manifestations of these expressions of MannerInstrument.

8.3.1. Semantic features of the annotated expressions of MannerInstrument

Manner expressions in the data are annotated as present when the expression refers to one or more of the following features: main body movements, accompanying body-movements, medium of motion, position or posture of the mover, physical condition of the mover, energy, force, weight, effort, continuity, harmony, steadiness, rhythm, trajectory, instrument, sound, speed, the appearance of the mover, and emotional state of the mover. These semantic features are detailed in Section 4.4 as theoretically possible manner features. This section shows that these features actually occur in the data and, thus, serves as a semantic background for the statistical analyses presented in Section 9.2.

Manner features can be incorporated both in verb meanings (though some of these may be less explicitly present or even absent), and in other expressions. However, the ability of the verbs to incorporate a variety of meanings is still somewhat limited compared to other linguistic means, such as noun or adverb phrases. This means that if manner is expressed outside the verb (i.e., by means of manner expressions), the formal and semantic variability of these outside-expressions is much more diverse.

However, not all expressions that have any of the manner features as listed above are tagged as manner expressions. The only expressions which are tagged as manner ones are those that provide explicit or implicit information about the motor pattern of the mover. Furthermore, many physical and emotional states, movements, and appearances can occur independently of motion. However, when occurring in the context of motion clauses, it is rather likely that they specify also the motor pattern of the mover. I have, though, not distinguished between these manner features when annotating the data because this would not have been possible based on one person's intuition. Thus, the exact frequencies of manner features cannot be reported.

Expressions that refer to the movements that are conducted in order to move (e.g., *sujuvate aerutõmmetega* 'oars stroking smoothly', as in (71)) and expressions which specify the part of the body responsible for carrying out the main motion (e.g., *jalgsi* 'on foot', as in (72)) occur frequently in the data, and are clear instances of manner of motion. Expressions of the kind can also describe the contact between the mover and the surface (e.g., *paljajalu* 'barefoot', as in (73)).

(71) ... *ent* *nüüd* *lähene-s* ***sujuva-te*** ***aerutõmme-te-ga***
but now approach-PST.3SG **smooth-PL.GEN** **oar.stroke-PL-COM**
karavelli-le.
caravel-ALL
'But now (s)he was approaching the caravel, oars stroking smoothly.' (FC)

(72) *Me* *kõndi-si-me* *need* *kolmsada* *meetri-t* ***jalgsi**.*
we walk-PST-1PL these three.hundred metre-PART **on.foot**
'We walked these three hundred metres on foot.' (FC)

(73) *Ta* *kõndi-s* ***paljajalu**.*
(s)he walk-PST.3SG **barefoot**
'(S)he walked barefoot.' (FC)

In addition to these basic movements, the accompanying movements are expressed. These movements can, in turn, be divided into two groups based on the affected parts of the body, and whether or not these parts of the body are simultaneously responsible for main motion too. First, there are co-movements which strongly influence the overall quality of motion, and these movements themselves may be caused by the physical condition of the mover, as exemplified by *longates* 'limping' in (74). Second, there are co-occurring movements that do not affect or affect modestly the main motor pattern. In this case, such expressions provide additional information about the nature of the motion. This is illustrated by the phrase *õige kergelt värisevate kätega* 'with only slightly shaking hands', as in (75).

(74) *Sergejev suundu-s* ***longa-tes*** *bussipeatuse poole ...*
Sergejev head-PST.3SG **limp-GER** bus.stop.GEN towards
'Limping, Sergejev headed towards the bus stop.' (FC)

(75) ***õige kergelt väriseva-te käte-ga,*** *muidugi kummikinnas-te-s*
only slightly shaking-PL.GEN hand.PL-COM of.course rubber.glove-PL-INE
käte-ga, lähene-s Pjotr Ilja poeg tema ees
hand.PL-COM approach-PST.3SG Pjotr Ilja.GEN son he.GEN in.front.of
lamaskleva-le odaliski-le.
sprawl-ALL odalisque-ALL
'The hands of Pjotr, Ilja's son, were shaking slightly when he was approaching the odalisque lying in front of him.' (Lit. 'With only slightly shaking hands, of course, with rubber gloved hands, approached Pjotr, Ilja's son, the sprawling odalisque in front of him.') (FC)

Expressions of the position or posture of the mover are also manner expressions. The position of the mover determines the movements one can make and, thus, contributes significantly to the motor pattern. This is shown by *poolkülitsi* 'crookedly' in (76). In addition, the physical state of the mover directly influences the movements of the mover. For instance, the phrase *purjuspäi* 'drunkenly', as in (77), clearly evokes a typical motor pattern of this condition.

(76) *... ja kõndi-si-n* ***peaaegu et poolkülitsi.***
and walk-PST-1SG **almost that crookedly**
'And I walked almost crookedly.' (FC)

(77) *Jõgeva meer ... ukerda-b* ***purjuspäi*** *tänava-l ...*
Jõgeva mayor plod-PRS.3SG **drunkenly** street-ADE
'The mayor of Jõgeva is plodding drunkenly along the street.' (NC)

There are also the so-called fundamental concepts (Cardini 2008: 544–545) that a motion can evoke: energy, force, weight, effort, continuity, harmony, steadiness, and rhythm. These concepts are not motion-specific in that they may be expressed in a variety of domains. However, when used in the context of motion clauses, the expression of these fundamental concepts provides information about the general motor pattern. For example, *kandami raskusest tuikudes* 'staggering under the weight of his burden', as in (78), explicitly refers to the motor pattern (which is staggering) and implies that motion is heavy, laborious, abrupt, clumsy, and somewhat uncontrolled. The phrase *elegantselt* 'elegantly', as in (79), refers to the motor pattern only implicitly by creating an image that motion is light, effortless, continuous, elegant, and controlled. What both these examples also show is that manner features form bundles in that several features are expressed simultaneously by a clausal unit. This is one of the main reasons why the classification of manner expressions (as well as manner verbs) on the basis of manner features would be very difficult, if not impossible, at least on intuitive grounds.

(78) *Arturs välju-s* ***kandami raskuse-st tuiku-des*** ...
Arturs exit-PST.3SG **burden.GEN heaviness-ELA stagger-GER**
'Arturs went out, staggering under the weight of his burden.' (FC)

(79) ... *ja liugle-s maasturi järel* ***elegantselt*** *oma*
and slide-PST.3SG off-road.vehicle.GEN after **elegantly** his/her
poe-ni välja …
shop-TERM until
'and (s)he slided elegantly after the off-road vehicle to his/her shop' (NC)

If we consider expressions which only implicitly provide information about the motor pattern, descriptions about the general appearance of the mover are also manner expressions and occur in the data. This considers information about appearance and facial expressions, or general behaviour of the mover. Such expressions may act as clear reflections of the motor pattern, but may also provide more subtle, yet crucial information about the nature of the described motion. For example, the reference to the clothing of the mover by *särgi väel* 'in my shirtsleeves', as in (80), entails that motion is carried out with fast steps (because it is cold) and, thus, contributes to the description of the motor pattern. The image that is evoked in people's minds depends both on the conceptualiser, and also on the context where the particular phrase occurs. In addition, the footwear one wears or does not wear (as indicated by the phrase *paljajalu* 'barefoot', as in (81)) directly contributes to the way one can, for instance, walk. Even the facial expression the mover has, may suggest in this context what the movement looks like, as exemplified by *asjatundlikul ilmel* 'having a look of an expert' in (82).

(80) *Lippa-si-n korra* ***särgi väel*** *üle tänava putka-sse*
scamper-PST-1SG only.once **shirt.GEN wearing** over street.GEN kiosk-ILL
suitsu too-ma ...
cigarette.PART bring-INF
'Only once, I ran across the street to the kiosk for cigarettes; I was in my shirtsleeves.' (Lit. 'I scampered only once in my shirtsleeves over the street to the kiosk to bring the cigarettes.') (NC)

(81) *Ta kõndi-s* ***paljajalu***.
(s)he walk-PST.3SG **barefoot**
'(S)he walked barefoot.' (FC)

(82) ... *tiirle-vad nad* ***asjatundliku-l ilme-l*** *ümber auto.*
circle-PRS.3PL they **expert-ADE look-ADE** around car.GEN
'Having a look of an expert they circle around the car.' (NC)

The phrase *asjatundlikul ilmel* 'having a look of an expert' in (82) simultaneously reflects the emotional state of the mover where emotional state is comparatively independent of motion. That is, a participant can typically be in one kind of state, such as being sad regardless of the motion. However, someone's emotional state can often be inferred from their motor patterns, and vice versa for inferring someone's emotional state. For example, and in (83), *vihaselt* 'angrily' provides also information about the energy, and perhaps speed of motion. As such, it evokes an image of the movements of the body an angry human can make.

(83) *Ivanov sammu-s* ***vihaselt*** *üle silla ...*
Ivanov step-PST.3SG **angrily** over bridge.GEN
'Ivanov stepped angrily over the bridge.' (FC)

Besides these features, I analyse the expressions of the speed, trajectory, instrument, and sound of motion as manner expressions. This is because motion is typically defined as the change of position of some entity during some time. Thus, there is no motion without a movable entity that moves along some trajectory at a certain speed, and either produces, or does not, some sound. In addition, motion may and may not be facilitated by some instrument or vehicle. Consequently, all speed, trajectory, and instrument expressions are tagged as manner expressions in the study, but sound ones are only selectively tagged.

As for speed expressions, these refer to how fast or slow the motion is. Most, if not all, manner expressions incorporate some reference to the speed of motion, and there are also expressions that do it exclusively. For example, the time expression *aeglaselt* 'slowly', as in (84), refers to the very slow manner of moving. In (85), the speed of motion can only be inferred from the fact that the mover is limping, which makes the motion slower than it normally would be.

(84) *Mati, kes longi-b* ***aeglaselt*** *läbi pargi ...*
Mati who stroll-PRS.3SG **slowly** through park.GEN
'Mati who is slowly strolling through the park' (NC)

(85) *Sergejev suundu-s* ***longa-tes*** *bussipeatuse poole ...*
Sergejev head-PST.3SG **limp-GER** bus.stop.GEN towards
'Limping, Sergejev headed towards the bus stop.' (FC)

Trajectory expressions of manner indicate the shape of the trajectory[46]. This, in turn, entails what the possible motor pattern may be. In (86), *otse* 'directly' indicates a straight trajectory. In (87), *loogeldes* 'meandering' shows a non-linear trajectory.

[46] This manner feature of trajectory is very close to the respective spatial category Trajectory. The main difference is that Trajectory as a spatial role specifies the spatial relationship between the trajector and landmark, whereas the trajectory as a manner feature specifies the shape of the path.

(86)	*Roomik*	*suundu-s*	***otse***	*minu*	*poole ...*
	tank	head-PST.3SG	**directly**	I.GEN	towards

‘The tank headed directly towards me.’ (FC)

(87)	*All*	*madala*	*oru*	*põhja-s*	*voola-s*
	underneath.LOC	deep.GEN	valley.GEN	bottom-INE	flow-PST.3SG
	loogel-des	*oja …*			
	meander-GER	stream			

‘Underneath, at the bottom of a deep valley, meandering, a stream was flowing.’ (FC)

Instrument expressions refer to any vehicle or other instrument that helps to conduct the desired motion. In (88), this information is captured by the phrase *hobustega* lit. ‘with horses’, and in (89), by *karkudel* ‘on crutches’.

(88)	*...*	*ratsuta-takse*	***hobus-te-ga**.*
		ride-IMPERS.PRS	**horse-PL-COM**

‘They are riding horses.’ (NC)

(89)	*Komberda-n*	***karku-de-l***	*ringi.*
	stumble-PRS.1SG	**crutch-PL-ADE**	around

‘I stumble around on crutches.’ (NC)

In addition to the speed, trajectory, and instrument, some sound expressions (i.e., expressions that refer to any auditory sounds) are coded in the same way as expressions of manner, as they contribute to the understanding of the depicted motor pattern. However, it is essential to note that not all sound expressions may be treated as manner expressions that provide information about the motor pattern if they occur in the context of motion. In the data, there are three types of sounds that are annotated as manner information. First, there are sounds which are produced by the mover as a consequence of being in motion. These are sounds coming from inside of the mover as described by the phrase *ähkides* ‘gasping’, as in (90); and *õudsa kolinaga* ‘with an awful noise’, as in (91), and are caused by motion itself. Sounds arising from the contact of the mover and medium (such as a surface or liquid) are also very manner-like information as exemplified by *heleda sulpsatusega* ‘with a light splash’ in (92).

(90)	*Ta*	*rooma-s*	***ähki-des***	*külmkapi*	*ukse-ni ...*
	(s)he	crawl-PST.3SG	**gasp-GER**	fridge.GEN	door-TERM

‘Gasping, (s)he crawled to the door of the fridge.’ (NC)

(91)	*Trammi-d*	*loksu-vad*	***õudsa***	***kolina-ga**.*
	tram-PL.NOM	shake-PRS.3PL	**awful.GEN**	**noise-COM**

‘Trams are jouncing with an awful noise.’ (NC)

(92)	*...*	*ja*	*[kala]*	*lange-s*	***heleda***	***sulpsatuse-ga***	*tagasi.*
		and	fish	fall-PST.3SG	**light.GEN**	**splash-COM**	back

‘and [the fish] fell back [to the water] with a light splash’ (FC)

Second, there are sounds which are produced by the mover that are somewhat independent of motion. Nevertheless, these expressions give information about the mental state of the mover and characterise the nature of motion as shown by *vaikides* 'silently' in (93); and *huilates* 'hootingly' in (94). Admittedly, such expressions could also be interpreted differently.

(93) ***Vaiki-des*** *sisene-ti* *rahvamajja,* *(vaiki-des*
be.silent-GER enter-IMPERS.PST community.house.ILL (be.silent-GER
võe-ti *iste-t).*
take-impers.PST seat-PART)
'Silently, they entered the community house; (silently, they took a seat).' (FC)

(94) *Mööda* *Sõpruse* *puiestee-d* *vihise-b* ***huila-tes*** *kiirabi.*
along Sõprus.GEN avenue-PART swish-PRS.3SG **hoot-GER** ambulance
'Along Sõprus avenue, the ambulance raced pass with its siren wailing.' (NC)

Finally, some sounds that surround the mover, and are not produced by the mover, are also analysed here as manner expressions. Primarily, when motion is conducted following the rhythm of the surrounding sounds, such expressions are taken here as manner expressions. This is exemplified by *muusika rütmis* 'in the rhythm of the music' in (95).

(95) *Juba* *õhtumiitingu* *avamise-l* *tatsa-s* *ta* ***muusika***
already eve.meeting.GEN opening-ADE toddle-PST.3SG (s)he **music.GEN**
rütmi-s *…*
rhythm-INE
'Already at the opening of the evening meeting, (s)he was toddling along the rhythm of the music.' (NC)

I regard the speed, trajectory, and instrument as manner of motion, and I treat sound as manner of motion only when there is a causal relationship between the sound and the motion. Other expressions, albeit providing *how*-information, are typically not tagged as manner expressions unless a clear influence on described motor patterns could have been inferred. This means that whether a particular expression can be analysed as a manner expression is decided upon on a case-by-case basis, as it is not possible to cover the variability of contexts where these expressions occur by a single definition.

Nevertheless, there are three types of expressions that are excluded from manner expressions. These are expressions which specify the (i) co-movers (e.g., *kõndis koos semudega* '(s)he walked with his/her friends'); (ii) number of movers (e.g., *kõndis üksinda* '(s)he walked alone'); and (iii) portable things (e.g., *väljus kotiga* 'she exited with a bag'). On formal and semantic grounds, *nud*- and *tud*-participle constructions are excluded as they refer to the previously occurring event (e.g., *söök söödud, jooksis ära* 'having eaten his/her lunch, (s)he ran away'). In addition, most instances of the verbless constructions are also excluded when they do not specify the motor pattern (e.g., *jooksis, müts* *peas* 'wearing a hat, (s)he ran') except when clearly specifying the posture of the mover (e.g., *hüppas jalad koos* '(s)he jumped, legs together').

8.3.2. Formal properties of manner expressions

From the analysis above, one can conclude that there is a great semantic diversity in the expression of MannerInstrument. The formal manifestations of the variable MannerInstrument also indicate heterogeneity of this category (see Table 18). As for major formal strategies, adverbs are commonly used to express manner-related information (43%), followed by noun phrases inflected for comitative (15%), noun phrases inflected for adessive (9%), and the *des*-construction (i.e., gerund; 9%). Other strategies are significantly less frequent.

Table 18. Distribution of MannerInstrument expressions across formal features

General formal strategy	Form	Frequencies	Total
Adverb phrases	Adv	866 (43.0%)	866 (43.0%)
Noun phrases inflected for cases	NP_{COM}	308 (15.3%)	681 (33.8%)
	NP_{ADE}	189 (9.4%)	
	NP_{INE}	105 (5.2%)	
	NP_{ESS}	53 (2.6%)	
	NP_{ABE}	16 (0.8%)	
	NP_{ELA}	4 (0.2%)	
	NP_{PART}	3 (0.1%)	
	NP_{ABL}	2 (0.1%)	
	NP_{TERM}	1 (0.1%)	
Other constructions	*des*-construction	187 (9.3%)	421 (21.2%)
	comparison	140 (7.0%)	
	fixed expressions	38 (1.9%)	
	mata-construction	26 (1.3%)	
	verbless clause	22 (1.2%)	
	NumP	8 (0.5%)	
Adpositional phrases	PostpP	44 (2.2%)	44 (2.2%)
Total			**2012 (100.0%)**

Although the expressions of instrument are included in the category of manner, it is worthwhile to examine separately the formal properties of 'pure' manner expressions and instrument ones. In what follows, the 'pure' Manner is described first followed by the analysis of Instrument.

The 'pure' Manner (e.g., *kiiresti* 'quickly') is expressed in 1641 (17%) motion clauses out of a total of 9500 clauses, and in 1770 instances of all 2012 manner and instrument expressions (88%). The distribution of these expressions based on their formal properties is given in Table 19. There are two main strategies to convey manner information: through the use of adverbs (49%) and through the use of noun phrases (26%). Amongst the noun phrases, noun phrases inflected for comitative are the most frequent (10.1%), followed by inflection for adessive (7%), inessive (4%), and essive (3.0%). Other case marking strategies are rare in the data and they are comprised of abessive, elative, partitive, ablative, and terminative cases. Two other common formal strategies to express Manner are the gerund or *des*-construction (10.5%) and constructions of comparison (8%). The *des*-construction (and its negative counterpart *mata*-construction) is a non-finite verb which in motion clauses can convey manner meanings. There are also occasional instances of other formal means (verbless clauses, measure phrases, fixed expressions), all of which seem to have only a minor importance to the category.

Table 19. The distribution of formal properties of Manner expressions (Instrument excluded)

General formal strategy	Form	Frequencies	Total
Adverb phrases	Adv	864 (48.8%)	864 (48.8%)
Noun phrases inflected for cases	NP_{COM}	179 (10.1%)	457 (25.8%)
	NP_{ADE}	125 (7.1%)	
	NP_{INE}	76 (4.3%)	
	NP_{ESS}	53 (3.0%)	
	NP_{ABE}	14 (0.8%)	
	NP_{ELA}	4 (0.2%)	
	NP_{PART}	3 (0.2%)	
	NP_{ABL}	2 (0.1%)	
	NP_{TERM}	1 (0.1%)	
Other constructions	*des*-construction	186 (10.5%)	420 (23.7%)
	comparison	140 (7.9%)	
	fixed expression	38 (2.1%)	
	mata-construction	26 (1.5%)	
	verbless clause	22 (1.2%)	
	NumP	8 (0.5%)	
Adpositional phrases	PostpP	29 (1.6%)	29 (1.6%)
Total			**1770 (100.0%)**

The use of adverbs as manner expressions is epitomised by *jalgsi* 'on foot' in (96). Case-inflected noun phrases can be found in (97) for comitative (i.e., *mõõdetud sammuga* 'at a measured pace'), in (98) for adessive (i.e., *sagedal sammul* 'at a frequent pace'), in (99) for inessive (i.e., *teises rütmis* 'with another rhythm'), and in (99) for essive (i.e., *sihikindlana* 'purposefully'). The other frequent formal strategy, the gerund or *des*-construction, is exemplified by *kiirustades* 'hurriedly' in (100), and constructions of comparison by *kui meele-segane* 'as a mad' in (101).

(96) *Me kõndi-si-me need kolmsada meetri-t **jalgsi**.*
we walk-PST-1PL these three.hundred metre-PART **on.foot**
'We walked these three hundred metres on foot.' (FC)

(97) *Ta jaluta-s **mõõde-tud sammu-ga** ukse-st välja ...*
(s)he walk-PST.3SG **measure-PPP pace-COM** door-ELA out
'At a measured pace, (s)he walked out of the door.' (FC)

(98) *... mees ... eemaldu-s **sageda-l sammu-l** ...*
man move.away-PST.3SG **frequent-ADE pace-ADE**
mööda pargitee-d
along park.path-PART
'The man moved away at a frequent pace along the park path.' (FC)

(99) *... suundu-s **hoopis teise-s rütmi-s**, toimekalt,*
head-PST.3SG **quite other-INE rhythm-INE** expeditiously
sihikindla-na väljapääsu poole.
purposeful-ESS exit.GEN towards
'S/he headed towards the exit in a totally different pace and with a business-like attitude and determined look.' (Lit. '(S)he headed with quite another rhythm, expeditiously, purposefully towards the exit.') (FC)

(100) *Naine ... eemaldu-s **kiirusta-des** ...*
woman move.away-PST.3SG **hurry-GER**
'The woman moved away hurriedly.' (FC)

(101) *Nicola komberda-s **kui meelesegane** kuhugi.*
Nicola stumble-PST.3SG **like frenzy** somewhere.LAT
'Nicola stumbled somewhere like a mad person.' (NC)

Instrument (e.g., *lennukiga* 'by plane') is expressed in 242 (3%) motion clauses out of a total of 9500 clauses. In these 242 clauses, only one expression of Instrument in each clause occurs. Thus, there are 242 instances of all 2012 manner and instrument expressions (12%). By means of the form, case-inflected noun phrases are used in 93% of the clauses. Comitative case marking is dominant (53%), followed by adessive (27%), and inessive marking (12%). Other formal means (*des*-construction, postpositional phrases, adverbs, and noun phrases inflected for abessive) are only modestly used (see Table 20).

Table 20. The distribution of the formal properties of Instrument expressions

General formal strategy	Form	Frequencies	Total
Noun phrases inflected for cases	NP_{COM}	129 (53.3%)	224 (92.6%)
	NP_{ADE}	64 (26.5%)	
	NP_{INE}	29 (12.0%)	
	NP_{ABE}	2 (0.8%)	
Adpositional phrases	PostpP	15 (6.2%)	15 (6.2%)
Adverb phrases	Adv	2 (0.8%)	2 (0.8%)
Other constructions	*des*-construction	1 (0.4%)	1 (0.4%)
Total			**242 (100.0%)**

The comitative case marking, *lennukiga* 'by plane', is epitomised in (102). Adessive-inflected noun phrase (i.e., *maailma ainsal personaallennukil* 'on the world's only personal plane') is used in (103) and inessive-inflected noun phrase (i.e., *hobuse seljas* 'on the back of the horse') is used in (104).

(102) *Pavka lenda-s* ***lennuki-ga*** *ette meie saabumis-t ja*
Pavka fly-PST.3SG **plane-COM** ahead our.GEN arrival-PART and
majutamis-t korralda-ma.
housing-PART arrange-INF
'Pavka flew there by plane beforehand to arrange our arrival and housing.' (FC)

(103) *Bigart naas-i-s oma Riiki*
Bigart return-PST-3SG his.GEN State.ILL
maailma ainsa-l personaallennuki-l *...*
world.GEN only-ADE personal.plane-ADE
'Bigart returned to his State on the world's only personal plane.' (FC)

(104) *Ratsuta-s* ***hobuse selja-s*** *mööda küla ringi ...*
ride-PST.3SG **horse.GEN back-INE** along village.GEN around
'(S)he rode the horse in the village around.' (NC)

8.3.3. Summary and discussion

The category of manner (i.e., variable MannerInstrument) is heterogeneous in comprising expressions of various manner features. This extends the knowledge of the expression of manner of motion in linguistics, and indicates that Estonian distinguishes manner meanings in such a detail that satellite-framed languages have a tendency to (Talmy 1985; 2000b; Slobin 1996; 2004; 2006; Özçalışkan & Slobin 2003; Cardini 2008; Malt et al. 2008; 2014; Kopecka 2010; Slobin et al. 2014). Similarly, the morphosyntactic inventory of these manner expressions is significantly richer than of spatial categories. In other words, the semantic heterogeneity of manner seems to be reflected in the formal heterogeneity of this category. The three most common ways to convey manner-related information are adverbs, noun phrases inflected for comitative, and the *des*-construction. Other means are much more modestly applied to express manner.

9. RESULTS: VERB SEMANTICS MEETS CLAUSAL PATTERNS

The main hypothesis of the current study is that motion verbs have specific clausal patterns in which the important information is expressed by means of several linguistic units. More specifically, the hypothesis suggests that motion verbs and other expressions in the clause tend to have similarities in their semantics, and that they tend to refer to the same portion of the path. In other words, I expect that important information is expressed in an enhanced manner in motion clauses through the simultaneous use of several linguistic units which entail similar information. In this study, this hypothesis is called the '**consistent windowing hypothesis**' to capture the idea that verbs and other expressions in a clause should have a tendency to window (i.e., express) similar information.

Such clausal patterns would account for a plausible explanation of language as this would concur with what is known about the cognitive processing of visual motion, the characteristics of attention, and the processing of language itself. This knowledge concerns the fact that objects in motion have an advantage of being processed faster than static objects (Tynan & Sekuler 1982; Ungerleider & Mishkin 1982; Fitzpatrick et al. 1983; Albright 1984; Livingstone & Hubel 1988; Goodale & Milner 1992; Watson et al. 1993; Dupont et al. 1994; Tootell et al. 1995; Schmolesky et al. 1998; Aschersleben & Müsseler 1999), and that there is a difference in the processing of spatial and manner information (Johansson 1973; Johansson 1976; Wu et al. 2008).

Furthermore, attention is limited and selective (James 1890: 402–458; Kahneman 1973; Desimone & Duncan 1995; Luck et al. 2000; Cowan et al. 2005; Alvarez & Franconeri 2007), but a moving object easily attracts attention (Tipper et al. 1990; Yantis & Hillstrom 1994; Abrams & Christ 2003; Franconeri & Simons 2003; Howard & Holcombe 2010). Finally, language cannot be separated from other cognitive domains (Miller & Johnson-Laird 1976; Langacker 1987; 1991; Talmy 2000a; 2000b). It has a bodily basis (Johnson 1987; 1989; Lakoff 1987; Dodge & Lakoff 2005), and must follow the capacity of working memory (Baddeley & Hitch 1974; Gathercole & Baddeley 1993; Cowan et al. 2005; Shen et al. 2014).

In addition, these patterns of consistent windowing would be consistent with the findings in linguistics which show that, at least in some languages, source verbs have a tendency to combine with Source phrases (Rohde 2001: 140–150, 312–324; Levinson 2006: 157–158, 199–204; Kita 2006: 449–462), goal verbs with Goal phrases (Rohde 2001; Rakhilina 2004; Stefanowitsch & Rohde 2004; Cristobal 2010; Kopecka 2010; Taremaa 2013), and many manner of motion verbs with atelic phrases, such as Location ones (Aske 1989; Slobin & Hoiting 1994; Stefanowitsch & Rohde 2004; Kopecka 2010; Taremaa 2013).

To test the hypothesis of consistent windowing, clausal patterns with respect to motion verbs are examined. The results of these examinations are presented in the following structure. First, I discuss the clausal patterns from the perspective of spatial information. Then, I proceed to the analysis of the expression of manner information. After that, other factors that can influence the structure of motion clauses are briefly addressed. Finally, the motion verbs of the study are classified and the whole data are analysed also from a different perspective to verify the results and to account for all factors simultaneously.

9.1. Verb semantic features of space and the expression of spatial categories

The material of the study consists of actual motion clauses for 95 motion verbs (100 clauses per verb; hence, 9500 clauses). I do not analyse each verb individually, because this may have distracted attention from understanding the clausal patterns of motion verbs from a holistic viewpoint. To capture verb semantics into more general categories and to allow statistical analysis, four verb-specific variables are included (see also Section 6.1.1): (i) type of verb (VerbType), (ii) type of motion (MotionType), (iii) general direction of motion (HorVert), and (iv) speed of motion (VerbSpeed). All of these variables represent meanings that could more or less clearly be considered as verb semantic ones. However, it should be noted that when regarding verb semantics, possible usage contexts would have some influence on how the semantics of a verb can be interpreted.

The following sections are devoted to these four verb semantic variables with regard to clausal patterns of spatial expressions. The main emphasis is on the type of verb (VerbType) as this is one of the main instruments here to test the consistent windowing hypothesis. The variables of the type of motion (MotionType) and the direction of motion (HorVert) are included as variables that can interfere with the other variables in predicting the outcome. The final variable of motion speed (VerbSpeed) is also a variable that would allow the capture of the semantic diversity of motion verbs. This concerns particularly manner of motion verbs, a heterogeneous group of verbs that are difficult to classify on a semantic basis (see also Section 4.4).

9.1.1. Verb type and spatial categories

The suggested semantic agreement between motion verbs and spatial expressions, or, in other words, the consistent windowing, could manifest itself in clausal patterns where source verbs have a preference of combining with Source, and FromDirection expressions (e.g., *väljus toast* '(s)he exited the room'), goal verbs with Direction, and Goal expressions (e.g., *suundus toa poole/tuppa* '(s)he headed towards the room/into the room'), and manner of motion verbs with Location, and Trajectory expressions (e.g., *kõndis linnas/üle tänava* '(s)he walked in the city/across the street'). As such, the verb and spatial expression would specify similar spatial regions. These three predicted patterns are typical examples of the consistent windowing of the initial, final, and medial portion of the path respectively.

These patterns are in line with the results of several studies (Rohde 2001; Rakhilina 2004; Stefanowitsch & Rohde 2004; Kita 2006; Levinson 2006; Cristobal 2010; Kopecka 2010; Taremaa 2013). They do, however, contradict with the studies of the *goal-over-source* principle which suggest that Goal should be expressed prominently in languages (Ikegami 1987; Dirven & Verspoor 1998: 87–89; Lakusta & Landau 2005; Lewandowski 2012; Pajusalu et al. 2013). If the predictions were confirmed, only goal verbs would have a tendency to combine with Goal expressions, whereas other verbs would not obey to the principle.

I present the results of the correspondence analysis in Figure 14 in order to give a preliminary view of the structure of the data[47]. Correspondence analysis is an explorative technique that reduces multidimensional data to a two-dimensional space. From the plotted results one can then infer important clusters of the values of some variable with respect to the other variables (see also Section 6.2.3). The closer the verbs are to the labels of spatial variables, the more frequently they tend to combine with each other. The closer the verbs or the variables are to each other, the more similar they are. The correspondence analysis of motion verbs and spatial variables is based on a contingency table where all the 'yes'[48] values of each spatial category are counted. The 'no' values are not considered. This, in turn, means that only the clauses where some spatial category is expressed (N = 6994) are included in this analysis here.

The results of the correspondence analysis (see Figure 14) provide initial evidence that the expression of spatial categories is not equal across clauses with different motion verbs. Taking the *x*-axis, which explains 47.4% of the variation in the data, it is clear that spatial categories form a continuum between static and dynamic categories: Location is placed on the left of the figure, the four directional variables (Source, FromDirection, Direction, and Goal) on the right, and Trajectory in the middle of the figure. This suggests that Trajectory exhibits directional properties despite the fact that it stands for the medial portion of the path together with Location. Nevertheless, these directional properties do not seem to be as strongly expressed as in the case of Source and Goal, that represent the initial and final portion of the path (see also the discussion in Section 4.3).

[47] Please note that the figures of the correspondence analyses in this study aim to show only general tendencies for verbs of different semantics. This is done by using different colours for different types of verbs. The exact placement of individual verbs in these figures is largely irrelevant with regard to this general aim. For this reason, verbs in the figures blend into each other.

[48] Recall that the 'yes' value shows that a category is expressed in a motion clause, and the 'no' value shows that it is not.

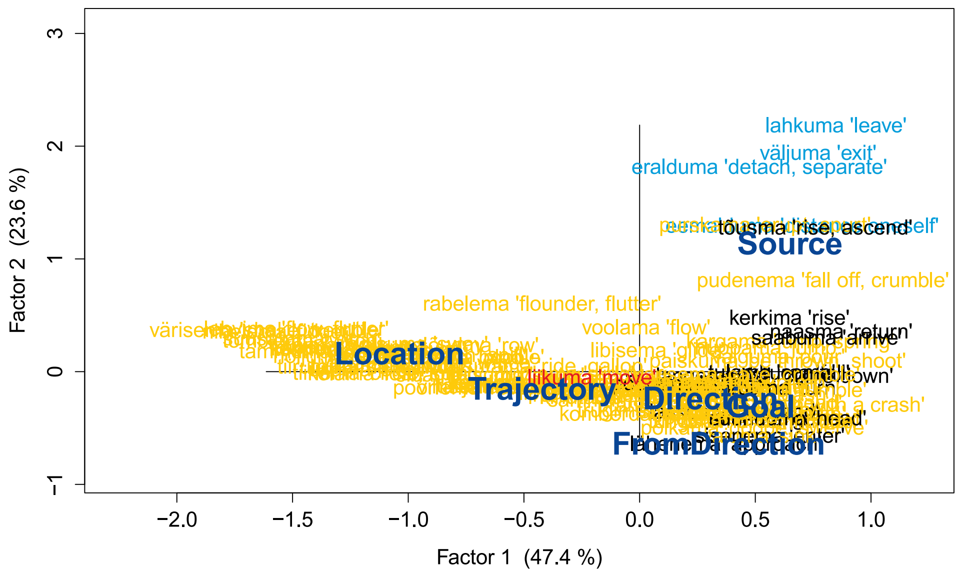

Figure 14. Results of the correspondence analysis. Large dark blue labels stand for spatial variables. Smaller labels refer to particular motion verbs: blue = source verbs, black = goal verbs, yellow = manner of motion verbs, red = the neutral verb

Regarding spatial variables and verbs belonging to different verb types, the following observations can be made from the correspondence analysis (see Figure 14). As expected, the four source verbs (shown in blue) tend to cluster around the variable Source (i.e., source verbs tend to co-occur with Source expressions). Goal verbs (shown in black), although close to Source, cluster around Direction, and Goal (i.e., they have a tendency to combine with Direction, and Goal, but also Source expressions). Interestingly, however, the category FromDirection shows more commonality to Direction, and Goal than to Source. This is particularly evident when we analyse the plot along the vertical axis. As for manner of motion verbs (shown in yellow), these are spread horizontally along the plot with the main density around Location, Trajectory, Direction, and Goal. This means that manner of motion verbs combine with expressions that refer to the medial, and the final portion of the path. The neutral verb *liikuma* ‘move’ (shown in red) is in the middle of the plot near Trajectory and Direction that suggests that it is mainly used in combination with Trajectory, and Direction expressions.

The frequencies of spatial expressions across verbs of different types are presented in Figure 15 (with FromDirection excluded due to its small frequencies). It can be seen that source verbs combine frequently with Source, goal verbs with Direction, and Goal, and manner of motion verbs (as well as the neutral verb) with Location, Trajectory, Direction, and Goal. The Chi-square test reveals a significant association between the type of verb and preferable spatial category with a weak effect size[49]: $\chi^2(12, N = 8492) = 1512.9$, $p < 0.001$, Cramér's V = 0.24.

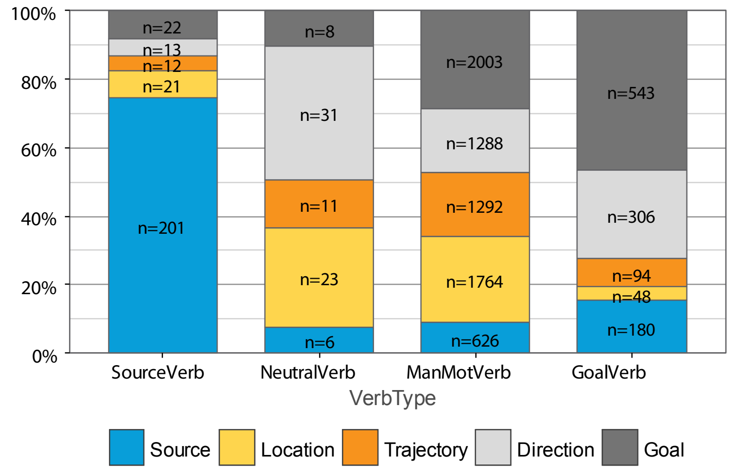

Figure 15. Distribution of spatial expressions of Source, Location, Trajectory, Direction, and Goal across source verbs (= SourceVerb), the neutral verb (= NeutralVerb), manner of motion verbs (= ManMotVerb), and goal verbs (= GoalVerb)

The results are further supported by Pearson's residuals (see Table 21). Pearson's residuals provide information on which cell values deviate significantly from the situation without significant associations (see also Section 6.2.1). Regarding the current data, positive values indicate preferable combinations between verbs of different types and spatial expressions, while negative values show that such combinations are infrequent or rare[50].

Table 21. Pearson's residuals for the spatial variables and VerbType

	SourceVerb	NeutralVerb	ManMotVerb	GoalVerb
Goal	−6.60	−3.26	−2.44	**9.96**
Direction	−5.40	**4.04**	−1.55	**5.33**
Trajectory	−4.88	−0.58	**3.97**	−7.20
Location	−4.93	1.38	**6.15**	−13.00
Source	**29.82**	−1.12	−7.14	**3.41**

The cell referring to combinations of source verbs with Source expressions deviates strongly indicating a high frequency of such clauses (see Table 21).

[49] Recall that Cramér's V measures the strength of association between two variables. It varies from 0 to 1. The value 0.1 shows weak, 0.3 medium, and 0.5 strong effect size: the higher the value, the more bound the two variables are (Cohen 1988: 224–225).
[50] If the values are smaller than −2 or larger than +2, significant deviances can be reported (Agresti 1996: 38–39; Durrheim & Tredoux 2004: 375).

Other combinations bear negative values, which suggest infrequent combinations between source verbs and the other spatial expressions. Goal verbs, on the other hand, exhibit high positive values for Goal, Direction, and Source. This shows a tendency for goal verbs to combine with directional spatial expressions. At the same time, goal verbs have significantly less combinations with Location, and Trajectory expressions than could be expected by chance.

These results of source and goal verbs confirm the results of the correspondence analysis. The behaviour of manner of motion verbs is somewhat ambiguous in the correspondence analysis. According to Pearson's residuals, however, clausal patterns of manner of motion verbs are consistent with the hypothesis as manner of motion verbs do tend to co-occur with Location, and Trajectory expressions. Manner of motion verbs' combinations with Source, and Goal are either unlikely or insignificant in the context of all verbs shown by small negative values of Pearson's residuals. The neutral verb *liikuma* 'move' seems to be different to the other verbs as it is inclined towards Direction, but away from Goal.

The tendency of consistent windowing seems, thus, to be present in the data. Goal verbs have a preference for the final portion of the path, as in (105), whereas there is a lack of expressions referring to the medial portion of the path. Source verbs show an extremely strong tendency to occur with Source expressions, as in (106). Unlike goal verbs, which are frequently used with Source expressions in addition to Direction and Goal ones, source verbs combine with Direction, and Goal expressions very rarely. In a dissimilar way to goal and source verbs, manner of motion verbs are inclined towards the medial portion of the path, as in (107).

(105)	*Nüüd*	***suundu-b***	*naine*	***tagasi***	***voodi-sse*** *...*
		[GV]		**[Direction]**	**[Goal]**
	now	**head-PRS.3SG**	woman	**back**	**bed-ILL**

'The woman is heading now back to bed.' (FC)

(106)	*Ta*	*ol-i*	*siin*	*ainsa-na*	***rongi-st***	***välju-nud***.
					[Source]	**[SV]**
	(s)he	be-PST.3SG	here.LOC	sole-ESS	**train-ELA**	**exit-APP**

'(S)he was the only one who exited the train here.' (FC)

(107)	***Tatsa-b***	***toa-s***	*tähtsa*	*näo-ga*	***ringi*** *...*
	[MMV]	**[Location]**			**[Trajectory]**
	toddle-PRS.3SG	**room-INE**	proud.GEN	face-COM	**around**

'(S)he is toddling around in the room with a proud face.' (NC)

Taken together, motion verbs and spatial expressions tend to refer to the same portion of the path. This suggests that the hypothesis of consistent windowing holds. However, as indicated by the correspondence analysis, the data exhibits a considerable variation, particularly regarding manner of motion verbs which form a large proportion (N = 75) of all the 95 verbs. As the associations show only weak effect sizes, the complexity of the data is not accounted for in full.

In order to describe the structure of the data more accurately, I examine each spatial category separately by presenting the results of significance testing, as well as conditional random forests, and conditional inference trees. The goal of applying the random forests is to establish significant variables that contribute to the expression of each spatial category, and also to reveal the reliability of the conclusions in terms of prediction performances. For a more detailed description of the data and patterns of motions clauses, I present the conditional inference tree for each spatial variable. Conditional inference trees allow the structure of the data to be analysed in a very detailed way, resulting in many more patterns than I discuss in the following analyses below. Here, I concentrate only on the main patterns where specific spatial categories are likely to occur.

More specifically, the aim of the following subsections is to reveal the role of the type of verb in predicting the presence of a particular spatial category in motion clauses. Since in Estonian the expressions of spatial categories combine rather freely, not only the associations between a spatial category and verb types, but also the complex set of spatial categories alongside the type of verb is examined. In other words, the dependent variables in the analyses of random forests and conditional inference trees are the spatial categories (i.e., Source, Location, Trajectory, Direction, or Goal), whereas the independent variables are the type of verb (VerbType) and all the other five spatial variables. The variable FromDirection is not analysed as a dependent variable as it is expressed rarely in the data (N = 56). It is included in the analyses only as an independent variable. In addition to the 'yes' values, the following analyses include also 'no' values, since these contribute to a more comprehensive picture of the data in terms of constructional patterns of spatial variables. This is because a substantial amount of motion clauses (N = 2506; 26%) in the data do not contain any expressions of the six spatial categories. These clauses are, thus, not represented in the analysis of the contingency data above, whereas verbs of different semantics are clearly sensitive to whether space is expressed or not as discussed in Section 8.1.

9.1.1.1. Source

The previous section shows that source verbs have a strong tendency to combine with Source expressions. This is also the case when 'yes' and 'no' values of the variable Source are included in the analysis. Figure 16 shows that 50% of clauses with source verbs contain Source expressions, whereas the other verbs show such combinations comparatively rarely. Note that altogether, Source is expressed (i.e., has the 'yes' values) in 1013 motion clauses (11%; see also Section 8.2.1). Evaluation of the role of the verb type on the presence of Source expressions reveals significant association between the two: $\chi^2(3, N = 9500) = 705.37$, $p < 0.001$. The effect size is small, but close to moderate: Cramér's V = 0.27.

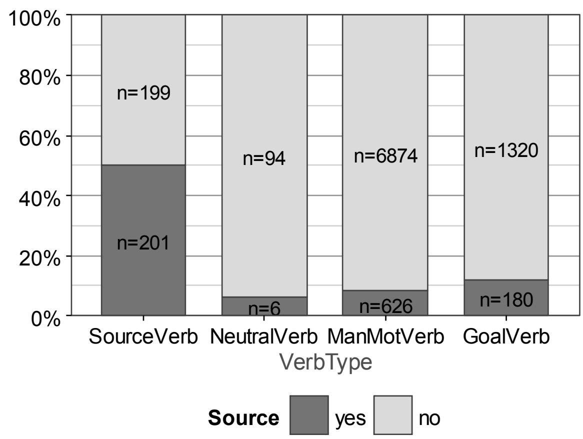

Figure 16. The presence (= yes) and absence (= no) of Source expressions across source verbs (= SourceVerb), the neutral verb (= NeutralVerb), manner of motion verbs (= ManMotVerb), and goal verbs (= GoalVerb)

Pearson's residuals in Table 22 confirm these findings, but provide also that particularly manner of motion verbs do not tend to have clauses with Source expressions.

Table 22. Pearson's residuals for Source and VerbType

	SourceVerb	NeutralVerb	ManMotVerb	GoalVerb
Source expression absent (= no)	−8.38	0.49	2.12	−0.55
Source expression present (= yes)	**24.25**	−1.43	**−6.14**	1.59

Aside from the type of verb, other factors too may contribute to whether Source is expressed or not. Here, I evaluate whether spatial variables FromDirection, Location, Trajectory, Direction, and Goal predict the variation of Source alongside VerbType. For prediction, I apply conditional random forests with the measure of conditional variable importance C (for an overview, see Sections 6.2.2 and 6.2.5).

Variable importances in predicting Source are presented in Figure 17. The variables that are significant in predicting the dependent variable are placed to the right of the vertical line. The further away from the vertical line the variable is, the more it contributes to the variation of the variable. As for Source (see Figure 17), the type of verb is the top variable positioned on the very right of the figure, while the other variables are located close to the vertical line.

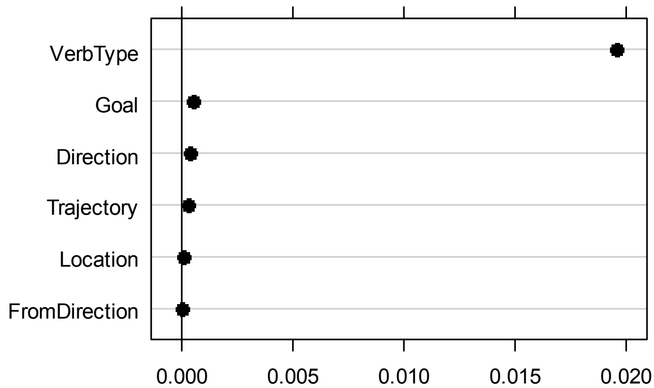

Figure 17. Conditional variable importance in predicting Source (predictors to the right of the vertical line are significant): Source ~ FromDirection + Location + Trajectory + Direction + Goal + VerbType

This finding suggests that whether Source is expressed or not can mostly be explained in terms of the type of verb. Validating the predictive ability of such analysis, the index of concordance C is calculated[51]. The index of concordance for Source is C = 0.78, which indicates close to good performance.

The analysis of conditional inference trees with all the aforementioned six independent variables can be found in Figure 18. The conditional inference tree provides further evidence that the expression of Source is mainly associated with VerbType because all significant constructions fall into two sets based on this factor (see Node 1). Centrally, source verbs (presented to the right of the tree) are opposed to the other verbs.

As for typical clausal patterns, it is particularly likely that source verbs (SV) have Source expressions present when Direction, Goal, and Trajectory are not described as can be seen in Node 34 (which can be found by moving along Nodes 1, 29, 31, and 33) of the tree. In the corpus example, as shown in (108), the source verb *väljuma* ‘exit’ combines with the Source phrase *kasarmutest* ‘from the barracks’. Direction, Goal, and Trajectory are not expressed in this clause, whereas the expression of Location (and FromDirection) is irrelevant in this pattern.

(108)	*Tanki-d*	***välju-vad***	***kasarmu-te-st*** ...
		[SV]	**[Source]**
	Tank-PL	**exit-PRS.3PL**	**barrack-PL-ELA**
	‘The tanks are exiting the barracks.’ (FC)		

51 The index of concordance C, also known as C-index or C-statistic, measures the performance of the model. If C = 0.5, the performance is no better than chance; if C = 1.0, the independent variables in the model predict the dependent variable perfectly. In general, when C = 0.7, the model is satisfactory, when C = 0.8, the results have great validity, and when C = 0.9 (or more), the model is excellent (Hosmer Jr et al. 2013: 177).

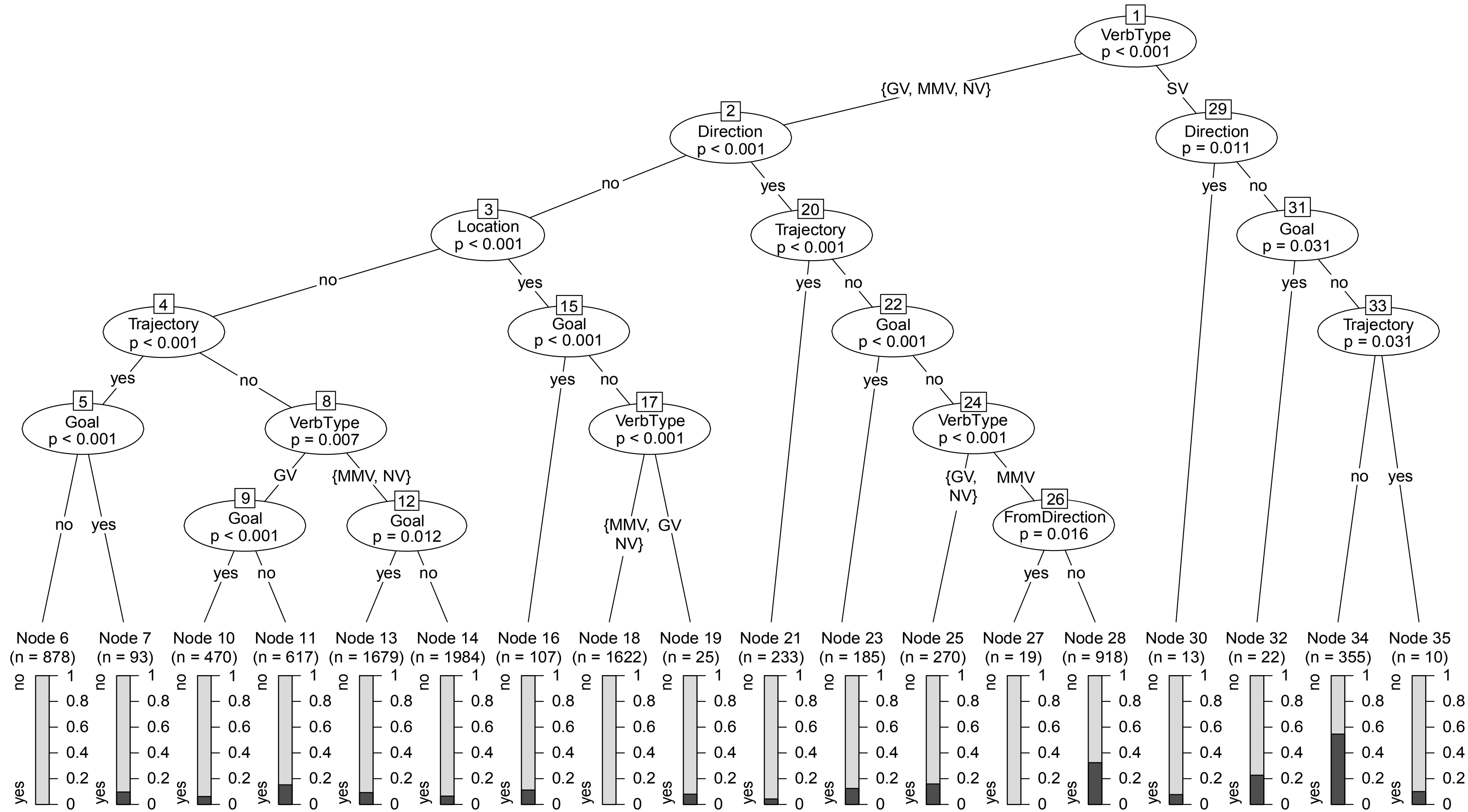

Figure 18. Conditional inference tree for Source: Source ~ FromDirection + Location + Trajectory + Direction + Goal + VerbType; SV = source verbs, NV = the neutral verb, MMV = manner of motion verbs, GV = goal verbs

In the case of the other types of verbs, much variation in clausal patterns can be observed (see Figure 18). Manner of motion verbs (MMV) show one distinct pattern where Source is somewhat more prominent than in other combination (see Node 28). In this pattern, there is a presence of Direction and an absence of Trajectory, Goal, and FromDirection expressions, as in (109), where the manner of motion verb *sööstma* 'shoot, dart', the Source expression *pilvedest* 'from the clouds', and the Direction expression *alla* 'down' occurs. Even so, this pattern is not as prominent as the one for source verbs.

(109)	***Pilve-de-st***	***sööst-i-s***	***alla***	*lenda-v*	*inimene ...*
	[Source]	**[MMV]**	**[Direction]**		
	cloud-PL-ELA	**dart-PST-3SG**	**down**	fly-PTCP	human

'From the clouds, a flying human darted down.' (FC)

To summarise, the expression of Source is mainly associated with the type of verb as predicted by the hypothesis, and suggested by the analysis of count data. In other words, Source is dominantly described in combination with source verbs. The other spatial variables contribute to the expression of Source only marginally. However, the analysis of random forests shows that VerbType and the five spatial variables analysed together predict Source comparatively well.

9.1.1.2. Location

Preliminary investigations on frequencies of Location expressions (Location is expressed in 1856 clauses (20%)) in Section 9.1.1 prove that Location expressions combine dominantly with manner of motion verbs. The analysis of all clauses across the 'yes' and 'no' values of Location confirms this result. 24% of clauses with manner of motion verbs contain Location expressions, whereas source and goal verbs combine with Location expressions rarely. The neutral verb behaves similarly to manner of motion verbs. Significance testing shows that the expression of Location has a bearing on the type of verb: $\chi^2(3, N = 9500) = 383.06$. The effect size is small: Cramér's V = 0.20.

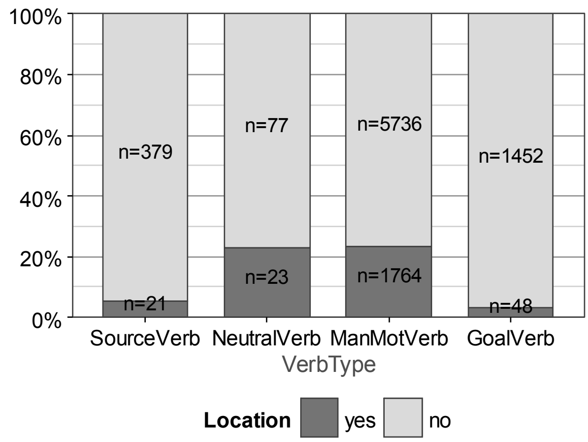

Figure 19. The presence (= yes) and absence (= no) of Location expressions across source verbs (= SourceVerb), the neutral verb (= NeutralVerb), manner of motion verbs (= ManMotVerb), and goal verbs (= GoalVerb)

The examination of Pearson's residuals (see Table 23) confirms that manner of motion verbs have frequent combinations with Location, whereas directional, particularly goal verbs, have very little such combinations. The neutral verb is insensitive to the expression of Location as well as being insensitive to Source (compare Table 22 and Table 23).

Table 23. Pearson's residuals for Location and VerbType

	SourceVerb	NeutralVerb	ManMotVerb	GoalVerb
Location expression absent (= no)	3.19	−0.39	−3.85	7.05
Location expression present (= yes)	**−6.46**	0.78	**7.80**	**−14.31**

The evaluation of the independent variables in the model of random forests shows that this set of variables is equally insignificant (see Figure 20). This result may be caused by the multicollinearity of the independent variables, and for that reason, none of these can contribute sufficiently to the outcome.

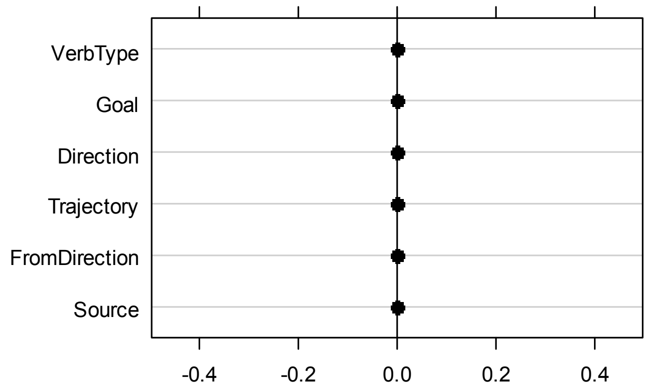

Figure 20. Conditional variable importance in predicting Location (no predictor is significant): Location ~ Source + FromDirection + Trajectory + Direction + Goal + VerbType

The conditional inference tree in Figure 21 gives, nevertheless, further information regarding typical patterns where Location is expressed.

Namely, Goal classifies the data into two main groups (see Node 1), and Location expressions can be found more frequently in clauses where a manner of motion verb or the neutral verb is used. The expression of Location is particularly likely if no other spatial category is expressed (see Node 11). The examples for this pattern can be found in (110), where the manner of motion verb *loksuma* 'splash, spill' combines with the Location phrase *Kalevi jahtklubi kai ääres* 'beside the wharfs of Kalev's yacht club'; and in (111), where the neutral verb (NV) *liikuma* 'move' combines with the Location phrase *metsaserval* 'at the edge of the forest'. In a less dominant way, Location is somewhat likely to occur if only Trajectory is depicted alongside a manner of motion or the neutral verb (see Node 12). In this case, Trajectory is typically described with the verbal particle *ringi* 'around', as in (112).

(110) ... ***Kalevi*** ***jahtklubi*** ***kai*** ***ääres*** ***loksu-vad***
[Location] **[MMV]**
Kalev.GEN **yacht.club.GEN** **wharf.GEN** **beside** **splash-PRS.3PL**
valge-d *jahi-d.*
white-PL yacht-PL
'There are white yachts splashing beside the wharfs of Kalev's yacht club.' (NC)

(111) ***Metsaserva-l*** ***liiku-si-d*** *justkui* *halli-de* *kuube-de-ga* *kogu-d*
[Location] **[NV]**
forest.edge-ADE **move-PST-3PL** like grey-PL.GEN coat-PL-COM body-PL
'At the edge of the forest, as if bodies with grey coats on were moving.' (FC)

(112) *Ta* ... ***kõndi-s*** ***toa-s*** *õnnelikult* ***ringi*** ...
[MMV] **[Location]** **[Trajectory]**
(s)he **walk-PST.3SG** **room-INE** happily **around**
'(S)he walked happily around in the room.' (FC)

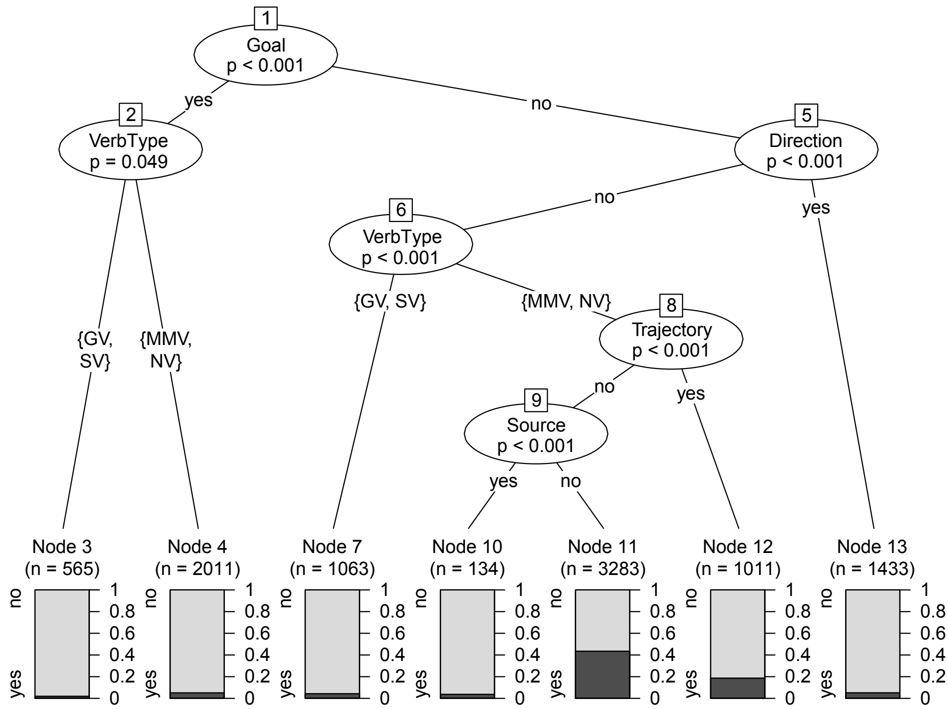

Figure 21. Conditional inference tree for Location: Location ~ Source + FromDirection + Source + Trajectory + Direction + Goal + VerbType; SV = source verbs, NV = the neutral verb, MMV = manner of motion verbs, GV = goal verbs

Overall, the expression of Location does seem to correlate with the type of verb. Manner of motion verbs and Location expressions significantly co-occur. This suggests consistent windowing. The neutral verb *liikuma* 'move' shows ambiguous results with respect to Location in either behaving similarly to manner of motion verbs or being insensitive to Location.

9.1.1.3. Trajectory

I hypothesise that Trajectory expressions combine mainly with manner of motion verbs similarly to Location as both Trajectory and Location profile the medial portion of the path. The introductory analysis of frequencies presented in Section 9.1.1 above give initial support for this expectation. The results of the analysis of the raw data are given in Figure 22 and present both 'yes' and 'no' values of Trajectory. These results are consistent with the initial ones of only 'yes' values in that manner of motion verbs are slightly different to the other verbs; 17% of clauses contain combinations of manner of motion verbs and Trajectory expressions. The Chi-squared test reveals a significant, yet very weak association between the variables Trajectory and VerbType: $\chi^2(3, N = 9500) = 166.66$, $p < 0.001$, Cramér's $V = 0.13$. Trajectory is expressed in 1408 clauses (15%).

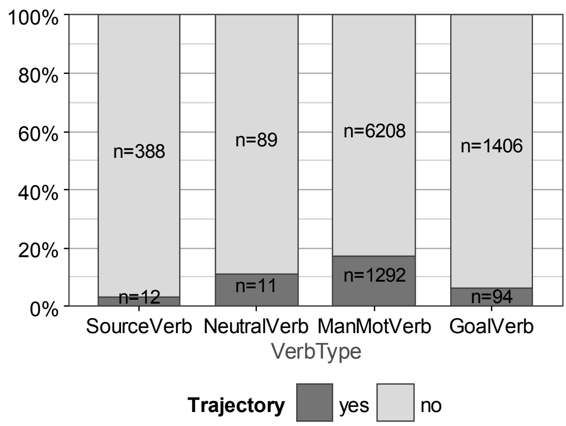

Figure 22. The presence (= yes) and absence (= no) of Trajectory expressions across source verbs (= SourceVerb), the neutral verb (= NeutralVerb), manner of motion verbs (= ManMotVerb), and goal verbs (= GoalVerb)

Although the effect size is small, Pearson's residuals indicate that, as expected, manner of motion verbs are likely to combine with Trajectory expressions, whereas goal and source verbs have few clauses with Trajectory (see Table 24).

Table 24. Pearson's residuals for Trajectory and VerbType

	SourceVerb	NeutralVerb	ManMotVerb	GoalVerb
Trajectory expression absent (= no)	2.56	0.42	−2.25	3.59
Trajectory expression present (= yes)	**−6.14**	−0.99	**5.39**	**−8.61**

The model of random forests yields that VerbType and the other five spatial variables do not predict Trajectory (see Figure 23). This result can be explained by the multicollinearity of the independent variables that is also found in the case for the model of Location (see Section 9.1.1.2).

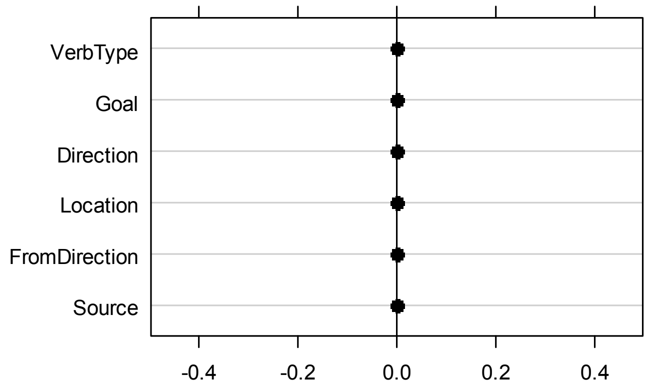

Figure 23. Conditional variable importance in predicting Trajectory (no predictor is significant): Trajectory ~ Source + FromDirection + Location + Direction + Goal + VerbTy

The conditional inference tree in Figure 24, however, shows that motion clauses fall into two groups based on Goal as indicated by Node 1. That is, clauses without Goal expressions are somewhat more likely to contain Trajectory expressions than clauses with Goal expressions. More specifically, Trajectory is somewhat more likely to be expressed in clauses with manner of motion verbs if the other spatial categories are not expressed (see Node 11) or if only Direction is expressed (see Node 10).

These two patterns are exemplified in (113) and (114). In (113), the manner of motion verb *ujuma* 'swim' combines with the Trajectory expression *mööda põhja* 'along the seafloor'. In (114), there is, in addition to the manner of motion verb *koperdama* 'blunder', the Trajectory phrase *trepist* 'along the stairs' and the Direction phrase *alla* 'down'.

(113)	*Kui*	*ta*	***mööda***	***põhja***	***uju-s*** ...
			[Trajectory]		**[MMV]**
	when	(s)he	**along**	**seafloor.PART**	**swim-PST.3SG**

'When she swam along the seafloor.' (FC)

(114)	...	***koperda-n***	***trepi-st***	***alla*** ...
		[MMV]	**[Trajectory]**	**[Direction]**
		blunder-1SG.PRS	**stairs-ELA**	**down**

'I'm blundering down the stairs.' (NC)

Similarly to Location, Trajectory is biased towards manner of motion verbs. This result is consistent with the expectation that the verb and spatial expression have a tendency to refer to the same portion of the path. However, the strength of this association is very weak. In addition, the independent variables in random forests are insignificant. This can be seen as an indicator of the absence of other effective variables that could predict Trajectory.

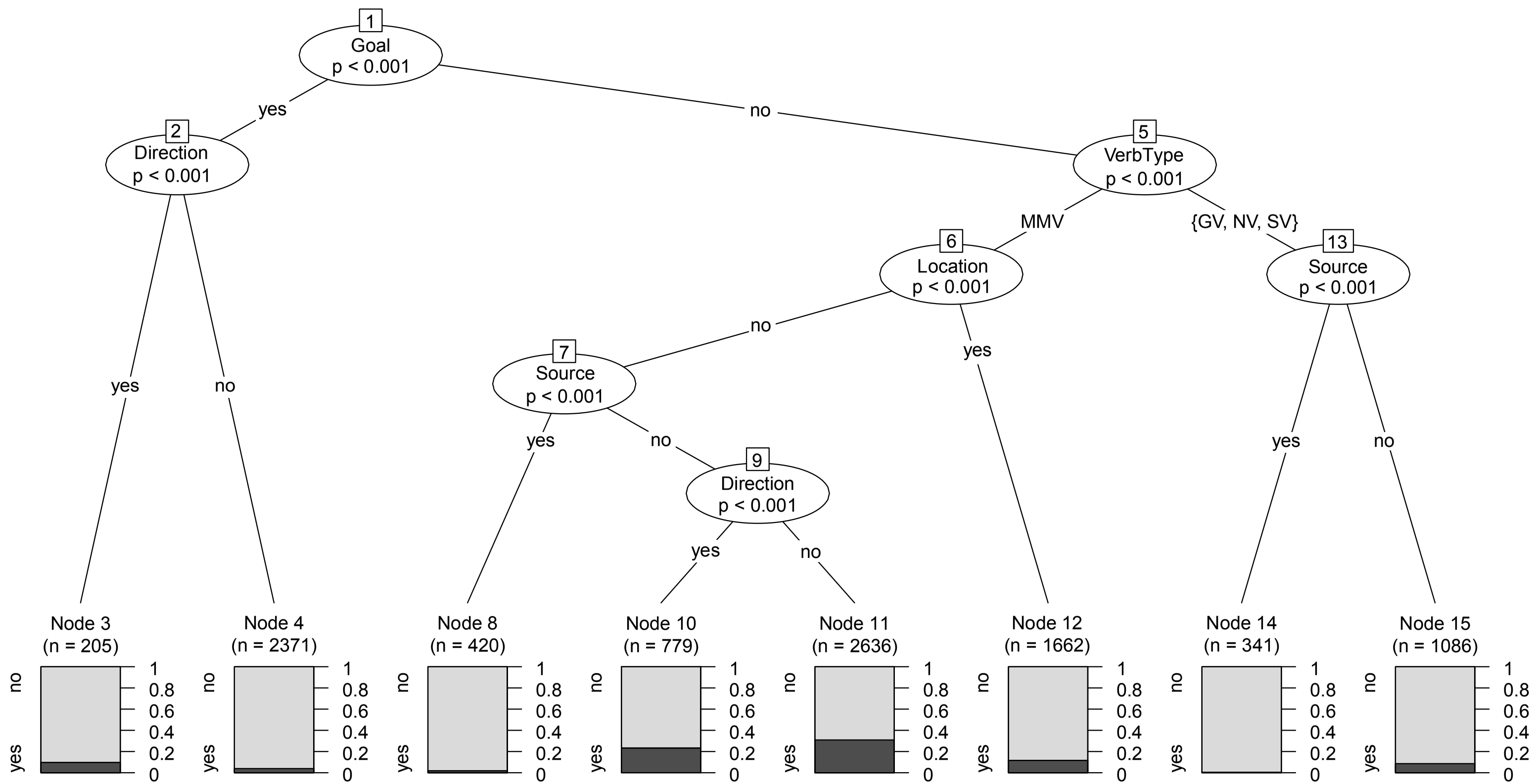

Figure 24. Conditional inference tree for Trajectory: Trajectory ~ Source + FromDirection + Location + Direction + Goal + VerbType; SV = source verbs, NV = the neutral verb, MMV = manner of motion verbs, GV = goal verbs

9.1.1.4. Direction

Direction, standing for the final portion of the path together with Goal, should be expressed dominantly in combination with goal verbs. Direction, itself, is depicted in 1638 clauses (17%). This prediction is confirmed by the analysis of the 'yes' values of Direction in Section 9.1.1 above. Somewhat surprisingly, this analysis shows also that the neutral verb is frequently expressed with Direction expressions. Regarding both 'yes' and 'no' values of the variable Direction (see Figure 25), manner of motion verbs are similar to goal verbs as 17% and 20% of clauses with these verbs respectively contain Direction expressions. The neutral verb has even more, 31% of clauses with Direction expressions. The association between the presence of Direction and the type of verb is significant: $\chi^2(3, N = 9500) = 78.65$, $p < 0.001$. However, the magnitude of the association is very small (Cramér's V = 0.09). This suggests that the association is extremely weak.

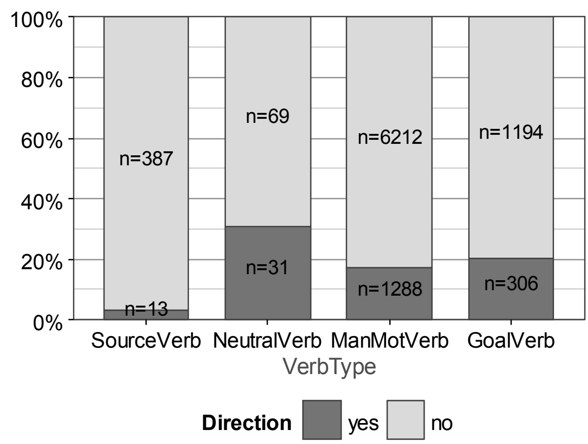

Figure 25. The presence (= yes) and absence (= no) of Direction expressions across source verbs (= SourceVerb), the neutral verb (= NeutralVerb), manner of motion verbs (= ManMotVerb), and goal verbs (= GoalVerb)

The analysis of Pearson's residuals (see Table 25) provides evidence for typical patterns where either goal verbs or the neutral verb combine with Direction expressions. Manner of motion verbs are insensitive to the variable Direction, and clauses with source verbs contain Direction expressions only rarely.

Table 25. Pearson's residuals for Direction and VerbType

	SourceVerb	NeutralVerb	ManMotVerb	GoalVerb
Direction expression absent (= no)	3.08	−1.51	0.07	−1.34
Direction expression present (= yes)	**−6.74**	**3.31**	−0.14	**2.95**

In the context of the other spatial variables, VerbType significantly contributes to the outcome of random forests (see Figure 26). There are three variables that have predictive power in the current model: Source, VerbType, and Goal. The other three variables are insignificant or close to being insignificant. The model of random forests, itself, is humble in its performance (C = 0.73).

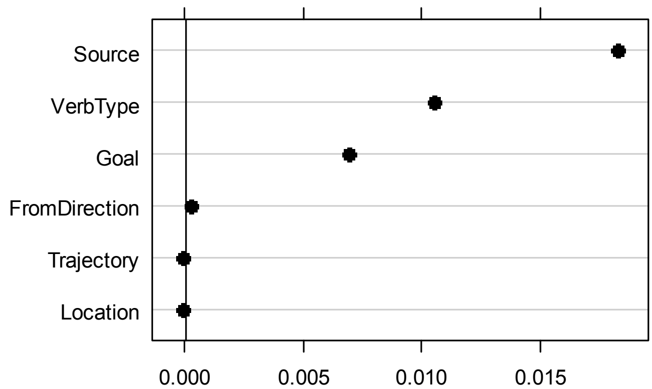

Figure 26. Conditional variable importance in predicting Direction (predictors to the right of the vertical line are significant): Direction ~ Source + FromDirection + Location + Trajectory + Goal + VerbType

The analysis of the conditional inference tree indicates the superiority of Source in predicting Direction (see Node 1), followed by VerbType (see Node 2).

Two patterns can be illustrated where the use of expressions referring to Direction are very typical. One culminates in Node 19 and considers instances with the neutral and manner of motion verbs where only FromDirection is expressed in combination with Direction. In this pattern, the other spatial categories are absent as illustrated in (115) for the neutral verb *liikuma* 'move', and (116) for the manner of motion verb *tormama* 'rush, dash'.

(115)	... *norralase-d*	***liiku-si-d***	***ida-st***	***läände*** ...
		[NV]	**[FromDirection]**	**[Direction]**
	Norwegian-PL	**move-PST-3PL**	**east-ELA**	**west.ILL**

'Norwegians went from east to west.' (FC)

(116)	***Vasakult***	***torma-s***	***minu***	***suuna-s***	*inimene* ...
	[FromDirection]	**[MMV]**	**[Direction]**		
	left.SEP	**rush-PST.3SG**	**I.GEN**	**direction-INE**	human

'From the left, someone rushed towards me.' (FC)

The other distinct pattern, manifested in Node 6, contains a manner of motion verb and Source expression. In this pattern, Goal is not encoded. For example, and in (117), the manner of motion verb *sammuma* 'walk, step', Source phrase *kõrvaltoast* 'of the next room', and Direction expression *välja* 'out' occur.

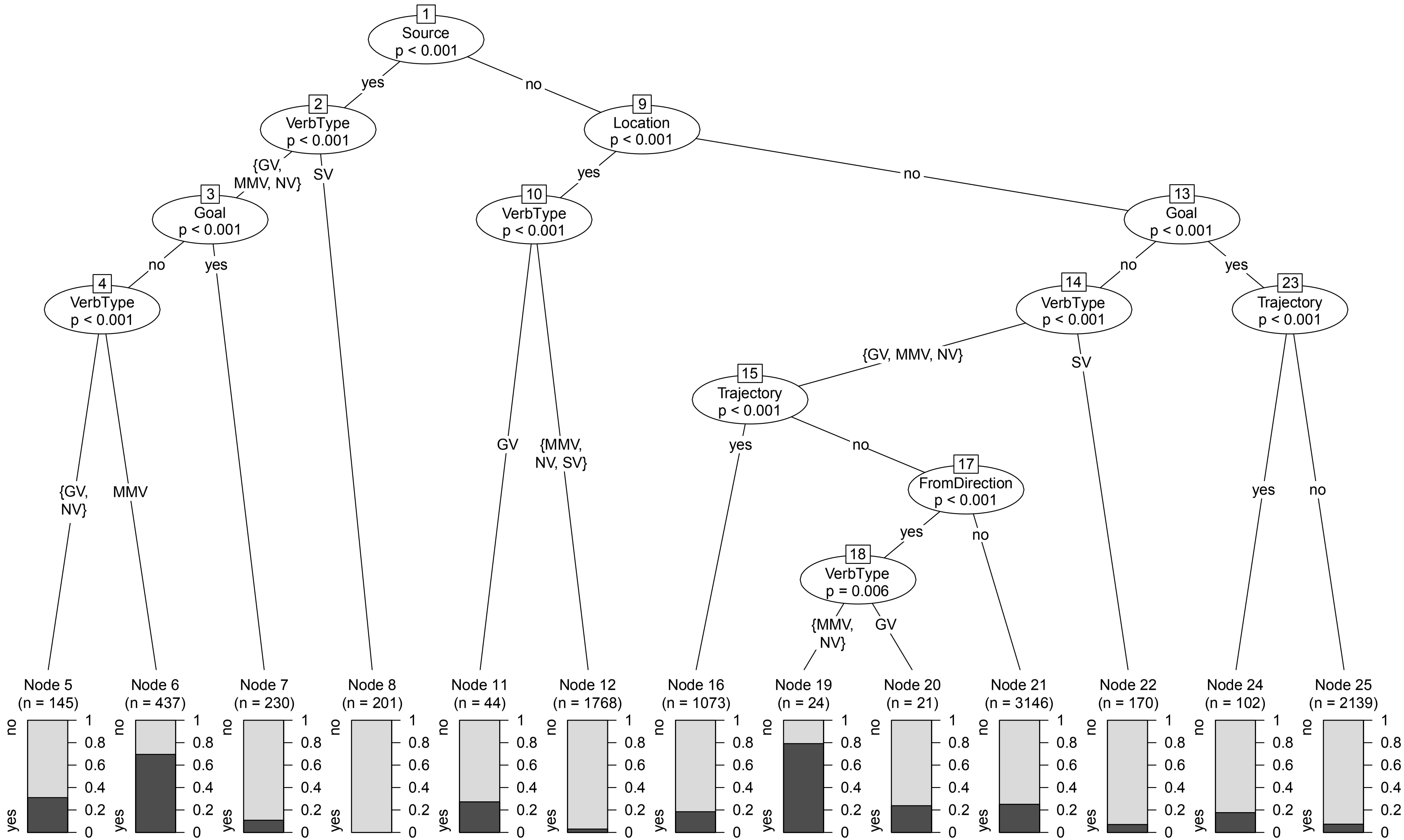

Figure 27. Conditional inference tree for Direction: Direction ~ Source + FromDirection + Location + Trajectory + Goal + VerbType; SV = source verbs, NV = the neutral verb, MMV = manner of motion verbs, GV = goal verbs

<table>
<tr><td>(117)</td><td>Just</td><td>sama-l</td><td>aja-l</td><td>sammu-s</td><td>kõrvaltoa-st</td><td>välja</td><td>naine ...</td></tr>
<tr><td></td><td></td><td></td><td></td><td>[MMV]</td><td>[Source]</td><td>[Direction]</td><td></td></tr>
<tr><td></td><td>Just</td><td>same-ADE</td><td>time-ADE</td><td>walk-PST.3SG</td><td>next.room-ELA</td><td>out</td><td>woman</td></tr>
<tr><td></td><td colspan="7">‘At the same time, a woman walked out of the next room.’ (FC)</td></tr>
</table>

As for goal verbs, the conditional inference tree (see Figure 27) shows various clausal patterns. These patterns, however, contain Direction expressions significantly less frequently than the characteristic patterns for manner of motion verbs that contain Direction expressions. Nevertheless, goal verbs separate from the other verbs in Nodes 4, 10, and 14, and show slight biases towards combining with Direction expressions. However, these biases are considerably weaker than those for manner of motion verbs.

To conclude, goal verbs are inclined only slightly towards combining with Direction expressions according to the univariate analysis and the conditional inference tree. Manner of motion verbs give mixed results. According to Pearson’s residuals, manner of motion verbs are insensitive to Direction. The conditional inference tree shows that in some patterns, manner of motion verbs are very likely to co-occur with Direction expressions. It seems that at least some, but a significant amount of, manner of motion verbs possess directional features allowing them to combine with Direction.

It should be noted though that Direction is an exceptional category within the spatial categories. That is, Direction information is frequently conveyed by means of adverbs, mostly verbal particles (i.e., satellites in Talmy’s (2000b: 102) terms). As shown in Section 8.2.2.5, three-quarters of Direction expressions are encoded as adverbs, most of which are verbal particles. The other spatial variables are expressed by adverbs only modestly (8–38%; see Section 8.2.2). Verbal particles seem to be more closely related to the grammatical inventory than to the lexical one along the continuum between the two. This, in turn, may result in distinct clausal patterns which are further discussed in Section 9.2.2.

9.1.1.5. Goal

Goal, similarly to Direction, refers to the final portion of the path, and is described in 2577 motion clauses (27%). I predict that it will combine mainly with goal verbs, because this combination appears to be frequent as shown by the analysis in Section 9.1.1. Comparing clauses with ‘yes’ and ‘no’ values of the variable Goal suggests that in addition to goal verbs, manner of motion verbs are also somewhat inclined towards Goal expressions. That is, 36% of clauses with goal verbs and 27% of clauses with manner of motion verbs contain Goal expressions (see Figure 28). The difference in proportions is significant with a small effect size: $\chi^2(3, N = 9500) = 153.16$, $p < 0.001$, Cramér’s $V = 0.14$.

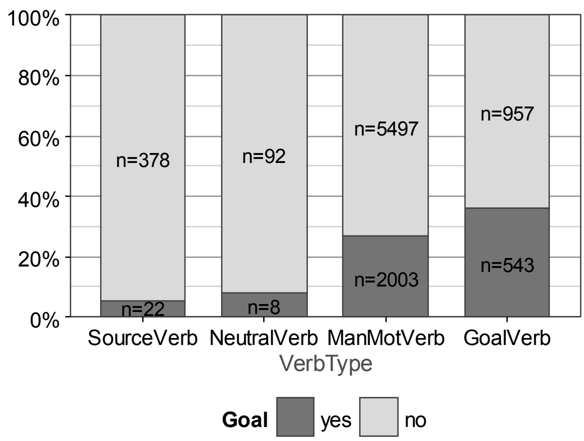

Figure 28. The presence (= yes) and absence (= no) of Goal expressions across source verbs (= SourceVerb), the neutral verb (= NeutralVerb), manner of motion verbs (= ManMotVerb), and goal verbs (= GoalVerb)

From Pearson's residuals in Table 26, it appears that goal verbs are biased towards combining with Goal, whereas source verbs generally do not combine with Goal. Manner of motion verbs, contrary to the results presented in Figure 28, remain rather neutral. These results are also rather similar to those of Direction reported in the previous section.

Table 26. Pearson's residuals for Goal and VerbType

	SourceVerb	NeutralVerb	ManMotVerb	GoalVerb
Goal expression absent (= no)	5.06	2.24	0.42	−4.12
Goal expression present (= yes)	**−8.30**	**−3.67**	−0.68	**6.76**

The model of random forests is presented in Figure 29. Three variables contribute to the variation of Goal: Direction, VerbType, and Source. The other three variables are insignificant, and the performance of the model is modest (C = 0.74).

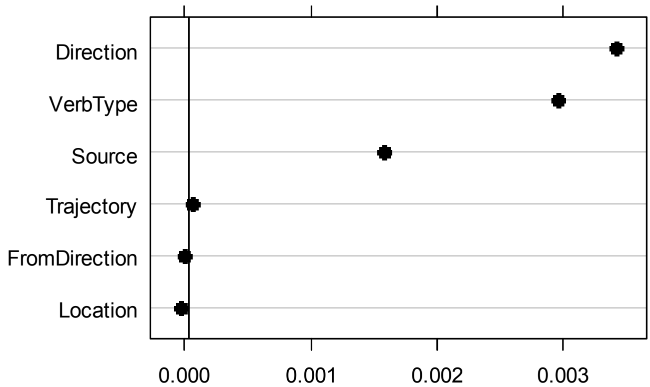

Figure 29. Conditional variable importance in predicting Goal (predictors to the right of the vertical line are significant): Goal ~ Source + FromDirection + Location + Trajectory + Direction + VerbType

The conditional inference tree provides a more in depth picture about the patterns where Goal is expressed (see Figure 30). Three characteristic patterns for Goal may be stated. One of these patterns considers manner of motion and goal verbs, and the other two patterns apply to all verb types.

Regarding manner of motion and goal verbs, Goal is likely to be found in clauses where Location, Trajectory, and Direction are not described (see the rightmost bar (Node 25) in Figure 30. In this combination, Source expressions are irrelevant in that they may or may not be expressed in clauses where this pattern occurs. The pattern is epitomised in (118) by the manner of motion verb *kõndima* 'walk' and the Goal phrase *Narva maanteele* 'to Narva road'; and in (119) by the goal verb (GV) *saabuma* 'arrive' and the Goal phrase *hotelli* 'to the hotel'.

(118)	***Ta***	***kõndi-s***	*peatu-mata*	***Narva***	***maantee-le*** *...*
		[**MMV**]		[**Goal**]	
	(s)he	**walk-PST.3SG**	stop-GER	**Narva.GEN**	**road-ALL**

'Without stopping, (s)he walked to Narva road.' (FC)

(119)	...	*siis*	***saabu-si-d***	***hotelli***	*purjus*	*soomlase-d.*
			[**GV**]	[**Goal**]		
		then	**arrive-PST-3PL**	**hotel.ILL**	drunk	Finn-PL.NOM

'Then drunk Finns arrived at the hotel.' (FC)

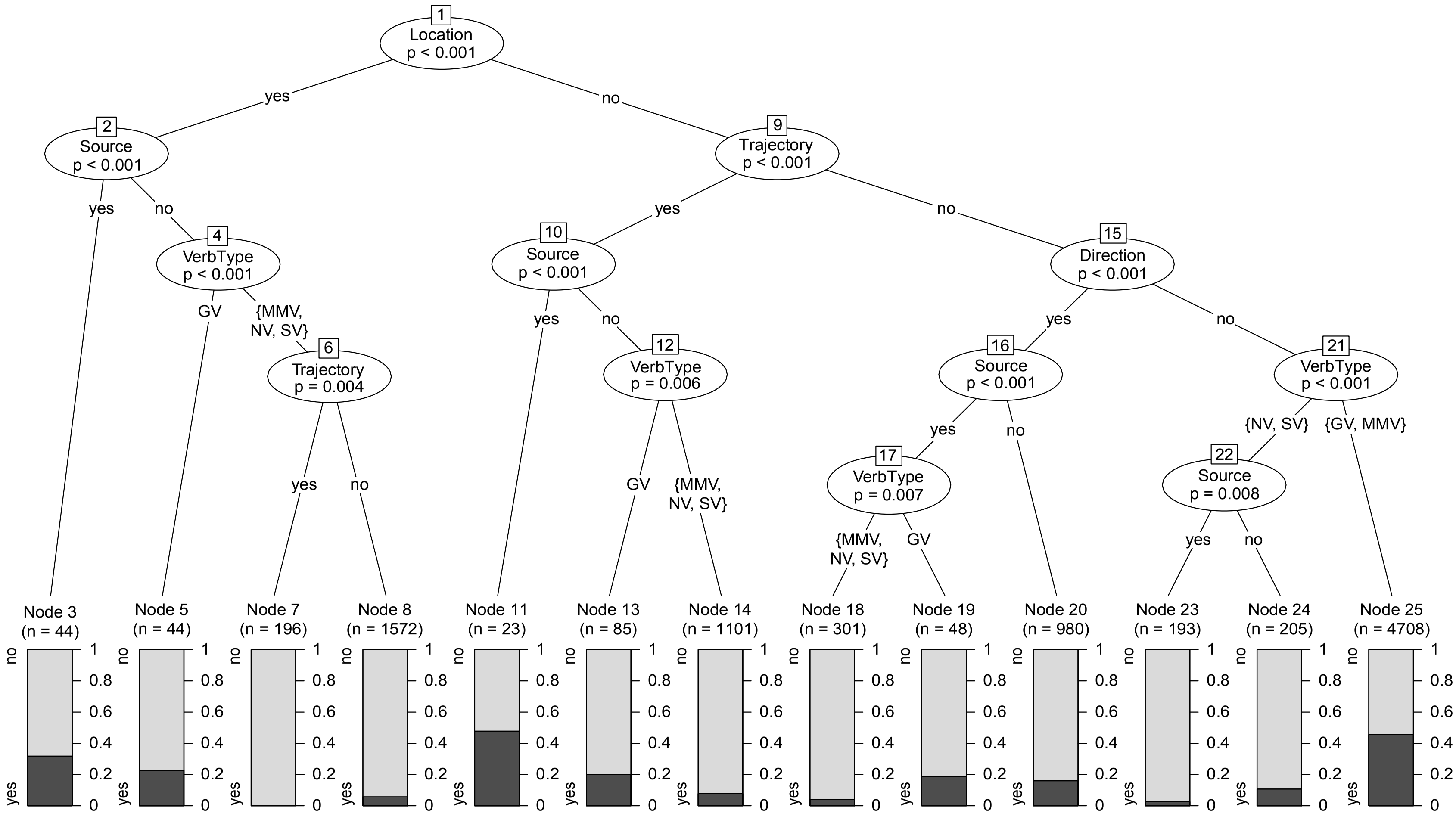

Figure 30. Conditional inference tree for Goal: Goal ~ Source + FromDirection + Location + Trajectory + Direction + VerbType; SV = source verbs, NV = the neutral verb, MMV = manner of motion verbs, GV = goal verbs

A pattern characteristic to all verb types becomes evident in Node 11. It consists of the expression of Source and Trajectory, and does not contain Location expressions. The pattern is illustrated by the goal verb in (120) and by the manner of motion verb in (121). In these cases, the presence or absence of Direction is irrelevant.

(120)

...	*kui*	*esimene*	*kohalik*	*elanik*	***sealt***	***mööda***	***rada***
					[Source]	**[Trajectory]**	
	then	first	local	inhabitant	**there.SEP**	**along**	**path.PART**

orgu	***suundu-s****...*
[Goal]	**[GV]**
valley.ILL	**head-PST.3SG**

'when the first local inhabitant headed along the pathway from there to the valley' (FC)

(121)

...	*jalgrada,*	***mida***	***mööda***	*Ahas*	*nii*	*tihtigi*	*ol-i*	*kevadeti*
		[Trajectory]						
	pathway	**which.PART**	**along**	Ahas	so	often	be-PST.3SG	spring

ja	*sügiseti*	***linna-st***	*välja*	***kuni***	***Kvissentali-ni***
		[**Source**]	[Direction][52]	[**Goal**]	
and	autumn	**town-ELA**	out	**until**	**Kvissental-TERM**

ol-i	***jaluta-nud.***
	[MMV]
be-PST.3SG	**stroll-APP**

'Ahas used to walk along this pathway in the springs and autumns to go out of the town in order to get to Kvissental.' (Lit. 'the pathway along which Ahas has been strolling so often at springs and autumns, out of the town until Kvissental.') (FC)

Lastly, there is a significant combination of Goal, Location, and Source irrespective of the type of verb (see Node 3). This is exemplified in (122) where the manner of motion verb *väntama* 'pedal' occurs together with the Location phrase *maalilisel Bretagne' maastikul* 'on a scenic landscape of Brittany', the Source phrase *ühest kalasadamast* 'from one fishport', and the Goal phrase *teise* 'to another'.

(122)

Maalilise-l	***Bretagne'***	***maastiku-l***	***vänta-s***	*seltskond*
[Location]			**[MMV]**	
scenic-ADE	**Bretagne.GEN**	**landscape-ADE**	**pedal-PST.3SG**	group

ühe-st	***kalasadama-st***	***teise ...***
[Source]		**[Goal]**
one-ELA	**fish.port-ELA**	**other.ILL**

'On a scenic landscape of Brittany, the group was pedalling from one fish port to another.' (NC)

[52] As the expression of Direction is not relevant in this pattern, it is not marked by Bold in this example. The same marking applies hereinafter to all such spatial categories which are not obligatory for the specific patterns discussed.

The main conclusion is that goal verbs have a tendency to co-occur with Goal expressions. The expression of Goal is significantly associated with the type of verb and with the other spatial variables. However, manner of motion verbs are also very likely to be used jointly with Goal expressions in some specific patterns. This tendency was also observed in the context of Direction analysis (see Section 9.1.1.4).

9.1.1.6. Summary and discussion

A variety of patterns can be identified with regard to spatial categories combining with each other, and with different types of motion verbs. Furthermore, the type of verb is clearly related to the expression of the spatial categories. Source verbs combine mainly with expressions of the initial portion of the path (i.e., Source expressions, as in *lahkus toast* '(s)he left the room'). Goal verbs have a tendency to co-occur with expressions of the final portion of the path (i.e., Direction, and Goal expressions, as in *suundus toa poole* '(s)he headed towards the room' and *sisenes tuppa* '(s)he entered the room'). Manner of motion verbs form frequent combinations with expressions of the medial portion of the path (i.e., Location, and Trajectory expressions, as in *suusatas mööda teed* '(s)he skied along the road' and *suusatas metsas* '(s)he skied in the forest'), but are also somewhat inclined towards combining with Direction, and Goal expressions, as in *jooksis toa poole* '(s)he ran towards the room' and *jooksis tuppa* '(s)he ran into the room'.

These results suggest that source and goal verbs fulfil the expectations regarding consistent windowing, and manner of motion verbs seem to fill this prediction only partly. However, these findings are not contrary to the hypothesis, because it shows that manner of motion verbs possess directional features. Furthermore, many manner of motion verbs are used in highly directional contexts, indicating that they comprise strong directional features in a similar way as goal verbs do. As such, this finding provides strong support for the assumption of the study that both manner of motion verbs and directional verbs entail directional information.

These findings are consistent with many studies that show verb specific patterns of motion expressions (Rohde 2001; Rakhilina 2004; Stefanowitsch & Rohde 2004; Levinson 2006; Kita 2006; Cristobal 2010; Kopecka 2010; Taremaa 2013), and indicate that the *goal-over-source* principle (Ikegami 1987; Dirven & Verspoor 1998: 87–89) is not an absolute one. They are also in agreement with studies that argue for verbs which incorporate both directional and manner features (Aske 1989; Cardini 2008; Cifuentes Férez 2010; Goldberg 2010; Kopecka 2010; Cardini 2012).

The directionality of the spatial categories (Source, Location, Trajectory, Direction, and Goal) can also be discussed. This study is based upon the assumption that Source (and FromDirection) expressions refer to the initial portion of the path, Location and Trajectory expressions refer to the medial portion of the path, and Direction and Goal expressions refer to the final portion of the path. Consequently, I assume that expressions of the initial and final portion of the path are directional expressions, and those of medial portion of the path are static expressions of space. As is elaborated in Section 4.3.1.1, however, Trajectory also entails some directional concepts. For example, the Trajectory expression *läbi metsa* 'through the forest' is clearly more directional than the static expression (Location) *metsas* 'in the forest'.

The results of the correspondence analysis and univariate analyses also suggest that Trajectory exhibits directional properties despite the fact that it stands for the medial portion of the path. Nevertheless, these directional properties do not seem to be as strong as in the case of the variables Source and Goal representing the initial and final portion of the path (see also the discussion in Section 4.3).

This section also shows that it is not only the type of verb that contributes to the expression of spatial categories, but also the constructions (combinations of spatial categories), or even perhaps the constructions themselves. For instance, Goal has a tendency to be expressed frequently in combination with manner of motion verbs or goal verbs, but only if Location, Trajectory, and Direction are not expressed. Goal expressions are also frequent in clauses with all types of verbs where Trajectory and Source are described, but Location is not. These findings clearly show the constructional nature of language.

These analyses are based on a limited set of factors. These factors include only one verb semantic variable representing the type of verb (VerbType), and the six spatial variables representing other spatial expressions in motion clauses (Source, FromDirection, Location, Trajectory, Direction, and Goal). However, the effect sizes of univariate analyses are weak (Cramér's V have values between 0.09 and 0.27) and model performances of the random forests are modest (the indices of concordances C are in between 0.73 and 0.79). This indicates that some other effective factors are absent. In the following sections, three important verb semantic factors are examined with respect to spatial categories: the type of motion (MotionType), the general direction of motion (HorVert), and the speed of motion (VerbSpeed).

9.1.2. Motion type and spatial categories

Motion verbs express different kinds of motions (see Sections 4.2.1.1, 6.1.1.3, and 8.1.2). That is, the material consists of verbs depicting translational, self-contained, and simultaneously both kinds of motions (hence, the variables TranslMotion, SelfContMotion, and BothMotions). In the current study, I define translational motion as motion in which the mover changes its position in space (e.g., *jooksma* 'run'), and self-contained motion as motion that is conducted in one restricted area (e.g., *värisema* 'shake, tremble').

As verbs do not necessarily fall exactly into these two categories, an intermediate category is introduced. This category, labelled as 'BothMotions', represents the verbs which could, in some way, refer to both motions (e.g., *hüppama* 'jump'). Nevertheless, it should be noted that verbs that express self-contained motion can enter constructions which depict translational motion. Furthermore, not all verb types in terms of source, goal, and manner of motion verbs are equally distributed across motion types in the data. Only manner of motion verbs represent all three motion types (see Section 7.1.2). Goal verbs depict either translational motion or both motions, source verbs depict only translational motion, and the neutral verb depict both motions.

Naturally, when discussing typical patterns of spatial expressions, one needs to take into account what kind of motion a verb carries information about. For example, a verb expressing translational motion is presumably more likely to be combined with directional spatial phrases (e.g., Source or Goal) than those expressing self-contained motion. Moreover, the possibility for such telic patterns have often been seen as the hallmark of translational motion (Vendler 1957; Aske 1989; Pourcel & Kopecka 2005; Cardini 2008; Pourcel 2010; Zlatev et al. 2010; Cardini 2012).

Thus, the type of verb and the type of motion are both included in the analysis when discussing patterns of spatial categories. First, I examine the role of motion type in the presence of particular expressions of spatial categories in a similar way as described in the previous section. For this, I use the Chi-square test and investigate Pearson's residuals. Then, I present variable importances of random forests and conditional inference trees where all the variables introduced so far are included (i.e., VerbType, MotionType, Source, FromDirection, Location, Trajectory, Direction, and Goal). As such, the presentation of the data follows the same structure as given in the previous section regarding the verb type.

The correspondence analysis is presented in Figure 31. As expected, verbs that cluster around directional categories (i.e., Source, Direction, FromDirection, and Goal; but also Trajectory, which is presumably only modestly directional) express translational motion (shown in blue). Some verbs of both motions (shown in black) are also near these categories. Verbs of translational motion can also be found in the proximity of Location as are verbs of both motions. Verbs of self-contained motion (shown in yellow) cluster around Location. However, some variation can be observed in this cluster as the verb *värisema* 'shake, tremble' is located on the very left-hand side of the figure, whereas the verb *rabelema* 'flounder, flutter' has a position much closer to the directional variables. These results show how flexible motion verbs are by their occurrence in different contexts of spatial expressions. This is also true to some extent in verbs that clearly express self-contained motion.

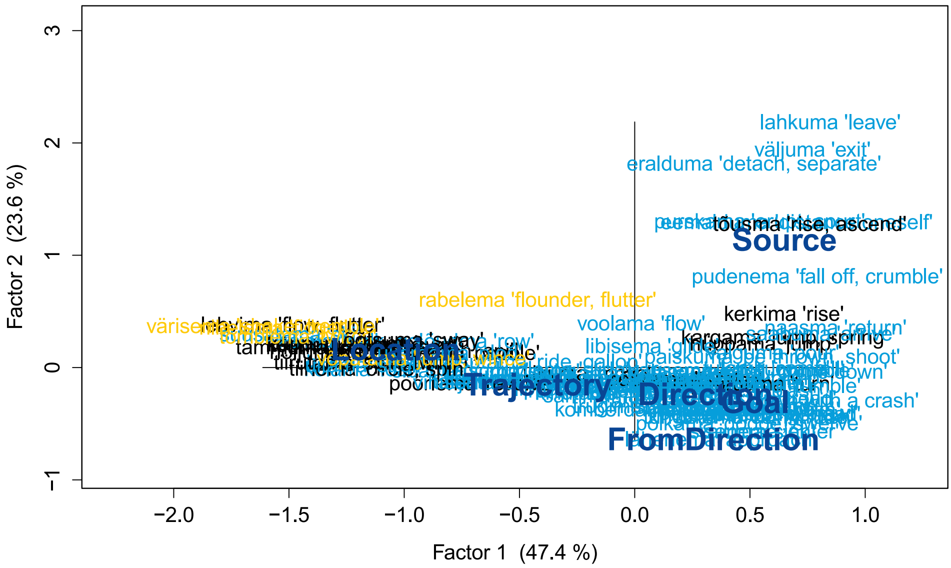

Figure 31. Results of the correspondence analysis. *Large dark blue labels stand for spatial variables. Smaller labels refer to particular motion verbs:* blue = verbs of translational motion, yellow = verbs of self-contained motion, black = verbs of both motions

On inspection of the proportional count data (see Figure 32), one can infer that there is some variation across the spatial variables in terms of motion type. That is, verbs of translational motion are biased towards combining with Goal expressions. Verbs of both motions, and particularly verbs of self-contained motion are mostly found in combination with Location expressions. The Chi-square test reveals significant associations with a small effect size: $\chi^2(8, N = 8492) = 827.1$, $p < 0.001$, Cramér's $V = 0.22$.

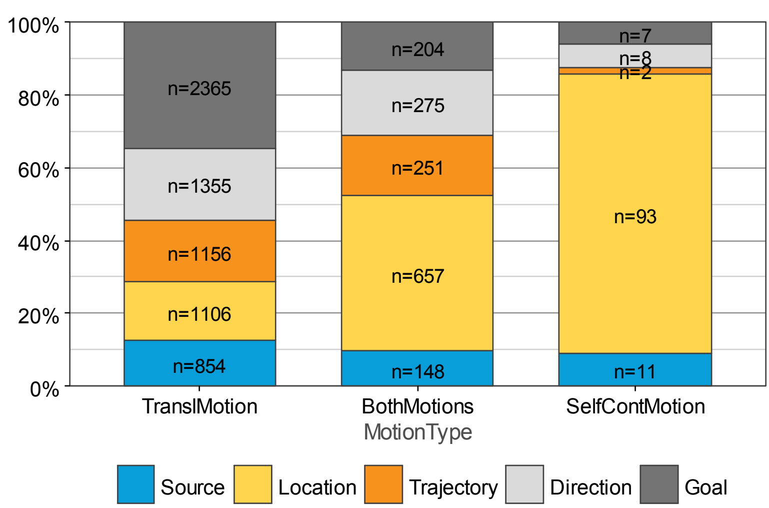

Figure 32. Distribution of spatial expressions of Source, Location, Trajectory, Direction, and Goal across verbs expressing translational (= TranslMotion), both translational and self-contained (= BothMotions), and self-contained motion (= SelfContMotion)

Pearson's residuals (see Table 27) confirm the observations of proportions. Verbs of translational motion are biased towards Goal, whilst they are biased away from Location expressions. Verbs of self-contained motion and verbs of both motions combine rarely with Goal, and are inclined towards Location expressions.

Table 27. Pearson's residuals for the spatial variables and MotionType

	TranslMotion	BothMotions	SelfContMotion
Goal	**6.40**	**−4.90**	**−12.12**
Direction	1.00	−3.18	−1.23
Trajectory	0.65	−4.03	−0.23
Location	**−10.04**	**12.94**	**17.55**
Source	1.35	−0.90	−2.59

In order to account for the more detailed usage patterns of spatial categories, I present pairwise Chi-squared analyses with each spatial variable. The results about the significance and strength of the association between the type of the motion and spatial categories are reported. To evaluate the role of motion type in clausal patterns, random forests are grown and conditional inference trees created. As such, the data analysis is presented in a similar way as in the previous Section for VerbType. However, the conditional inference trees are created only if the variable MotionType is significant in the random forests. If MotionType is significant and the conditional inference tree is calculated, only MotionType and variables that contribute equally to MotionType (or more) to the outcome are presented in the tree. This is because a tree with all the variables would result in a highly complex picture.

9.1.2.1. Source

The more directional a category is, the more it should be sensitive to the type of motion the verb expresses. As Source is a highly directional category, it should mainly be expressed alongside verbs of translational motion. Figure 33 shows support for this prediction as 12% of clauses contain Source expressions if the verb depicts translational motion, whereas only 2% of such clauses occurs for self-contained motion. Verbs expressing both motions are in between these two categories of motion with 7% of clauses containing Source. The Chi-square test reveals significant differences in proportions with a very small effect size: $\chi^2(2, N = 9500) = 77.31$, $p < 0.001$, Cramér's V = 0.09.

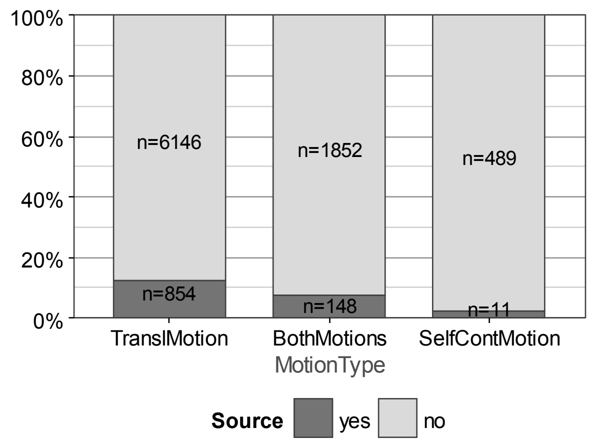

Figure 33. The presence (= yes) and absence (= no) of Source expressions across verbs expressing translational (= TranslMotion), both translational and self-contained (= BothMotions), and self-contained motion (= SelfContMotion)

Pearson's residuals (see Table 28) confirm these results because verbs of translational motion have a significant number of clauses incorporating Source expressions, while the other verbs have infrequently such clauses.

Table 28. Pearson's residuals for Source and MotionType

	TranslMotion	BothMotions	SelfContMotion
Source expression absent (= no)	−1.36	1.54	2.00
Source expression present (= yes)	**3.94**	**−4.47**	**−5.80**

A typical clausal pattern is illustrated in (123) where the verb *sukelduma* 'dive' is combined with the Source expression *paadist* 'from the boat'.

(123)	*Tema*	***sukeldu-s***	***paadi-st***	*akvalangi-ga.*
		[MMV: TranslMotion]	**[Source]**	
	(s)he	**dive-PST.3SG**	**boat-ELA**	scuba-COM

'(S)he dived from the boat in scuba diving gear.' (NC)

To evaluate to what degree motion type contributes to the variation of Source, I present the analysis of relative variable importances on the basis of random forests (see Figure 34). The results in predicting Source suggest that the type of motion is not important. However, the performance of the Source model improves slightly when adding the variable MotionType into the model (C = 0.81). As the type of motion contributes negligibly to the outcome, the conditional inference tree is not created.

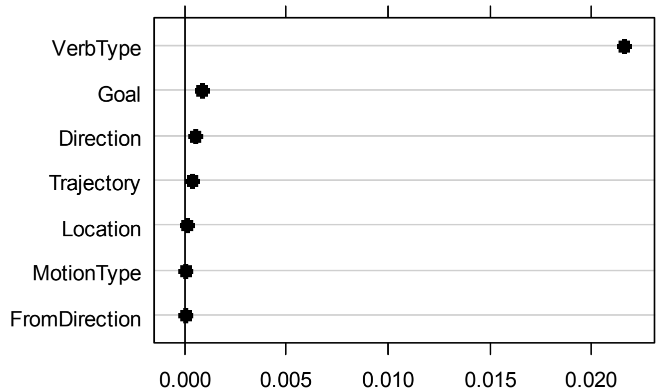

Figure 34. Conditional variable importance in predicting Source (predictors to the right of the vertical line are significant): Source ~ FromDirection + Location + Trajectory + Direction + Goal + VerbType + MotionType

Thus, the type of motion is associated with Source in that verbs of translational motion are slightly more likely to combine with Source expressions than the other verbs. However, the magnitude of its effect to the results is rather limited as the verb type variable (VerbType) clearly overrides the other variables.

9.1.2.2. Location

The analysis of the contingency table (see Figure 32 in Section 9.1.2 above) shows that verbs of self-contained and both motions are inclined towards combining with Location expressions, and verbs of translational motion are inclined away from combining with Location expressions. This is in accord with the expectation that Location should be expressed mostly in combination with verbs of self-contained motion. Proportional results on the basis of both 'yes' and 'no' values show somewhat different results (see Figure 35). Most notably, verbs of translational motion are not significantly different to verbs of self-contained motion. 16% of clauses with verbs of translational motion and 17% of clauses with verbs of self-contained motion combine with Location expressions. Interestingly, verbs of both motions are more biased towards combining with Location expressions (33%) than verbs of translational motion, and verbs of self-contained motion. The Chi-square test confirms these observations as statistically significant associations with a weak effect size: $\chi^2(2, N = 9500) = 287.96$, $p < 0.001$, Cramér's $V = 0.17$.

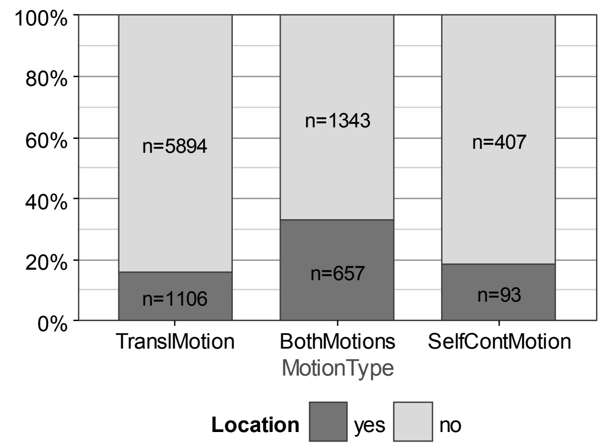

Figure 35. The presence (= yes) and absence (= no) of Location expressions across verbs expressing translational (= TranslMotion), both translational and self-contained (= BothMotions), and self-contained motion (= SelfContMotion)

The analysis of Pearson's residuals (see Table 29) shows that verbs of both motions do combine frequently with Location expressions.

Table 29. Pearson's residuals for Location and MotionType

	TranslMotion	BothMotions	SelfContMotion
Location expression absent (= no)	3.49	−6.64	0.23
Location expression present (= yes)	**−7.07**	**13.47**	**−0.47**

This is illustrated in (124) by the combination of the verb *tammuma* 'stamp, tread' and the Location expression *nurgal* 'at the corner'. However, verbs of translational motion are not similar to verbs of self-contained motion, because verbs of self-contained motion are insensitive to Location according to Pearson's residuals (see Table 29 above), while verbs of translational motion are strongly inclined away from clauses with Location expressions.

(124) ***Nurga-l*** ... ***tammu-vad*** *erutatult* *tumedanahalise-d* *noore-d*
[Location] **[MMV: BothMotions]**
corner-ADE **tread-PRS.3PL** excitedly black-PL.NOM youngster-PL
'At the corner, there are some black youngsters treading excitedly.' (NC)

The random forests model for Location indicates that the motion type has a great influence on the results (see Figure 36). The performance of the model is good (C = 0.81). Moreover, otherwise non-significant variables (i.e., VerbType, Trajectory, Goal, Direction, and Source; cf., Figure 20 in Section 9.1.1.2) have become significant by the inclusion of MotionType, and MotionType and VerbType are relatively more important than the other variables (see Figure 36).

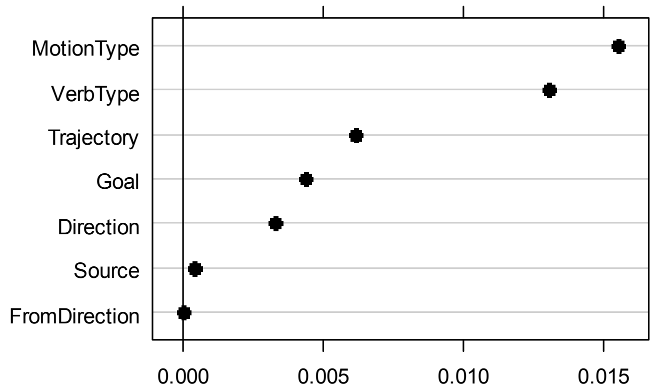

Figure 36. Conditional variable importance in predicting Location (predictors to the right of the vertical line are significant): Location ~ Source + FromDirection + Trajectory + Direction + Goal + VerbType + MotionType

The conditional inference tree is given in Figure 37. For the sake of clarity, it comprises only the two most important variables of the random forest (i.e., MotionType and VerbType) as the independent variables. First of all, it shows that manner of motion verbs and the neutral verb are more likely to combine with Location expressions than directional verbs. Then, it indicates that MotionType interferes with VerbType in that verbs of both motions, and particularly manner of motion verbs, are most likely to co-occur with Location (see Nodes 4 and 6). This pattern can also be observed in (124) above where the manner of motion verb expressing both motions (*tammuma* 'stamp, tread') is combined with the Location phrase (*nurgal* 'at the corner').

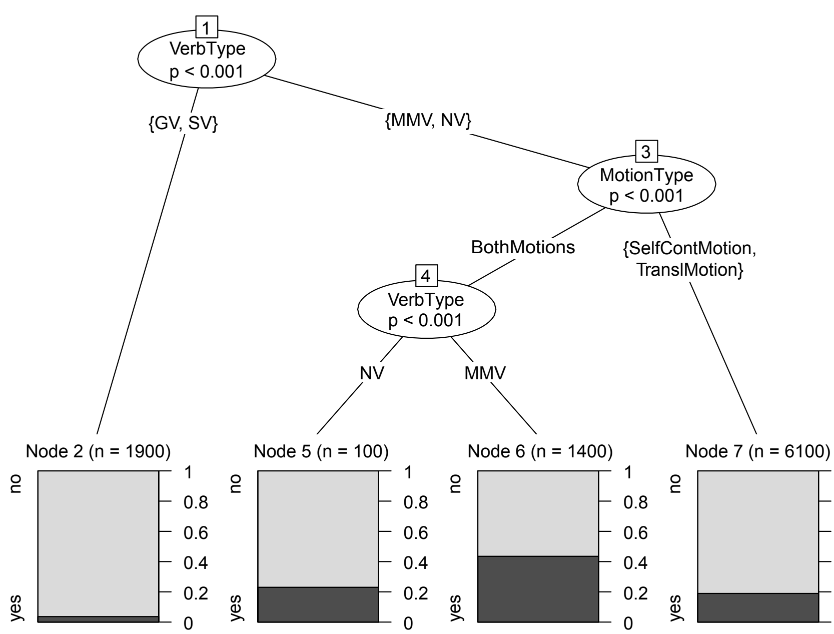

Figure 37. Conditional inference tree for Location: Location ~ MotionType + VerbType; SV = source verbs, NV = the neutral verb, MMV = manner of motion verbs, GV = goal verbs

The variable MotionType contributes significantly to whether Location is expressed or not. More importantly, the overall performance and the significance of the other variables improves, with VerbType improving the most. However, the expression of Location does not seem to associate clearly with self-contained motion as was predicted. According to the conditional inference tree, manner of motion verbs, regardless of the type of motion, are inclined towards Location. Nevertheless, all the analyses suggest that manner of motion verbs expressing both motions are most likely to occur in clauses that contain Location expressions.

9.1.2.3. Trajectory

Trajectory stands for the medial portion of the path. In this respect, Trajectory is similar to Location in that they both refer to the medial portion of the path. At the same time, Trajectory expressions comprise dynamic information, which becomes much more apparent particularly in the context of motion type. For instance, expressing Trajectory with verbs of self-contained motion would indicate translational motion interpretation of a clause (e.g., *tõmbleb üle ekraani* ‘twitches over the screen’, as in (125)).

(125)	... *ja*	*äkki*	***tõmble-b***	*mingi*	*perversne*
			[MMV: SelfContMotion]		
	and	suddenly	**twitch-PRS.3SG**	some	perverse

	arvutigraafika-s	*jänes*	***üle***	***ekraani*** ...
			[Trajectory]	
	computer.graphics-INE	rabbit	**over**	**screen.GEN**

‘And suddenly some perverse computer graphics rabbit is twitching all over the screen.’ (NC)

As shown by the correspondence analysis above (see Figure 31 in Section 9.1.2), Trajectory is an intermediate category between the static Location and clearly directional categories Source, FromDirection, Direction, and Goal. The analysis of the contingency table (see Figure 32 and Table 27 in Section 9.1.2) suggests that Trajectory exhibits similar patterns to Source and Direction in terms of motion type.

A more detailed analysis of both ‘yes’ and ‘no’ values provides additional support for this conclusion (see Figure 38). Verbs of translational motion combine with Trajectory expressions in 17% of clauses. Less than 1% of verbs of self-contained motion show similar combinations. Verbs of both motions are in between the two extremes in that 13% of their clauses contain Trajectory expressions. Consequently, verbs of both motions are more closely related to translational motion than to self-contained one. These observations are significant even though the effect size indicates only a weak strength of the association: $\chi^2(2, N = 9500) = 106.37$, $p < 0.001$, Cramér’s V = 0.11.

Figure 38. The presence (= yes) and absence (= no) of Trajectory expressions across verbs expressing translational (= TranslMotion), both translational and self-contained (= BothMotions), and self-contained motion (= SelfContMotion)

Consistently with these observations, Pearson's residuals (see Table 30) indicate a biased behaviour towards expressing Trajectory in the case of translational motion.

Table 30. Pearson's residuals for Trajectory and MotionType

	TranslMotion	BothMotions	SelfContMotion
Trajectory expression absent (= no)	−1.53	1.11	3.50
Trajectory expression present (= yes)	**3.66**	**−2.65**	**−8.38**

To illustrate this, the combination of the verb of translational motion *kihutama* 'race, career' and the Trajectory expression *läbi kõrbe* 'through the desert' is presented in (126). The other verbs, particularly verbs of self-contained motion, are biased away from having clauses with Trajectory expressions.

(126) *... ning rebukollane autobuss* ***kihuta-s*** ***läbi kõrbe****.*
[MMV: TranslMotion] [Trajectory]
and yolk.yellow autobus **race-PST.3SG through desert.GEN**
'And the egg yolk-coloured bus raced through the desert.' (FC)

The variable importances of the model of random forests are presented in Figure 39. It suggests limited importance of the motion type in predicting the presence of Trajectory expressions. The model, itself, does not distinguish between independent variables particularly well as all variables fall to the left of the line of significance. In this model, Location is even more insignificant than the other six variables. As the variables are insignificant in predicting Trajectory, the index of concordance C is not calculated and the conditional inference tree is not created.

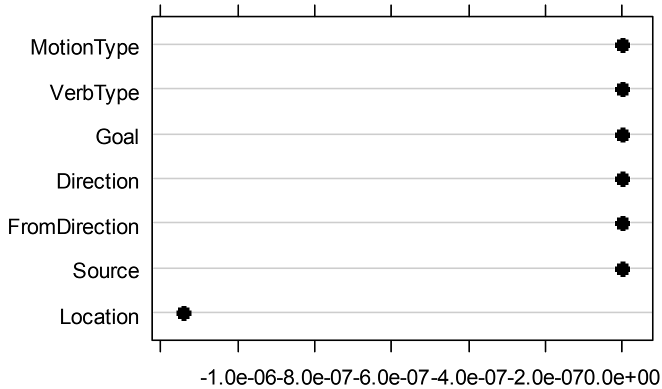

Figure 39. Conditional variable importance in predicting Trajectory (predictors to the right of the vertical line are significant): Trajectory ~ Source + FromDirection + Location + Direction + Goal + VerbType + MotionType

Taken together, the univariate analysis shows that the type of motion (i.e., MotionType) and Trajectory are significantly associated with each other. More specifically, verbs of translational motion have a tendency to combine with Trajectory expressions, whereas verbs of self-contained motion do not. However, the analysis of random forests suggests that neither MotionType nor the other variables (at least not in this combination) can predict whether Trajectory is expressed or not.

9.1.2.4. Direction

Direction refers to the final portion of the path. Despite this, in terms of the type of motion, it has similar usage patterns to those of Source and Trajectory according to the analysis of the contingency table (see Section 9.1.2). The analysis that includes both 'yes' and 'no' values confirms this result as can be seen in Figure 40. That is, verbs of translational motion are most likely to co-occur with Direction expressions (19%), followed by verbs of both motions (14%). Verbs of self-contained motion combine rarely with Direction expressions (2%). The associations are significant with a weak effect size: $\chi^2(2, N = 9500) = 124.77$, $p < 0.001$, Cramér's $V = 0.11$.

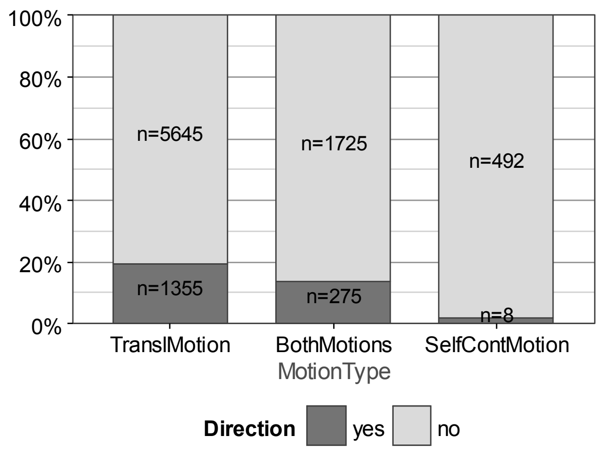

Figure 40. The presence (= yes) and absence (= no) of Direction expressions across verbs expressing translational (= TranslMotion), both translational and self-contained (= BothMotions), and self-contained motion (= SelfContMotion)

Pearson's residuals (see Table 31) suggest that Direction has similar tendencies to Source and Trajectory in that Direction expressions are most likely to combine with verbs of translational motion.

Table 31. Pearson's residuals for Direction and MotionType

	TranslMotion	BothMotions	SelfContMotion
Direction expression absent (= no)	−1.95	1.72	3.84
Direction expression present (= yes)	**4.26**	**−3.76**	**−8.42**

This combination is epitomised in (127) by the verb *kiirustama* 'hurry' and the Direction expression *välja* 'out'.

(127)	*Mees …*	***kiirusta-s***	*kambri-st*	***välja****.*
		[MMV: TranslMotion]	[Source]	**[Direction]**
	man	**hurry-PST.3SG**	chamber-ELA	**out**
	'The man hurried out of the room.' (FC)			

The relative importance of variables in predicting Direction shows that motion type contributes to the result only minimally (see Figure 41). This is despite that the general performance of the model benefits greatly from the inclusion of this predictor (C = 0.78). Source, VerbType, and Goal are of major importance in predicting Direction (see also Section 9.1.1.4 for a similar result). As Motion-Type adds negligibly to the main results according to the variable importances, the conditional inference tree is not created.

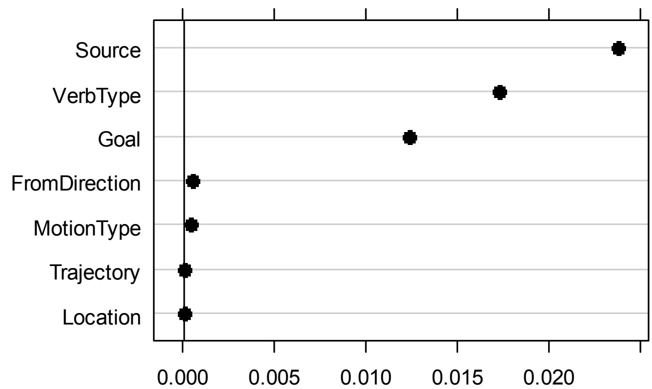

Figure 41. Conditional variable importance in predicting Direction (predictors to the right of the vertical line are significant): Direction ~ Source + FromDirection + Location + Trajectory + Goal + VerbType + MotionType

To some extent, Direction is more frequently expressed alongside verbs of translational motion than with the other verbs. This association is, however, very weak. In predicting Direction, MotionType contributes little, if anything, to the outcome. In other words, whether a motion verb depicts translational or self-contained motion only has a marginal influence on the expression of Direction. However, the set of variables with MotionType accounts for the variation of Direction better than if it had been excluded.

9.1.2.5. Goal

There are two characteristics of Goal. First, it is similar to Direction in referring to the final portion of the path. Second, it is similar to Source in entailing highly directional meanings. Consequently, it can be predicted to combine mostly with verbs of translational motion. Moreover, as described in Section 4.2.1.1, the interpretation of translational motion of a clause, itself, is frequently achieved on the basis of the presence of Goal expressions.

Contingency data representing the ‘yes’ values confirms these expectations (see Section 9.1.2 above). The same can also be seen in Figure 42, which presents the proportions of both ‘yes’ and ‘no’ values of the variable. That is, 34% of clauses feature combinations of verbs expressing translational motion and Goal expressions. This is considerably more than in the case of self-contained (1%) and both motions (10%). The Chi-square test reveals significant difference in proportions with a weak, but close to medium effect size: $\chi^2(2, N = 9500) = 614.45$, $p < 0.001$, Cramér’s $V = 0.25$.

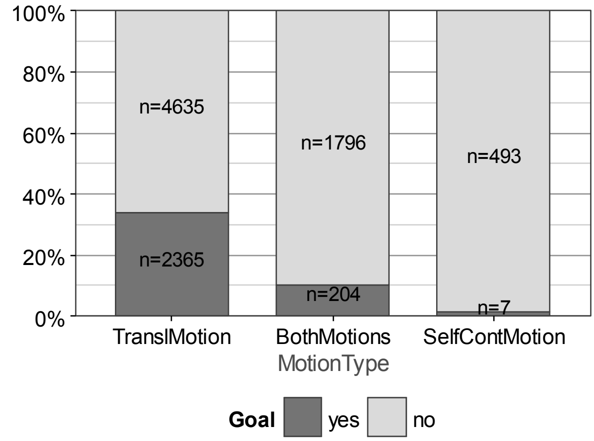

Figure 42. The presence (= yes) and absence (= no) of Goal expressions across verbs expressing translational (= TranslMotion), both translational and self-contained (= BothMotions), and self-contained motion (= SelfContMotion)

Pearson's residuals (see Table 32) provide additional robust evidence that there are strong biases towards expressing Goal with verbs of translational motion too, while the other verbs are significantly biased away from such combinations.

Table 32. Pearson's residuals for Goal and MotionType

	TranslMotion	BothMotions	SelfContMotion
Goal expression absent (= no)	−6.54	6.74	8.86
Goal expression present (= yes)	**10.72**	**−11.04**	**−14.53**

An example of this is the combination of the verb *minema* 'go' and the Goal phrase *leti juurde* 'to the counter', as in (128).

(128)	... ***läks-i-n***[53]	*pikka-de*	*sammu-de-ga*	***leti***	***juurde*** ...
	[GV]			**[Goal]**	
	go-PST-1SG	long-PL.GEN	stride-PL-COM	**counter.GEN**	**to**

'With long strides I went to the counter.' (FC)

By means of variable importance in the model of random forests, the importance of the type of motion becomes even more evident. The main variable that splits the data into two is MotionType, followed by Direction, Location, and Trajectory (see Figure 43). More importantly, the performance of the model improves substantially with the inclusion of MotionType (C = 0.81). It can also be observed that VerbType, which had a great influence over Goal in the former model of random forests (see Section 9.1.1.5), is only somewhat important in the current model. This suggests that in predicting Goal, verb

53 *läksin* 'go.PST.1SG' is the suppletive form of the verb *minema* 'go'.

semantic features that refer to motion type are more prominent than those that refer to the portions of the path.

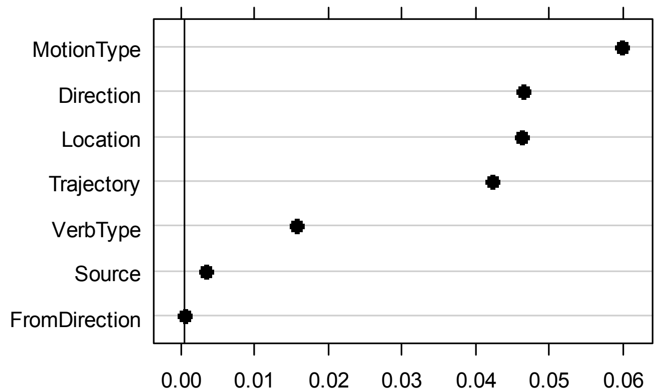

Figure 43. Conditional variable importance in predicting Goal (predictors to the right of the vertical line are significant): Goal ~ Source + FromDirection + Location + Trajectory + Direction + VerbType + MotionType

The conditional inference tree representing the best predictor MotionType provides further evidence that translational motion is clearly opposed to self-contained and both motions (see Figure 44 and the example in (128)).

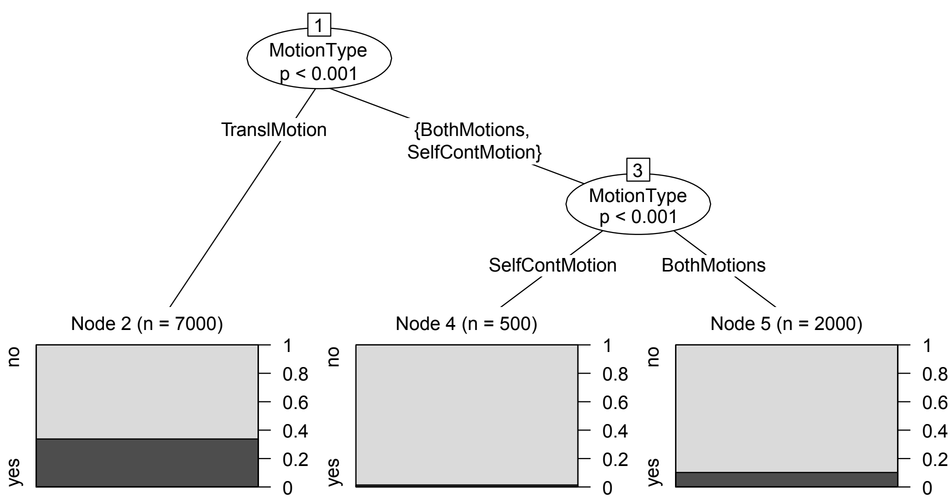

Figure 44. Conditional inference tree for Goal: Goal ~ MotionType

Based on the univariate analysis, Goal does associate with MotionType as verbs of translational motion are very likely to combine with Goal expressions. However, the magnitude of the effect is weak, suggesting the importance of other variables in explaining Goal. Multivariate analysis shows that MotionType is a highly important factor in explaining the variation of Goal. The type of verb is less important in respect to motion type.

9.1.2.6. Summary and discussion

The type of motion (MotionType) is significantly related to the expression of spatial categories (Source, Location, Trajectory, Direction, and Goal). The results can be summarised by stating that the more directional a spatial category is, the more likely it is expressed in combination with verbs of translational motion. According to Pearson's residuals, Location is biased towards verbs of both motions (e.g., *tammus maja ees* '(s)he was stamping in front of the house'), but also towards verbs of self-contained motion (e.g., *niheles toolil* '(s)he was fidgeting on a chair'). Other categories (Source, Trajectory, Direction, and particularly Goal) are biased towards verbs of translational motion (e.g., *suundus tuppa* '(s)he headed into the room'). On the basis of deviance magnitudes in pairwise analyses (from smaller to bigger values of residuals), the cline of spatial variables is as follows: Location > Trajectory > Source > Direction > Goal. In other words, Location is least and Goal most likely to co-occur with verbs of translational motion. This finding provides strong evidence for the consistent windowing hypothesis in that the more directional a spatial category is, the more easily it combines with directional verbs, as translational motion is clearly more directional than self-contained motion.

As for verbs of different motion types, the results indicate that it is justifiable to divide verbs into three types. Verbs of translational motion differ clearly from verbs of self-contained motion according to their typical clausal patterns. However, verbs of both motions do seem to form an intermediate category between the two. As the verbs can be used in both translational and self-contained motion contexts, the spatial information as a context is essential in these cases in order to decide upon the type of motion.

Simultaneously, the results justify the inclusion of self-contained motion in the study, and show that translational and self-contained motion are both a matter of degree. From most studies of motion expressions, self-contained motion is excluded (e.g., Slobin 1996; Slobin 2004; Filipović 2007; Papafragou et al. 2008; Chen & Guo 2009; Ibarretxe-Antuñano 2009; Hickmann et al. 2011). This is mainly because Talmy's (2000b: 25–27, 35–36) model of the motion event accounts for translational motion only, and most studies on motion are conducted in the vein of Talmy's model. Another reason may be that translational motion is more prototypical than self-contained motion, and, thus, is more likely to attract the attention of the researchers.

This study also aims to investigate verbs of self-contained motion in addition to verbs of translational motion (see Section 5.1 for verb selection). The rationale for this is twofold. First, there seems to be limited justification for why a location of an entity is covered by Talmy's model of the motion event, whereas self-contained motion is not (see also Sections 3.2.2.1 and 4.2). Second, both verbs of translational and self-contained motion can occur in dynamic and static contexts in Estonian. That is, verbs of self-contained motion can be used to describe translational motion, and verbs of translational motion can be used in combination with expressions of static locations. Moreover, it can often be difficult to separate verbs of self-contained and translational motion. This is because verbs, rather than falling into discrete categories, fill a continuum between self-contained and translational motion (see Section 8.1.2).

However, it should be noted that the influence of MotionType on the results is rather small according to the weak effect sizes of the pairwise analyses (the values of Cramér's V are between 0.09 and 0.25). This means that many other important factors are missing from the analyses and multifactorial analyses are needed. This was also found in the analysis of the variable VerbType (see Section 9.1.1 above). Similar conclusions can be drawn from conditional inference trees too in that the variable MotionType interplays with the other variables in predicting the presence of any of the spatial categories.

Moreover, the inclusion of the variable MotionType to the models of random forests clearly improves the performance of all models as the indices of concordances C range from 0.78 to 0.81. Without MotionType, these indices are between 0.73 and 0.79 (see Section 9.1.1). The impact of MotionType is highest in predicting Location and Goal, where it is clearly the most influential variable for the models. In predicting Source and Direction, MotionType is insignificant. The model for Trajectory did not yield significant results. In predicting Goal, the impact of VerbType clearly diminishes due to MotionType. This result can be explained by the fact that most goal verbs (but not all, some also express both self-contained and translational motion as shown in Table 7 in Section 8.1) in the data depict translational motion. Overall, these results suggest an intricate structure of the data and an important interplay between verb semantic features.

9.1.3. Horizontal/vertical motion and spatial categories

Another factor that represents verb semantics is whether motion is conducted along the horizontal or vertical axis (i.e., the variable HorVert; see also Section 6.1.1.4). Verbs of vertical motion can behave quite differently from verbs of horizontal motion. This is because vertical motion is very different from horizontal motion (see Section 3.3.3.2 for a further explication). There is also convincing evidence that the direction of motion in terms of horizontality and verticality is linked to the aspectual patterns in language (Tragel & Veismann 2008).

In motion clauses, information about motion along the horizontal and vertical axes (as embedded in verb meaning) is presumably also relevant to spatial expressions. It is likely that this variable (HorVert) interferes with the above-examined variables (VerbType and MotionType) in predicting the spatial variables (Source, Location, Trajectory, Direction, and Goal). More specifically, it may be that verbs of vertical motion combine with Source, and Goal expressions more frequently than other verbs. This is because the starting and the final location of a vertical motion are typically visible and self-evident, as they are determined by gravity. This is not the case for typical horizontal motion which can be conducted over much longer distances. In addition, vertical motion is typically faster (particularly downward motion) or more forceful (particularly upward motion) than horizontal motion. This is again due to gravity to which horizontal motion is less sensitive than vertical motion.

The results of the correspondence analysis (see Figure 45) provide support to this explanation. Verbs expressing vertical motion (shown in black) are on the right-hand side of the plot. They cluster around spatial categories that represent the initial or final portion of the path. Verbs that are ambiguous in terms of horizontal and vertical motion (shown in yellow) show partly similar tendencies, while many of those (mostly expressing self-contained or both motions) can be found close to the category of Location. Verbs expressing horizontal motion (shown in blue) are scattered along both axes of the plot. It can be inferred, therefore, that verbs of horizontal motion do not show clear biases towards combining with particular spatial categories. By contrast, verbs of vertical motion seem to be biased towards Source, FromDirection, Direction, and Goal.

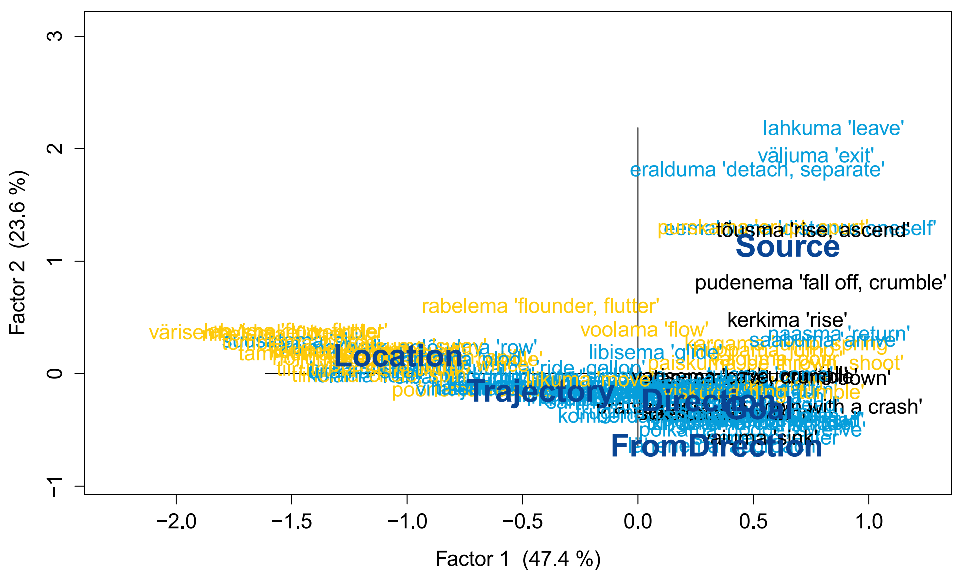

Figure 45. Results of the correspondence analysis. Large dark blue labels stand for spatial variables. Smaller labels refer to particular motion verbs: blue = verbs of horizontal motion, black = verbs of vertical motion, yellow = verbs of ambiguous motion

The analysis of the contingency table data (see Figure 46) indicates that, as expected, spatial variables behave somewhat differently with respect to vertical and horizontal motion. More specifically, verbs of horizontal motion (labelled as ‘HorVerb’) combine most frequently with Goal expressions (30%) and least frequently with Source ones (11%). Ambiguous verbs (i.e., verbs that do not express horizontal and vertical motion or can express both; labelled as ‘HorVertVerb’) combine more frequently with Location expressions (38%) than the other verbs. Verbs of vertical motion (labelled as ‘VertVerb’) are even more likely to combine with Goal (55%). Compared to the other verbs, verbs of vertical motion combine also frequently with Source expressions (19%). The Chi-square test reveals significant differences in proportions with a weak effect size: $\chi^2(8, N = 8492) = 812.84$, $p < 0.001$, Cramér's $V = 0.22$.

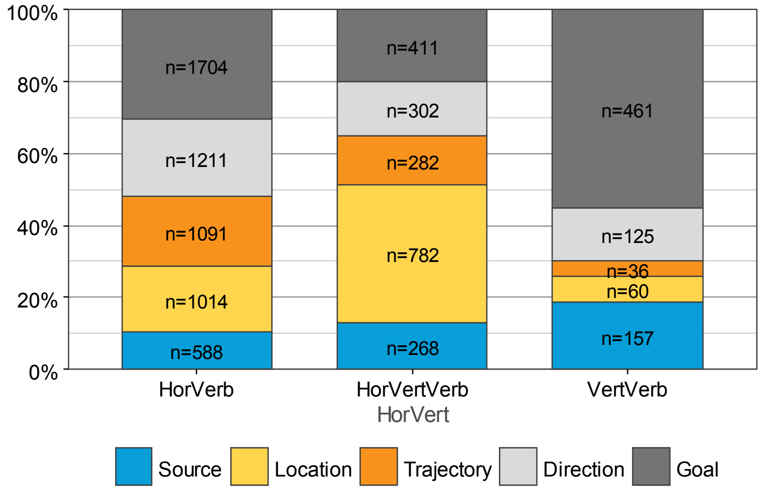

Figure 46. Distribution of spatial expressions of Source, Location, Trajectory, Direction, and Goal across verbs expressing horizontal (= HorVerb), directionally unspecified (= HorVertVerb), or vertical motion (= VertVerb)

By and large, Pearson's residuals confirm these observations (see Table 33). Verbs of horizontal motion tend to combine with Trajectory, and Direction, but are insensitive to Goal expressions. Verbs that are ambiguous in terms of horizontal and vertical motion are mostly biased towards Location expressions, and away from Trajectory, Direction, and Goal expressions. Verbs of vertical motion tend to co-occur with Source, and Goal, but not with the other spatial expressions.

Table 33. Pearson's residuals for the spatial variables and HorVert

	HorVerb	HorVertVerb	VertVerb
Goal	0.07	−8.40	**12.94**
Direction	**3.93**	−4.66	−2.90
Trajectory	**5.26**	−3.11	−8.75
Location	−6.05	**15.85**	−9.11
Source	−3.13	1.54	**5.69**

Vertical motion can be conducted upwards and downwards. Due to gravity, the two are very different. Upward motion needs extra energy and moving fast is difficult, whereas downward motion is effortless and fast. This suggests that spatial information is also differently encoded in the case of upward and downward motion. In the current data, two of the verbs of vertical motion describe upward motion (*kerkima* 'rise' and *tõusma* 'rise, ascend'), and eight verbs describe downward motion (*kukkuma* 'fall', *langema* 'fall, come down', *laskuma* 'descend', *prantsatama* 'fall with a crash', *pudenema* 'fall off, crumble', *sukelduma* 'dive', *vajuma* 'sink', and *varisema* 'cave, crumble'). The distribution of spatial expressions across these verbs of upward and downward motion is presented in Figure 47. It shows that verbs of upward motion are biased towards Source, whereas verbs of downward motion are biased towards Goal expressions.

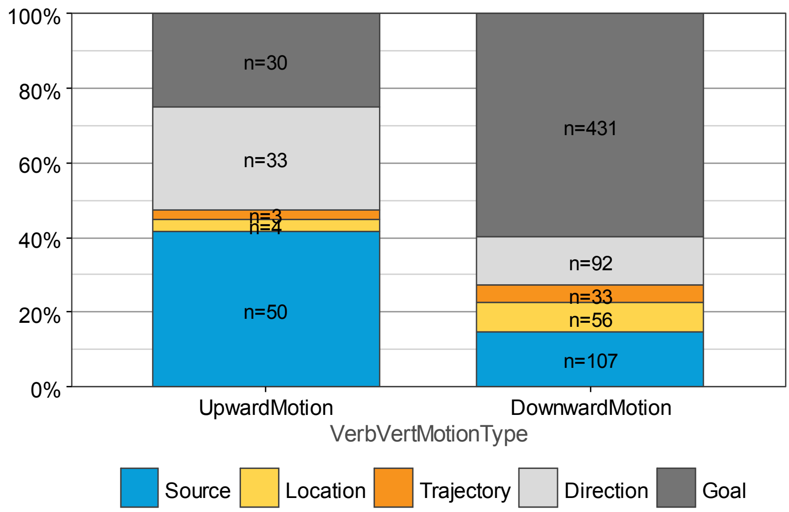

Figure 47. Distribution of spatial expressions across verbs of upward and downward motion

As for the results of the analysis on the frequencies of 'yes' values of spatial variables, the variable HorVert does seem to have an impact on clausal patterns of spatial information. To gain a more elaborate understanding of clausal patterns with respect to HorVert, and to evaluate the role of this variable in the context of the other variables, the spatial variables are, again, examined one by one. The results are presented in the same way as in the previous sections of VerbType and MotionType. That is, I discuss the expression of each five spatial categories in the following sections by applying both univariate and multivariate analyses on the raw data which contains both 'yes' and 'no' values of spatial variables. The conditional inference trees are, again, presented only if the variable HorVert is significant in predicting a spatial variable.

9.1.3.1. Source

The analysis of 'yes' values of the variable Source across the variable HorVert shows that expressing Source is biased towards verbs of vertical motion (see Figure 46 in Section 9.1.3). The analysis which is based on both 'yes' and 'no' values provides similar results (see Figure 48). 16% of verbs of vertical motion, and 10% of verbs of horizontal and ambiguous motion, co-occur with Source expressions. The difference between proportions is significant: $\chi^2(2, N = 9500) = 29.99$, $p < 0.001$. However, the effect size is extremely low (Cramér's V = 0.06), and indicates that the association between Source and HorVert is very weak.

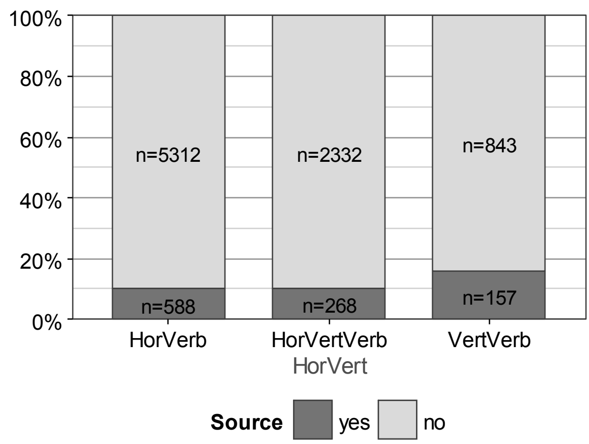

Figure 48. The presence (= yes) and absence (= no) of Source expressions across verbs expressing horizontal (= HorVerb), ambiguous (= HorVertVerb), and vertical motion (= VertVerb)

Despite the very weak association strength, Pearson's residuals (see Table 34) confirm that verbs of vertical motion are very likely to combine with Source expressions.

Table 34. Pearson's residuals for Source and HorVert

	HorVerb	HorVertVerb	VertVerb
Source expression absent (= no)	0.57	0.19	−1.69
Source expression present (= yes)	−1.64	−0.56	**4.88**

This is also illustrated in (129) where the verb of vertical motion *pudenema* 'fall off, crumble' co-occurs with a Source phrase *puudelt* 'from the trees'. Combinations between verbs of horizontal or ambiguous motion and Source expressions are unimportant.

(129) *Siis* *kui* ... ***puude-lt*** *lehe-d* ***pudene-si-d*** ...
[Source] **[MMV: VertVerb]**
then when **tree-ABL** leaf-PL.NOM **fall-PST-3PL**
'then when leaves fell slowly from the trees' (FC)

In the context of the other variables, the variable HorVert has some predictive power in explaining the variation of Source, as shown by the variable importance analysis of random forests in Figure 49. The variable HorVert is located to the right of all the other verb semantic variables except VerbType making it the second variable that influences the expression of Source. However, VerbType is the most influential variable in predicting Source. The index of concordance has risen to C = 0.84, which shows an improvement of performance. The inclusion of HorVert into the model has made the other variables more important in predicting Source than they are in the models without HorVert (see Figure 17 in Section 9.1.1.1, and Figure 34 in Section 9.1.2.1; cf., Figure 49).

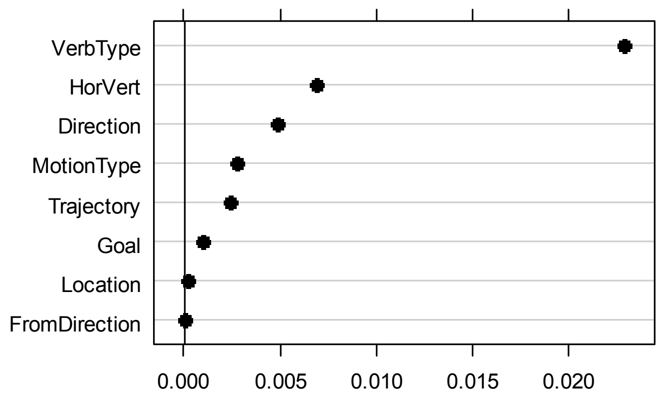

Figure 49. Conditional variable importance in predicting Source (predictors to the right of the vertical line are significant): Source ~ FromDirection + Location + Trajectory + Direction + Goal + VerbType + MotionType + HorVert

Only the most effective variables starting from HorVert are included as independent variables in the conditional inference tree analysis. Thus, the tree is created with two variables (VerbType and HorVert) predicting Source (see Figure 50). It shows that source verbs, unlike the other verbs (see Node 1), are very likely to combine with Source expressions (see Node 9). This is similar to the results found in the previous analyses of Source. The other types of verbs are much more modest in this respect, and the differences between other nodes are extremely small.

To summarise, the inclusion of the variable HorVert into the group of independent variables improves the predictive performance of the model for Source. However, the type of verb (VerbType) is the main factor that determines whether Source is expressed or not, and the variable HorVert contributes only to some degree to the variation of Source. In particular, verbs of vertical motion are slightly more likely to combine with Source expressions than verbs of horizontal and ambiguous motion.

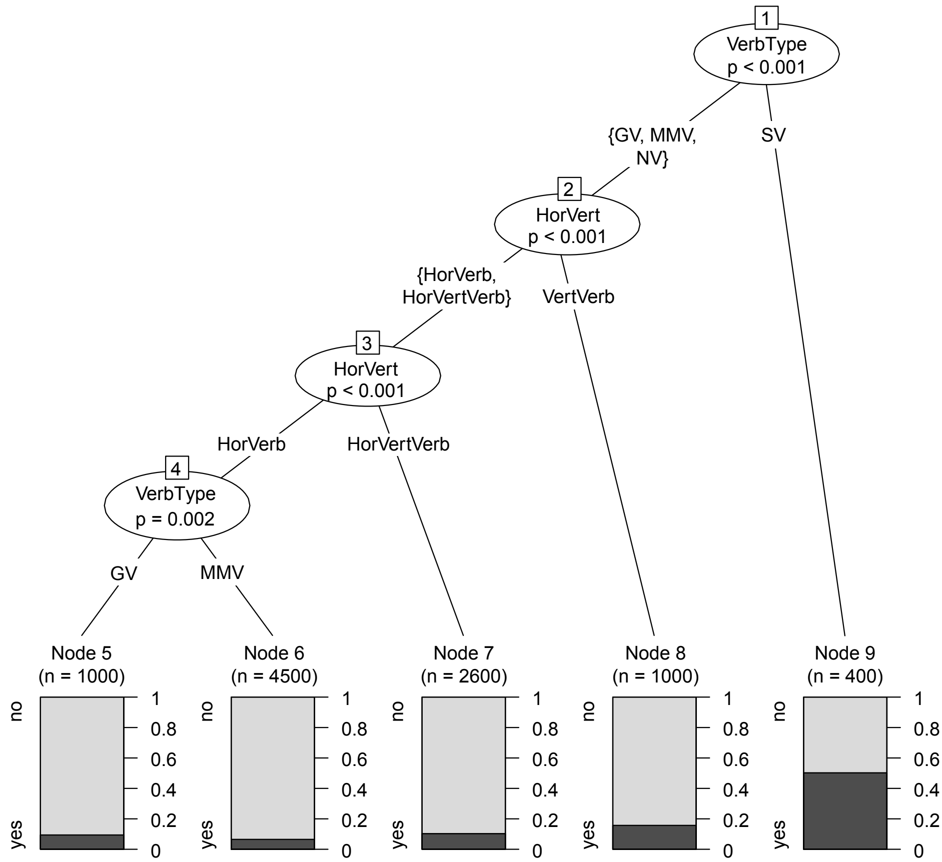

Figure 50. Conditional inference tree for Source: Source ~ VerbType + HorVert; SV = source verbs, NV = the neutral verb, MMV = manner of motion verbs, GV = goal verbs

9.1.3.2. Location

Location is shown to be rather exceptional in the context of the other spatial variables in that it is inclined towards combining with verbs of ambiguous direction (see Section 9.1.3). Regarding proportions of 'yes' and 'no' values (see Figure 51), the same pattern can be seen in that Location is expressed frequently with verbs which could be used to depict both horizontal and vertical motion (30%). Verbs of horizontal motion are combined with Location expressions less frequently (17%), and verbs of vertical motion rarely (6%). The Chi-square test reveals significant difference in proportions with a weak effect size: $\chi^2(2, N = 9500) = 321.05$, $p < 0.001$, Cramér's V = 0.18.

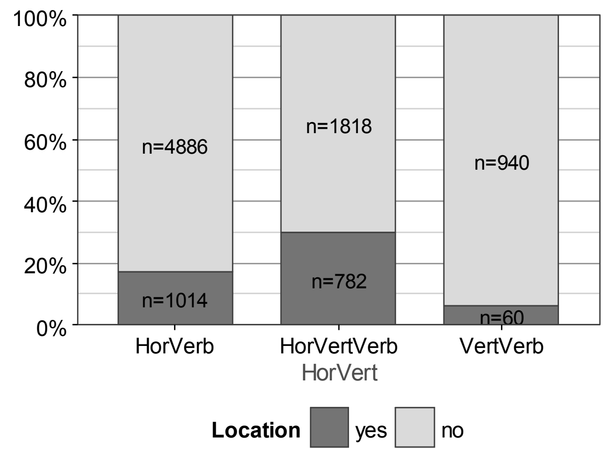

Figure 51. The presence (= yes) and absence (= no) of Location expressions across verbs expressing horizontal (= HorVerb), ambiguous (= HorVertVerb), and vertical motion (= VertVerb)

Pearson's residuals (see Table 35) confirm this bias towards expressing Location with ambiguous verbs. Moreover, verbs of vertical motion and verbs of horizontal motion have significantly less Location-containing clauses than expected by chance.

Table 35. Pearson's residuals for Location and HorVert

	HorVerb	HorVertVerb	VertVerb
Location expression absent (= no)	2.01	−5.99	4.77
Location expression present (= yes)	**−4.08**	**12.16**	**−9.68**

To illustrate this, in (130), the verb of both horizontal and vertical motion *hüppama* 'jump' is used together with the Location phrase *voodis* 'on the bed'.

(130) ... ***hüppa-si-n*** ***voodi-s.***
[MMV: HorVertVerb] **[Location]**
jump-PST-1SG **bed-INE**
'I was jumping on the bed.' (FC)

The evaluation of the impact of different variables indicates an insignificant role of the variable HorVert in predicting Location (see Figure 52). MotionType continues to be of the primary importance, followed by Trajectory, Goal, and Direction (cf., Figure 36 in Section 9.1.2.2). Nevertheless, the inclusion of the variable HorVert not only improves slightly the model performance in predicting Source (C = 0.82), but also reduces the influence of VerbType, which had become a significant factor after the inclusion of the variable MotionType (see Figure 36 in Section 9.1.2.2). As the variable HorVert, itself, appears to be insignificant in the model, the conditional inference tree is not created.

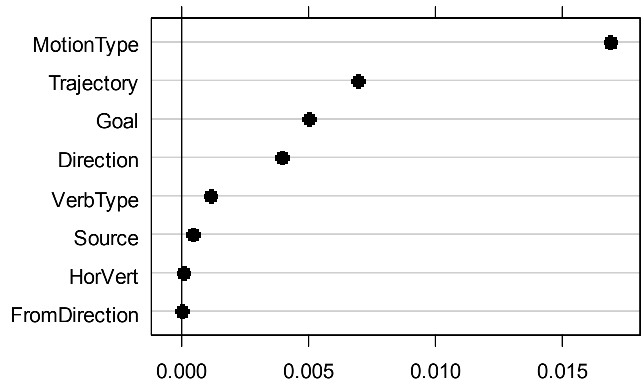

Figure 52. Conditional variable importance in predicting Location (predictors to the right of the vertical line are significant): Location ~ Source + FromDirection + Trajectory + Direction + Goal + VerbType + MotionType + HorVert

Whether a verb expresses horizontal or vertical motion, is somewhat associated with the expression of Location. The results are mixed, though, as verbs which are ambiguous with regard to general direction (i.e., verbs labelled as HorVertVerb) are significantly more likely to combine with Location expressions than the other verbs, but then the importance of the variable HorVert becomes negligible in the context of the other verb semantic and spatial variables. However, the ensemble of the independent variables gains strength in explaining the outcome of the model of random forests.

9.1.3.3. Trajectory

In comparison with the other spatial variables, Trajectory occurs more frequently with verbs of horizontal motion than the other variables (see Section 9.1.3). The count data of both 'yes' and 'no' values (see Figure 53) suggests that Trajectory is indeed inclined towards horizontal (19%) and away from vertical motion (4%). The results are significant with a weak effect size: $\chi^2(2, N = 9500) = 195.12$, $p < 0.001$, Cramér's V = 0.14.

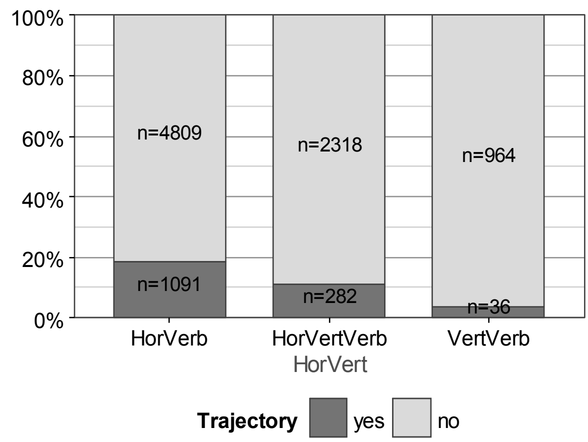

Figure 53. The presence (= yes) and absence (= no) of Trajectory expressions across verbs expressing horizontal (= HorVerb), ambiguous (= HorVertVerb), and vertical motion (= VertVerb)

Similar conclusions can be drawn from the inspection of Pearson's residuals (see Table 36). The residuals indicate that only verbs of horizontal motion are biased towards Trajectory expressions.

Table 36. Pearson's residuals for Trajectory and HorVert

	HorVerb	HorVertVerb	VertVerb
Trajectory expression absent (= no)	−3.05	2.20	3.85
Trajectory expression present (= yes)	**7.30**	**−5.28**	**−9.22**

This is exemplified in (131) by the combination of the verb of horizontal motion *kõndima* 'walk' and the Trajectory phrase *mööda jõekallast* 'along the river bank'.

(131)	*Malin*	***kõnd-i-s***	***mööda***	***jõekallas-t***	*vastuvoolu ...*
		[MMV: HorVerb]	**[Trajectory]**		[Direction]
	Malin	**walk-PST-3SG**	**along**	**river.bank-PART**	upstream

'Malin walked upstream along the river bank.' (FC)

The importance of the variable HorVert in predicting Trajectory can be seen as very high (see Figure 54). In this respect, HorVert is similar to MotionType. However, the presence or absence of Source expressions is more important than the variables HorVert and MotionType. The index of concordance (C = 0.79) suggests an improvement to the model accuracy and almost good performance.

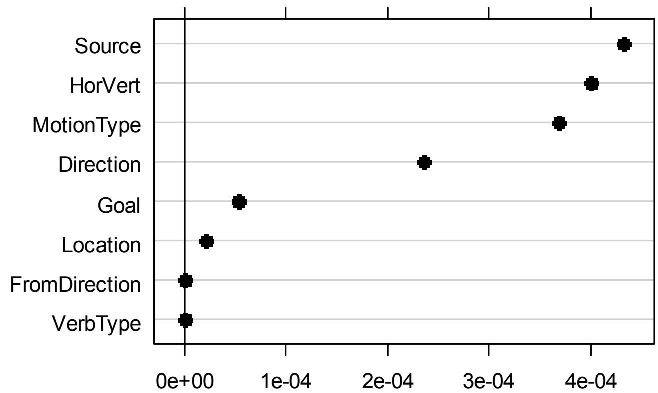

Figure 54. Conditional variable importance in predicting Trajectory (predictors to the right of the vertical line are significant): Trajectory ~ Source + FromDirection + Location + Direction + Goal + VerbType + MotionType + HorVert

The conditional inference tree with these three predictor variables (Source, HorVert, and MotionType) provides more insight into the data by showing the importance of the absence of Source expressions in the presence of Trajectory expressions (see Figure 55). That is, whenever Source expressions are not present, Trajectory has a higher likelihood of being expressed (see Nodes 7, 13, and 17). This can also be seen above in (131) which contains a verb of horizontal motion (*kõndima* 'walk') and a Trajectory expression (*mööda jõekallast* 'along the river bank'), but no Source expression. At the same time, the main factor that separates the clauses into two is HorVert (see Node 1).

The expression of Trajectory does associate with the direction of motion as expressed by the verb. More specifically, there is a slight bias towards horizontal motion. With respect to the other variables introduced so far, HorVert is one of the three most important variables in predicting Trajectory.

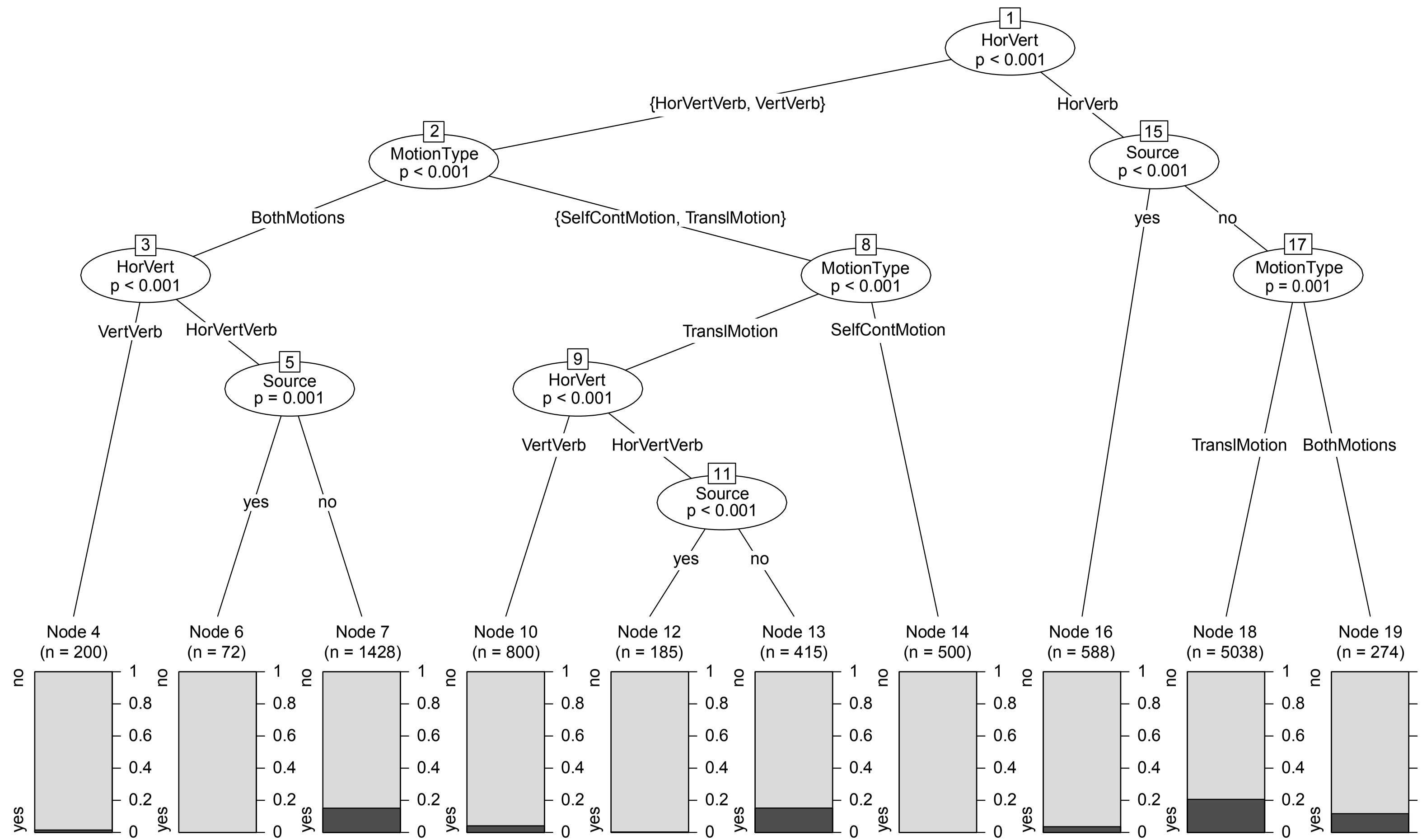

Figure 55. Conditional inference tree for Trajectory: Trajectory ~ Source + HorVert + MotionType

9.1.3.4. Direction

According to the initial analysis presented in Section 9.1.3 above, Direction is comparable to Trajectory in that they both have a tendency to combine with verbs of horizontal motion to a similar extent. The analysis of the raw data, which contains both 'yes' and 'no' values of Direction, confirms this result (see Figure 56). Verbs of horizontal motion tend to co-occur with Direction expressions more frequently (21%) than verbs of ambiguous direction (12%) and verbs of vertical motion (13%). This is confirmed by the Chi-square test: $\chi^2(2, N = 9500) = 118.02$, $p < 0.001$. The strength of the association is weak: Cramér's V = 0.11.

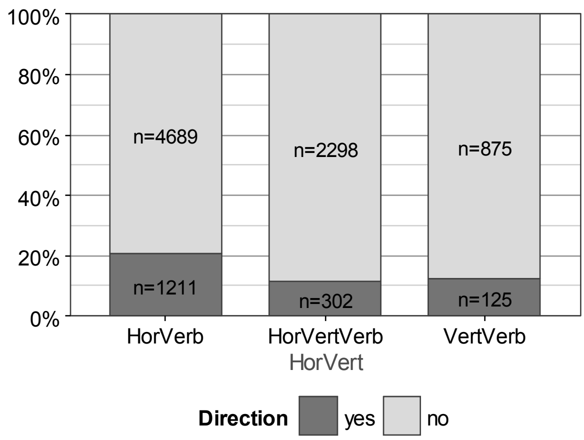

Figure 56. The presence (= yes) and absence (= no) of Direction expressions across verbs expressing horizontal (= HorVerb), ambiguous (= HorVertVerb), and vertical motion (= VertVerb)

This finding is also supported by Pearson's residuals (see Table 37) which show the bias towards combining Direction expressions with verbs of horizontal motion.

Table 37. Pearson's residuals for Direction and HorVert

	HorVerb	HorVertVerb	VertVerb
Direction expression absent (= no)	−2.77	3.15	1.65
Direction expression present (= yes)	**6.07**	**−6.91**	**−3.61**

This combination is exemplified in (132) by the combination of the verb of horizontal motion *kõndima* 'walk' and the Direction expression *välja* 'out'.

(132)	*Mare* ...	***kõnd-i-s***	*lihtsalt*	***toa-st***	***välja****.*
		[MMV: HorVerb]		**[Source]**	**[Direction]**
	Mare	**walk-PST-3SG**	simply	**room-ELA**	**out**

'Mare simply walked out of the room.' (FC)

The inspection of the variable importance in random forests model (see Figure 57) suggests a modest impact of the variable HorVert in explaining the variation of Direction. The three variables, already attested in the models without HorVert, are clearly more significant than HorVert: Source, VerbType, and Goal. The performance of the model has improved slightly, to C = 0.79.

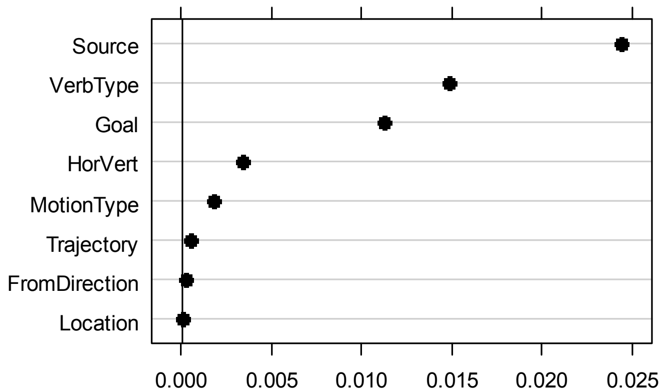

Figure 57. Conditional variable importance in predicting Direction (predictors to the right of the vertical line are significant): Direction ~ Source + FromDirection + Location + Trajectory + Goal + VerbType + MotionType + HorVert

The conditional inference tree in Figure 58 shows that the main variable that splits the data into two is Source (see Node 1). The variable HorVert becomes important mainly when Source *is* expressed, but Goal *is not* expressed, and the verb is either a goal, neutral, or manner of motion verb (see Node 2). Under these conditions, the expression of Direction is preferred by verbs expressing horizontal or directionally ambiguous motion. This pattern differentiates Direction from Trajectory. Trajectory tends not to be expressed if Source is expressed (see Figure 55 in Section 9.1.3.3). By contrast and as shown in Figure 58, Source and Direction tend to combine with each other. This is particularly true when manner of motion verbs are used, and the verb expresses horizontal or directionally ambiguous motion (see Node 8). Furthermore and in this pattern, Direction is almost always expressed in the case of verbs describing horizontal motion (see Node 10 and the example in (132) above).

The results suggest that the expression of Direction is related to whether a verb depicts horizontal or vertical motion. Verbs of horizontal motion (particularly those of manner of motion) are extremely likely to co-occur with Direction expressions in the presence of Source and the absence of Goal expressions.

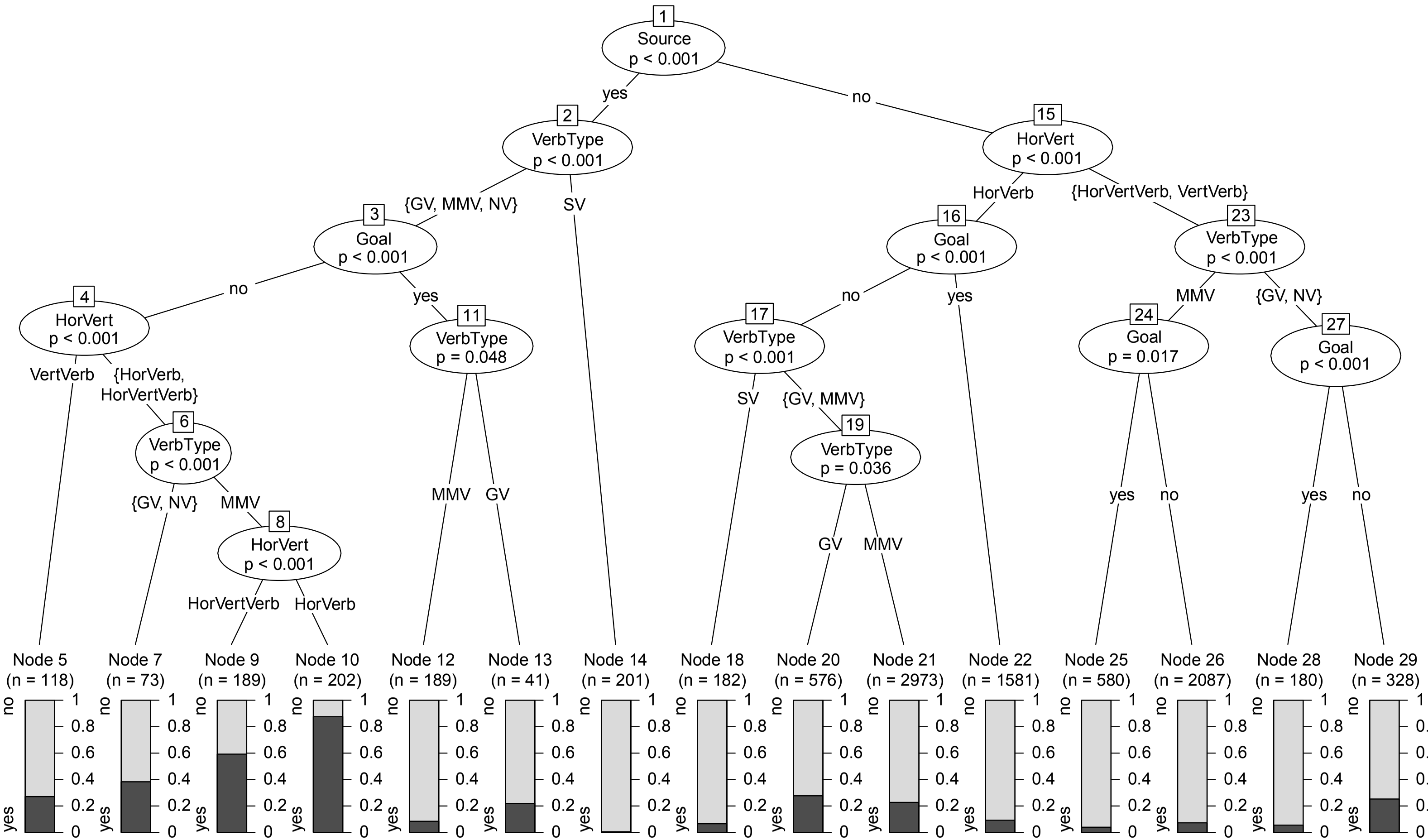

Figure 58. Conditional inference tree for Direction: Direction ~ Source + VerbType + Goal + HorVert; SV = source verbs, NV = the neutral verb, MMV = manner of motion verbs, GV = goal verbs

9.1.3.5. Goal

According to the analysis based on the 'yes' values of Goal, it has similar proportions to Source with respect to horizontal and vertical motion in being biased towards horizontal motion (see Section 9.1.3). The raw data with comparing 'yes' and 'no' values of Goal (see Figure 59), however, indicates a strong bias towards vertical motion. 46% of the verbs of vertical motion are used in combination of Goal expressions. Simultaneously, only 29% of the verbs of horizontal motion and 16% of the verbs of ambiguous motion combine with Goal expressions. The Chi-square test confirms the association being significant, but weak: $\chi^2(2, N = 9500) = 359.89$, $p < 0.001$, Cramér's $V = 0.19$.

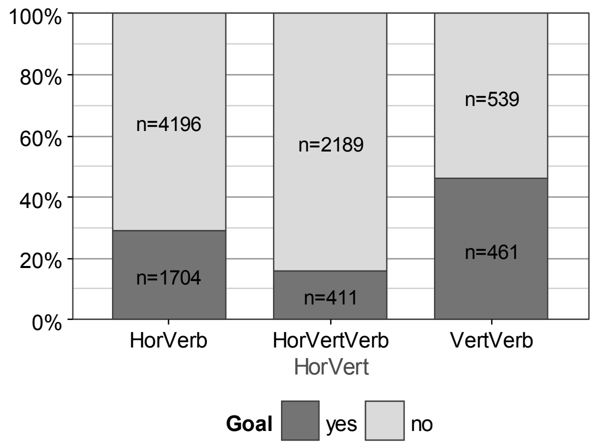

Figure 59. The presence (= yes) and absence (= no) of Goal expressions across verbs expressing horizontal (= HorVerb), ambiguous (= HorVertVerb), and vertical motion (= VertVerb)

Pearson's residuals (see Table 38) provide more evidence for this bias. Verbs of vertical motion are strongly inclined towards Goal. The residuals suggest also that verbs of horizontal motion exhibit somewhat more combinations with Goal, and ambiguous verbs have significantly less clauses with Goal than if the data were evenly distributed.

Table 38. Pearson's residuals for Goal and HorVert

	HorVerb	HorVertVerb	VertVerb
Goal expression absent (= no)	−1.59	6.75	−7.03
Goal expression present (= yes)	**2.60**	**−11.07**	**11.53**

A combination between a verb of vertical motion and a Goal expression is illustrated in (133) by the verb *laskuma* 'descend' and the Goal phrase *metsa vahele* 'into the forest'.

(133)	*Ja*	*Joost*	***lasku-s***	*kirikumäe-st*	*alla*
			[**GV: VertVerb**]	[Trajectory]	[Direction]
	and	Joost	**descend-PST.3SG**	church.hillock-ELA	down
	metsa	***vahele …***			
	[Goal]				
	forest.GEN	**between**			

'And Joost descended down the church hillock into the forest.' (FC)

Compared to the other variables in the model of random forests, the variable HorVert, being ranked as a penultimate one, has a rather modest impact on the results (see Figure 60). The four most important variables, discussed already in the context of motion type (see Figure 43 in Section 9.1.2.5), are Direction, Location, Trajectory, and MotionType. The model has improved slightly with the inclusion of HorVert (C = 0.82). As HorVert has only a minor influence on predicting Goal, the conditional inference tree is not created.

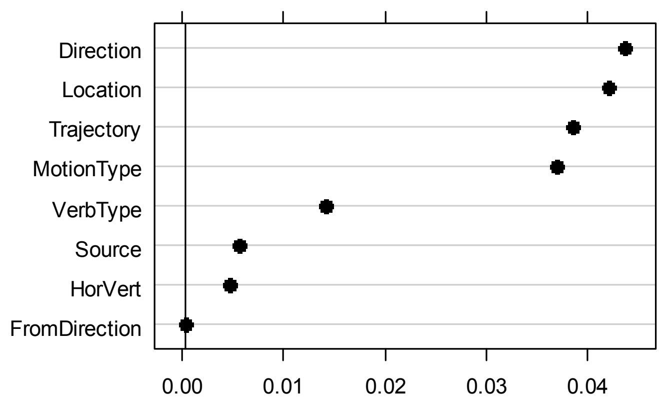

Figure 60. Conditional variable importance in predicting Goal (predictors to the right of the vertical line are significant): Goal ~ Source + FromDirection + Location + Trajectory + Direction + VerbType + MotionType + HorVert

This analysis indicates the impact of directionality on the expression of Goal even though the association between the two is weak. Verbs of vertical motion are somewhat more likely to co-occur with Goal expressions than the other verbs. In the context of the other variables, this semantic feature of verbs appears to be of minor importance in predicting the presence or absence of Goal expressions.

9.1.3.6. Summary and discussion

The verb semantic factor of horizontal and vertical motion (variable HorVert) affects the clausal patterns of motion verbs. The univariate analyses of both the contingency table and binary data show that Trajectory, and Direction are mainly combined with verbs of horizontal motion (e.g., *hulkus mööda tänavaid* '(s)he wandered along the streets', *jooksis maja poole* '(s)he ran towards the house');

Source, and Goal with verbs of vertical motion (e.g., *ta kerkis maast (õhku)* '(s)he rose (up) from the ground', *kukkus põrandale* '(s)he fell to the floor'); and Location with verbs of directionally ambiguous motion (e.g., *hüples põrandal* '(s)he bobbled on the floor'). Moreover, verbs of vertical motion that express upward motion are biased towards Source, whereas those that express downward motion are biased towards Goal.

Verbs of vertical motion can be seen as more directional than verbs of horizontal motion, or those expressing both or neither dimensions. As such, the results indicate that the more directional the verb is, the more likely it occurs in combination with directional spatial categories. This concurs with both the finding of the type of verb (VerbType; see Section 9.1.1) and type of motion (MotionType; see Section 9.1.2). Consequently, the consistent windowing hypothesis is confirmed.

However, the role of the verb semantic features of horizontal and vertical motion (variable HorVert) cannot be overestimated. According to the effect sizes of pairwise significance testing (Cramér's V ranged from 0.06 to 0.22), this variable HorVert is rather weakly associated with spatial variables. This result can again be contributed to the multivariate structure of the data in that a single variable is not sufficient to explain the variation in the data. In the ensemble of the other variables, the variable HorVert contributes most to Trajectory. In other models, HorVert is modest in its predictive power. The models themselves, however, have improved with the inclusion of HorVert, as indicated by the indices of concordances C, that are between the values 0.79 and 0.84 (risen from the values between 0.78 and 0.81).

To conclude, information about horizontality and verticality as conveyed by motion verbs does seem to have an impact on how spatial information is expressed. Presumably, these differences can be contributed to the essential differences in experiencing motion along horizontal and vertical motion. However, as the strengths of the association are very small, the impact of the general directionality is somewhat marginal. Furthermore, verb type, motion type, horizontality/verticality, and spatial categories show a high degree of interactions. This means that not one verb semantic variable can predict the variation of a particular spatial variable with reasonable accuracy. However, when all of these verb semantic variables and the other spatial variables are accounted for together, then a good performance can be reached in predicting a particular spatial variable.

9.1.4. Motion speed and spatial categories

As the final main variable of verb semantics, the variable of motion speed (VerbSpeed) is discussed in this section. The variable VerbSpeed stands for speed ratings as collected in the experiment (see Section 6.1.1.5). The ratings are standardised by the participants and vary between −1.34 (*lonkima* 'stroll, saunter') and +1.68 (*kihutama* 'race, career'; see also Sections 6.1.1.5 and 8.1.4).

The speed of motion is an important characteristic of physical motion and influences the processing of it (Tynan & Sekuler 1982; Burr et al. 1998; Kreegipuu et al. 2006; Kreegipuu & Allik 2007; Hutchinson & Ledgeway 2010). It has also been shown that the speed of motion affects the processing of linguistic structures (Matlock 2004; Richardson & Matlock 2007; Lindsay et al. 2013; Speed & Vigliocco 2013). Moreover, verbs of fast and slow motion evoke different attentional patterns in that fast motion is more Goal-biased than slow motion (Lindsay et al. 2013; Speed & Vigliocco 2013).

Thus, it may be that the speed of motion also associates with patterns of motion clauses. This may manifest itself in patterns where verbs of fast motion are more likely to combine with Direction, and Goal expressions than verbs of slow motion. In contrast, verbs of slow motion may then be combined with Location, and Trajectory more frequently than the other verbs. The speed variable may also capture the semantic diversity of motion verbs. As such, the speed of motion, as expressed by a motion verb, can function as a yardstick for directionality in that the faster the expressed motion is, the more directional the verb is.

In addition, as manner of motion verbs provide enhanced information about the speed of motion (Slobin et al. 2014), the speed of the verb can provide the means to assess the semantic diversity of manner of motion verbs. As such, manner of motion verbs expressing fast motion could be seen as comprising a strong sense of directionality, whereas those of slow motion as providing information about less directional motion. At the same time, I hypothesise that directional verbs comprise also some backgrounded information about manner and, thus, may have speed-related features present in their meaning.

Figure 61 presents the distribution of speed ratings across verbs of different types. The left, centre and right figures stand for VerbType, MotionType, and HorVert respectively. It can be seen that all these three semantic properties of motion verbs show associations with the mean ratings of the speed of the verb. As for VerbType, manner of motion verbs have a median and mean value (indicated by a horizontal line and a plus sign respectively) of a much higher speed than source and goal verbs. To put it differently, manner of motion verbs are typically assessed as expressing faster motion than directional verbs. However, manner of motion verbs exhibit an enormous variation of values of speed indicated by a very tall box in the figure. This shows that many manner of motion verbs depict also much slower motion than the other verbs. Directional verbs, particularly goal verbs, possess rather similar speed values, and their median is considerably lower than in the case of manner of motion verbs. It can also be seen that there are two outliers of goal verbs. More specifically, these outliers are two verbs of vertical motion (i.e., *kerkima* ‘fall’ and *tõusma* ‘rise’; see Figure 8 in Section 8.1.4) which were initially analysed as goal verbs in this study (see Section 8.1.1). However, the speed ratings of these two verbs seem to suggest that they should instead have been analysed as verbs incorporating manner more saliently than directional features. Source verbs are ranked as somewhat slower than goal verbs, and the speed ratings of source verbs also vary more than the ratings of goal verbs. Note that the verb types are represented unevenly in the data (see also Section 8.1.1). There are 75 manner of motion verbs, 15 goal verbs, 4 source verbs, and 1 neutral verb.

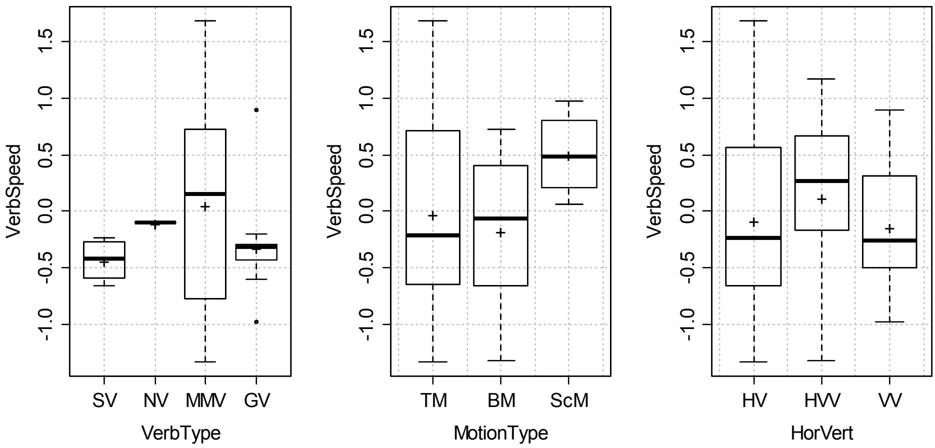

Figure 61. The speed of motion as attributed to motion verbs across verb types (left figure), motion types (middle figure), and general direction (right figure); SV = source verbs, NV = the neutral verb, MMV = manner of motion verbs, GV = goal verbs; TM = verbs of translational motion; BM = verbs of both self-contained and translational motion; ScM = verbs of self-contained motion; HV = verbs of horizontal motion, HVV = verbs of both horizontal and vertical motion, VV = verbs of vertical motion. Horizontal line indicates median values; + indicates mean values

The speed of motion associates also with the type of motion (see the middle figure in Figure 61). More specifically, verbs expressing self-contained motion show indications of faster motion than the other verbs. Verbs of translational and both motions are slower, but show more variation in speed ratings. These differences seem to account for the different contents of the term ‘speed’. In other words, when dealing with verbs of translational motion, the time needed to change the position in space is the primary issue, whereas in the case of verbs of self-contained motion, the time between two sequencies of performing a particular motion is the focal point. For instance, the verb *jooksma* ‘run’ can imply how fast the mover can reach some other location. In the case of the verb *värisema* ‘shake, tremble’, the frequentative nature of the motion receives speed interpretation. Again, these results should be interpreted with the knowledge that verbs distribute across motion types unevenly. There are 70 verbs of translational motion, 5 of self-contained motion, and 20 of both translational and self-contained motion (see also Section 8.1 for an overview of the distribution of verbs across their semantic features).

Considering whether a verb expresses horizontal or vertical motion, ambiguous verbs have higher mean and median values (see the right figure in Figure 61) than the other verbs. In other words, if a verb depicts both horizontal as well as vertical motion (e.g., *hüppama* ‘jump’) or is otherwise ambiguous (e.g., *värisema* ‘shake, tremble’), it is typically considered to imply faster motion than the other motion verbs. Verbs of horizontal motion are most diverse in their speed ratings. This may be attributed to the uneven distribution of the verbs in the dataset in that the number of horizontal verbs (59) exceeds the other verbs (10 vertical and 26 ambiguous motion verbs).

In order to attest the relationship between speed ratings and the other verb semantic features in their complexity, the conditional inference tree is presented in Figure 62. In this tree, speed ratings are predicted on the basis of the variables VerbType, MotionType, and HorVert. The results provide strong evidence for the difference between manner of motion verbs (occurring jointly with the neutral verb) and directional verbs (see the split in Node 1). In general, manner of motion verbs are rated as expressing faster motion than directional verbs. Furthermore, the speed of motion varies more in manner of motion verbs than it does in directional verbs. As for MotionType, directional verbs of translational motion are similar to manner of motion verbs with respect to variation in speed ratings as well as to their fastness of motion. Directional verbs of both motions are ranked as expressing comparatively slow motion (see Node 15).

Finally, vertical motion appears to be also sensitive to speed information as shown in Nodes 11 and 17. Verbs of vertical motion which have higher speed values (those in Node 11) express downward motion (i.e., *kukkuma* 'fall', *langema* 'fall, come down', and *laskuma* 'descend'), and verbs of vertical motion which have lower speed values (in Node 17) express upward motion (i.e., *kerkima* 'rise' and *tõusma* 'rise, ascend'). Due to gravity, moving downwards is fast and effortless. Conversely, upward motion needs extra energy and high speeds are difficult to reach. This results typically in slow motion.

Thus far, I have tackled the variable VerbSpeed with respect to the verb semantic variables VerbType, MotionType, and HorVert. Furthermore, speed ratings of motion verbs differ across the spatial variables as can be seen in Figure 63. In this figure, the mean values of the speed ratings of the verbs show that verbs of slowest motion in terms of mean values are slightly inclined towards Location, while verbs of fastest motion are inclined towards Direction.

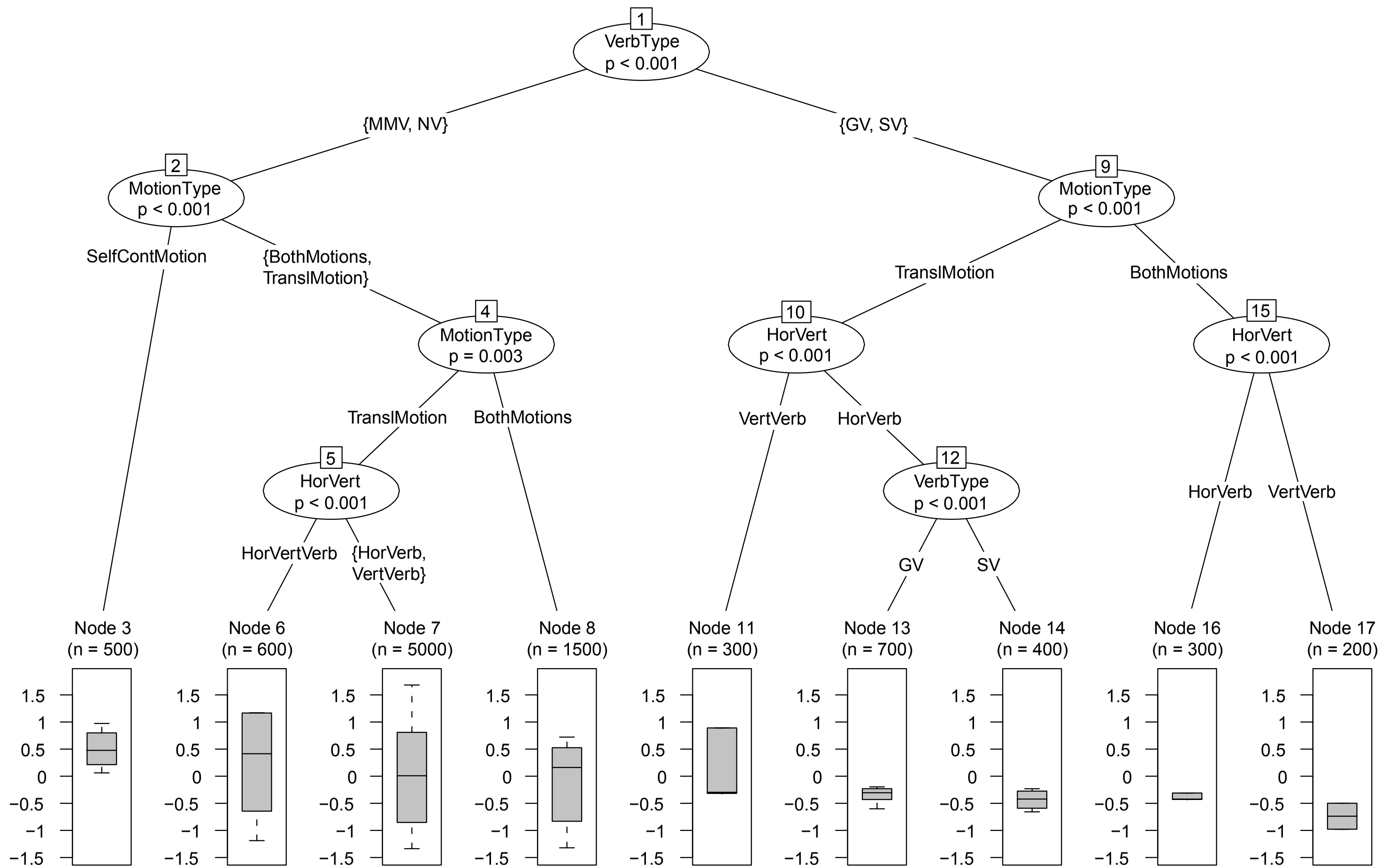

Figure 62. Conditional inference tree for VerbSpeed: VerbSpeed ~ VerbType + MotionType + HorVert; SV = source verbs, NV = the neutral verb, MMV = manner of motion verbs, GV = goal verbs

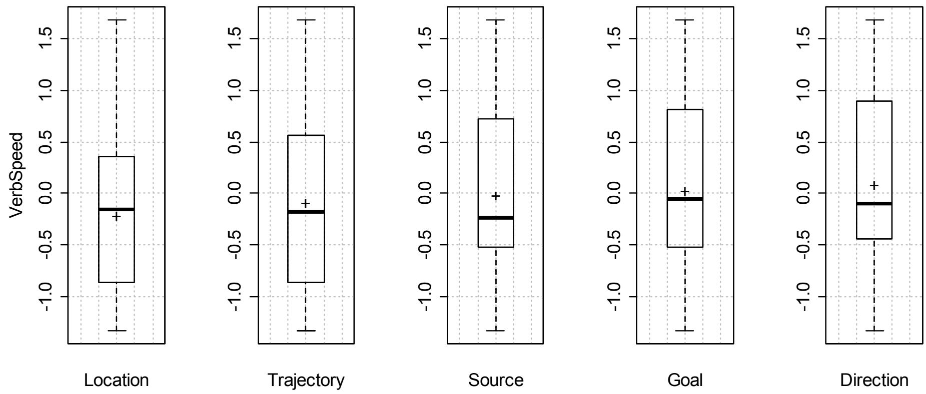

Figure 63. Speed ratings of verbs (VerbSpeed) across spatial variables. Spatial variables are arranged in ascending order (from left to right) based on the mean values. Horizontal line indicates median values; + indicates mean values.

In order to understand the data more thoroughly, I transform the continuous variable VerbSpeed into the binned categorical variable BinnedSpeed by means of K-means clustering (see also Section 6.1.1.5). This means that the expression of spatial categories can be analysed across discrete categories of verb speed ratings. The resulting variable BinnedSpeed has three levels: ‘slow’, ‘medium’, and ‘fast’ to indicate three different speed groups. Spatial expressions across this new variable (BinnedSpeed) are presented in Figure 64. Two clear tendencies can be observed. First, the amount of clauses with the expressions of the medial portion of the path (Location and Trajectory) decreases when the speed of motion increases. Second, the amount of clauses containing expressions of the final portion of the path (Direction and Goal) increases when the speed of motion increases. The difference in proportions is significant with a weak effect size: $\chi^2(8, N = 8492) = 230.44$, $p < 0.001$, Cramér’s $V = 0.12$.

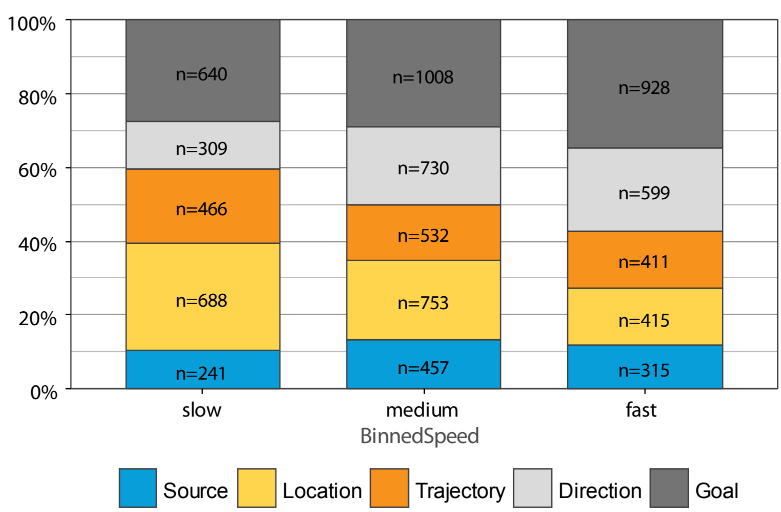

Figure 64. Distribution of spatial expressions across verbs expressing slow, medium, and fast motion (variable BinnedSpeed)

Pearson's residuals confirm these observations in that slow motion verbs are inclined towards Location, and Trajectory, and fast motion verbs towards Direction, and Goal expressions. Verbs of medium speed have a tendency to combine with Source, and Direction expressions.

Table 39. Pearson's residuals for the spatial variables and BinnedSpeed

	slow	medium	fast
Goal	−2.66	−1.47	**4.17**
Direction	−6.73	**2.27**	**3.72**
Trajectory	**3.91**	−1.89	−1.51
Location	**7.76**	−0.27	−6.96
Source	−2.31	**2.06**	−0.18

The following sections analyse the link between the spatial variables and the variable VerbSpeed in more depth. The structure of the analysis is similar to the previous sections in which VerbType, MotionType, and HorVert are examined. Once again, each spatial variable is predicted on the basis of the other spatial variables together with the four verb semantic variables (VerbSpeed, VerbType, MotionType, and HorVert). As the variable VerbSpeed is continuous, while the spatial variables are categorical binary ones, the results of significance testing are reported from the analysis of binary logistic regression (see also Section 6.2.2). To characterise the data, spineplots and boxplots are presented. Spineplots combine features from mosaic plots, bar plots, and histograms, and they enable us to account for frequencies across a categorical variable. The higher and wider the bar for the 'yes' values (shown in dark grey), the more common it is to express a particular spatial category with the verbs of these speed ratings.

Additionally, random forests are grown to assess model performances and the importance of VerbSpeed. The conditional inference trees are also presented to account for a more detailed structure of the data. Although continuous variables could be included in the tree, I use the categorical BinnedSpeed variable of speed ratings in conditional inference trees as it is easier to interpret and to explain the results when motion verbs are classified into 'slow', 'medium', and 'fast' motion verbs.

9.1.4.1. Source

Speed values across clauses with and without Source expressions are presented in Figure 65. The spineplot is to the left of the figure, and the boxplots are to the right. The spineplot for Source shows that Source is somewhat prone to rather slow motion verbs (speed ratings varying around −0.4) or to very fast motion verbs (speed ratings varying around 1). However, the boxplots are difficult to interpret and would suggest no strong biases in the data. A binary logistic regression confirms this by showing that the correlation between Source and

VerbSpeed is not significant: Nagelkerke's $R^2 = 0.000$, df = 1, p = 0.348, C = 0.51. In other words, the speed of motion, as embedded in the meaning of motion verbs, cannot predict whether Source is expressed or not expressed.

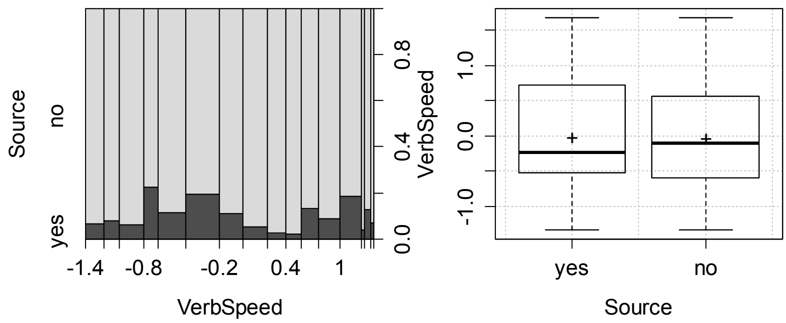

Figure 65. Spineplot (left figure) and boxplot (right figure) of verb speed ratings (VerbSpeed) across clauses with (= yes) and without (= no) Source expressions

On its own, VerbSpeed cannot predict Source. However, when it is added to the model of random forests, it improves the performance of the model slightly (C = 0.85). The model of random forests attributes that VerbSpeed has some influence in predicting Source as can be seen from Figure 66. The most influential variable for predicting Source continues to be VerbType. The next three most influential variables, HorVert, Direction, and VerbSpeed, have less prominence in relation to Source, but clearly have strong predictive power as compared to the last five variables.

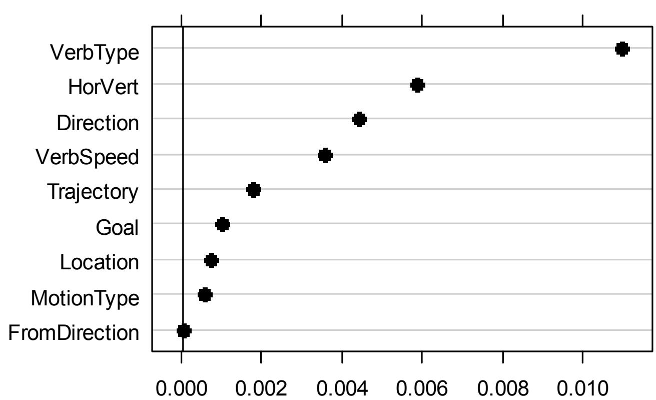

Figure 66. Conditional variable importance in predicting Source (predictors to the right of the vertical line are significant): Source ~ FromDirection + Location + Trajectory + Direction + Goal + VerbType + MotionType + HorVert + VerbSpeed

The conditional inference tree with the most important variables VerbType, HorVert, Direction, and BinnedSpeed[54] is presented in Figure 67. As for speed information, Node 23 shows that source verbs that depict slow motion are more likely to combine with Source expressions than the other verbs. This is exemplified in (134) by the verb *eralduma* 'detach, separate' and the Source phrase *rahvamassist* 'from the crowd'. These only four source verbs in the data are distinguished by their speed of motion. The only verb that describes slow motion is *eralduma* 'detach, separate'. The other three verbs express medium speeds. There appears to be no source verbs of fast motion (which may be interpreted as if there were no fast ways to leave). Source verbs of medium speed have also a tendency to combine with Source expressions if Direction is not expressed. This can be seen in Node 26, and also in (135) where a combination of the source verb of medium speed *väljuma* 'exit' and the Source phrase *kasarmutest* 'from the barracks' occurs. Note that Direction is not expressed in this example.

(134)	***Eraldu-si-n***	***rahvamassi-st …***
	[SV: slow speed]	**[Source]**
	separate-PST-1SG	**crowd-ELA**
	'I separated from the crowd.' (NC)	

(135)	*Tanki-d*	***välju-vad***	***kasarmu-te-st****, …*
		[SV: medium speed]	**[Source]**
	tank-PL.NOM	**exit-PRS.3PL**	**barrack-PL-ELA**
	'The tanks are exiting the barracks.' (FC)		

Beyond the source verbs, the other verbs are somewhat more likely to combine with Source expressions if (i) Direction is expressed, and (ii) the verb is ambiguous with respect to horizontal and vertical motion, and (iii) it depicts either slow or fast motion. This can be seen in Node 19 and in (136). In this example, the verb *kargama* 'jump, spring' is used in combination with the Source (*sillalt* 'from the bridge'), Direction (*alla* 'down'), and Goal expression (*jõkke* 'into the river').

(136)	*ta*	***karga-s***	***silla-lt***	***alla***	***jõkke.***
		[MMV: HorVertVerb: fast speed]	**[Source]**	**[Direction]**	**[Goal]**
	(s)he	**jump-PST.3SG**	**bridge-ABL**	**down.LAT**	**river.ILL**
	'From the bridge she jumped down the river.' (FC)				

Taken together, information about motion speed, as embedded in verb meanings, appears to be somewhat significant in explaining the variation of Source. As a single factor, VerbSpeed is not significantly associated with Source, but it improves the random forests model in predicting Source. Convergent with the previous models for Source, the type of verb is the most important variable in predicting Source.

[54] For conditional inference trees and for clarity reasons, the continuous variable VerbSpeed is transformed to a categorical one. BinnedSpeed has three speed values: 'slow', 'medium', and 'fast'.

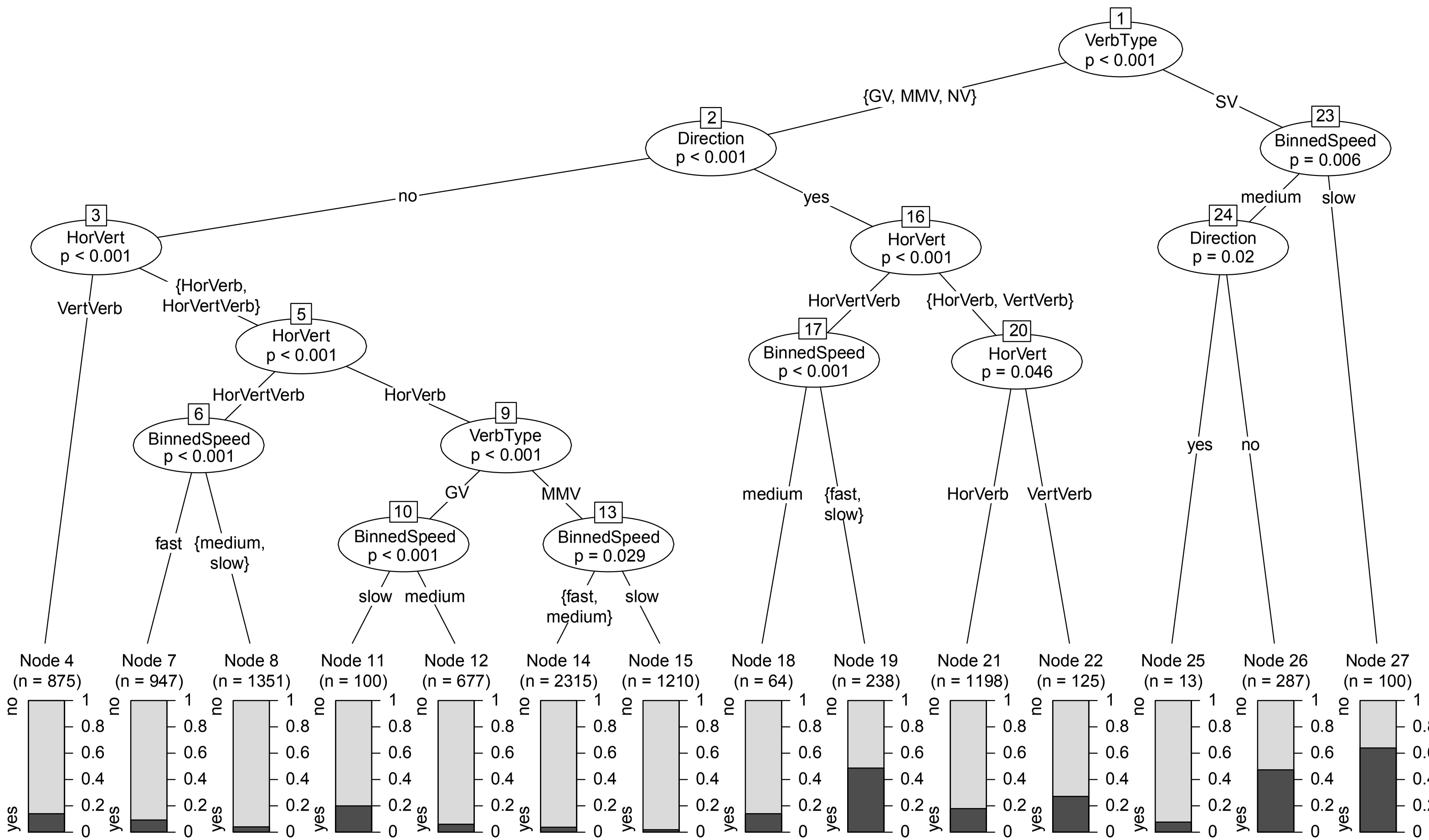

Figure 67. Conditional inference tree for Source: Source ~ VerbType + HorVert + Direction + BinnedSpeed; SV = source verbs, NV = the neutral verb, MMV = manner of motion verbs, GV = goal verbs

9.1.4.2. Location

Motion verbs occurring in clauses with Location expressions have the smallest mean values of speed ratings as shown in Section 9.1.4. From the proportions in the spineplot (see Figure 68), one can also observe that there are clearly two sets of verbs that are more prone to combine with Location expressions than the other verbs. These are verbs ranked as expressing very slow motion (speed ratings varying around −1), and verbs whose mean speed values are close to 0. Boxplots in Figure 68 show that expressing Location is more likely if the depicted motion is slow. Binary logistic regression confirms that speed values of motion verbs associate with Location, but the effect size is very weak: Nagelkerke's $R^2 = 0.021$, df = 1, $p < 0.001$, C = 0.57, which suggests overdispersion. That is, VerbSpeed, although significant, cannot in itself explain the variation of Location.

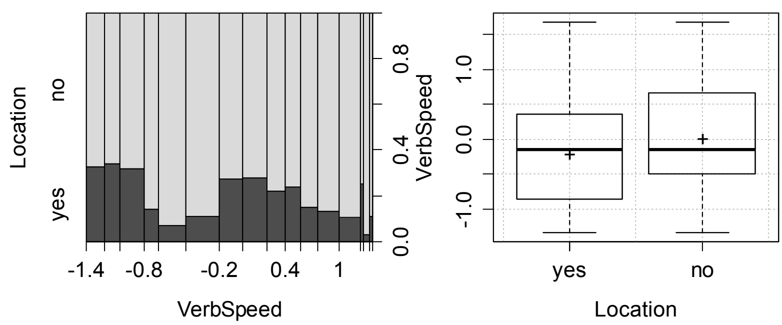

Figure 68. Spineplot (left figure) and boxplot (right figure) of verb speed ratings (VerbSpeed) across clauses with (= yes) and without (= no) Location expressions

In combination with the other variables, VerbSpeed is a highly important one for predicting Location as shown in Figure 69. It overrides the importance of MotionType which is highly influential in previous models of Source (cf., Figure 36 in Section 8.1.2.2 and Figure 52 in Section 9.1.3.2). The other variables have similar relative positions as in previous models for Location. This indicates that speed information is relevant to clausal patterns. Moreover, it is more accurate in classifying clauses with and without Location expressions than the three-level variable MotionType. Not surprisingly, the index of concordance has risen too (C = 0.84).

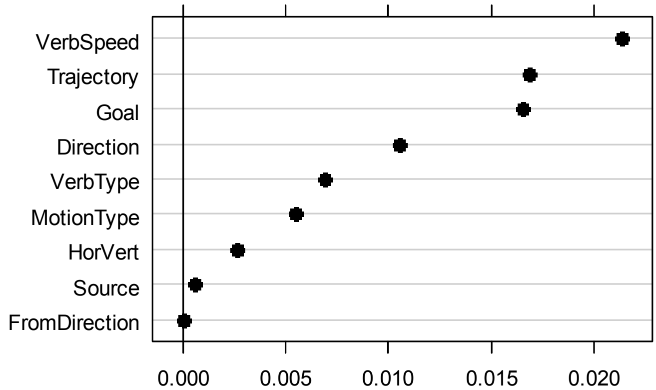

Figure 69. Conditional variable importance in predicting Location (predictors to the right of the vertical line are significant): Location ~ Source + FromDirection + Trajectory + Direction + Goal + VerbType + MotionType + HorVert + VerbSpeed

The conditional inference tree with the independent variables BinnedSpeed, Trajectory, and Goal is given in Figure 70. It appears that Location has a tendency to be expressed in the absence of Goal expressions (see Node 1), and with verbs of slow motion, and particularly if Trajectory is not expressed (see Node 5). For example, in (137), the verb of slow motion *hiilima* 'sneak' co-occurs with the Location phrase *siin* 'here'.

(137)	*Mida*	*teie*	***siin***	***hiili-te****?*
			[Location]	**[MMV: slow speed]**
	what	you.PL	**here.LOC**	**sneak-PRS.2PL**

'What are you sneaking in here?' (FC)

Thus, the expression of Location is highly sensitive to VerbSpeed. VerbSpeed is the most important factor that has an influence upon whether Location is expressed or not. More specifically, verbs of slow motion have a strong tendency to be expressed with Location expressions. Furthermore, VerbSpeed is relevant mostly in cases when Goal *is not* expressed. When Goal *is* expressed, Location tends to be not expressed regardless of the speed of the verb.

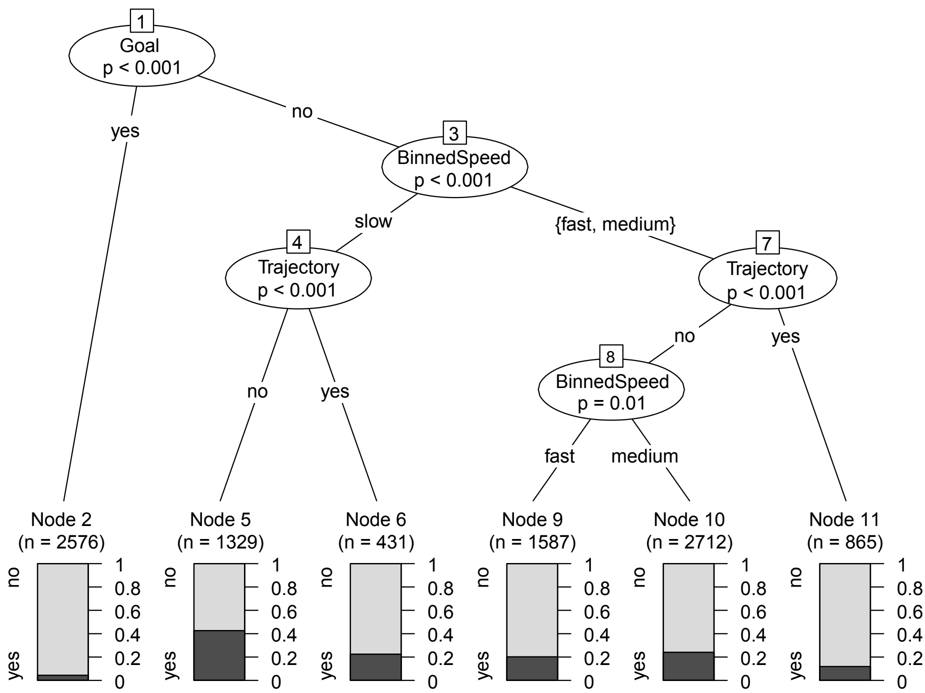

Figure 70. Conditional inference tree for Location: Location ~ BinnedSpeed + Trajectory + Goal

9.1.4.3. Trajectory

Trajectory, as does Location, stands for the medial portion of the path. Thus, it seems logical that Trajectory could show similar tendencies to Location. As shown in Figure 71, the proportions of clauses with Trajectory expressions reflect the two curves present for Location (cf., Figure 68 above), but to a lesser extent. In addition, some verbs of very fast motion can be seen as being strongly inclined towards combinations with Trajectory expressions. Boxplots to the right of Figure 71 indicate only modestly that the slower the motion is, the more likely Trajectory is described. This is confirmed by the binary logistic regression analysis which suggests significant associations, but with very weak strength: Nagelkerke's $R^2 = 0.001$, df = 1, p = 0.013, C = 0.52.

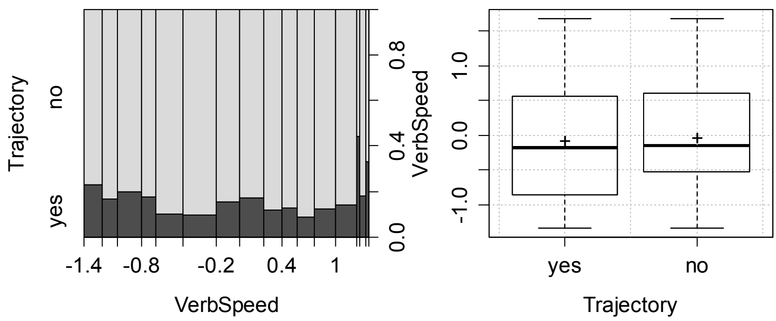

Figure 71. Spineplot (left figure) and boxplot (right figure) of verb speed ratings (VerbSpeed) across clauses with (= yes) and without (= no) Trajectory expressions

Variable importances of the model of random forests in predicting Trajectory is presented in Figure 72. Goal, VerbSpeed, and Location are the most important variables of predicting Trajectory. The index of concordance has risen to C = 0.82. Similarly to Location, VerbSpeed is one of the most influential variables in predicting the outcome. At the same time, it does make the otherwise prominent verb semantic variables MotionType (cf., Figure 39 in Section 9.1.2.3) and HorVert (cf., Figure 54 in Section 9.1.3.3) less significant. Furthermore, it makes the otherwise marginal variables, Goal, and Location, much more significant in that they become highly influential variables in predicting the presence or absence of Trajectory expressions.

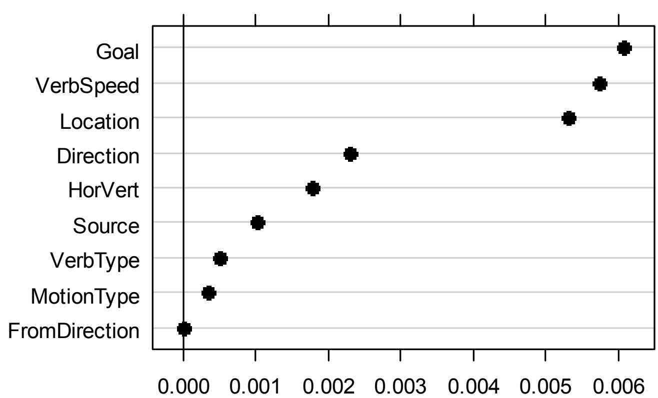

Figure 72. Conditional variable importance in predicting Trajectory (predictors to the right of the vertical line are significant): Trajectory ~ Source + FromDirection + Location + Direction + Goal + VerbType + MotionType + HorVert + VerbSpeed

The conditional inference tree with the categorical BinnedSpeed variable, Goal, and Location (see Figure 73) indicates the main importance of Goal (see Node 1). More importantly, clauses without Goal expressions are somewhat more likely to contain Trajectory expressions. As for speed information, the tree specifies that slow motion verbs have the strongest tendency to combine with Trajectory expressions, with neither Goal nor Location being expressed (see Node 10). Source and Direction may or may not be expressed. The pattern is exemplified in (138) where the verb of slow motion *hiilima* ‘sneak’ is used together with the Trajectory phrase *mööda seinaäärt* ‘along the walls’. These results are similar to the tree for Location. This suggests that both Location and Trajectory, referring both to the medial portion of the path, share similar characteristic properties of clausal patterns.

(138)	*Kurt*	***hiili-b***	***mööda***	***seinaäär-t***	*toa-st*	*välja, ...*
		[**MMV: slow speed**]	[**Trajectory**]		[Source]	[Direction]
	Kurt	**sneak-PRS.3SG**	**along**	**wall.edge-PART**	room-ELA	out
	‘Kurt sneaks out of the room along the walls.’ (FC)					

Trajectory is influenced by motion speed in that the slower the motion is, the more likely Trajectory is described. This indicates that Trajectory is similar to Location, which has a similar inclination. Furthermore, Trajectory and Location are highly related to each other. In the context of the other variables, Goal and VerbSpeed contribute most in explaining the variation of Trajectory, which also holds true for Location.

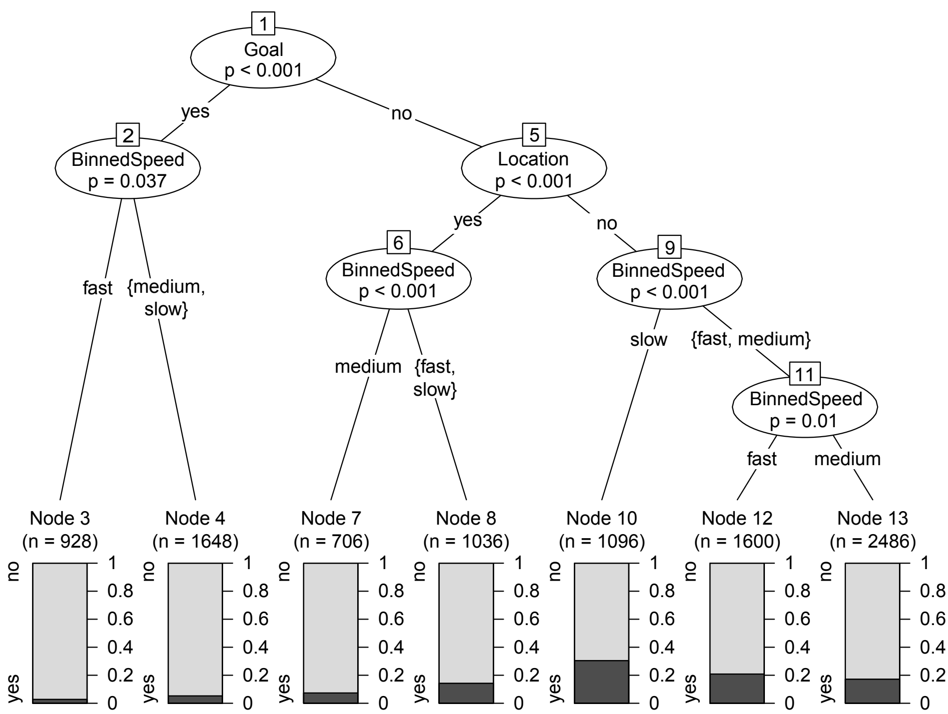

Figure 73. Conditional inference tree for Trajectory: Trajectory ~ BinnedSpeed + Goal + Location

9.1.4.4. Direction

Direction and Goal, standing for the final portion of the path, are most prone to combine with verbs depicting fast motion in the analysis of the contingency data (see Section 9.1.4 above). The distribution of clauses with and without Direction expressions across verbs of different speed ratings is presented in Figure 74. It shows that verbs of very fast motion are particularly biased towards combining with Direction. Boxplots confirm that clauses with Direction expressions are somewhat more likely to contain verbs of faster motion than clauses without Direction expressions. The spineplot shows also that there are verbs, with ratings around −0.2, which are also somewhat inclined towards co-occurring with Direction. Binary logistic regression reveals that VerbSpeed significantly associates with Direction; however, the magnitude of this effect is, again, very small: Nagelkerke's $R^2 = 0.008$, $df = 1$, $p < 0.001$, $C = 0.55$.

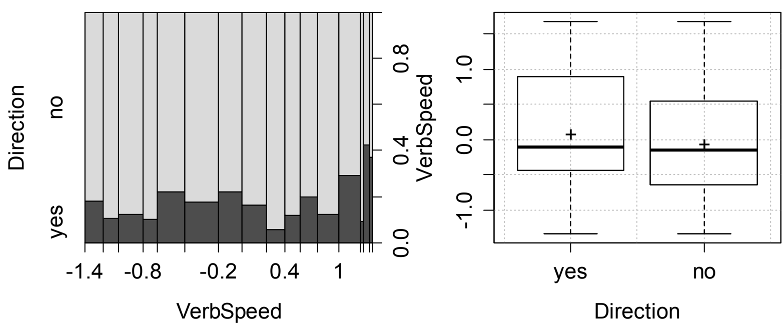

Figure 74. Spineplot (left figure) and boxplot (right figure) of verb speed ratings (VerbSpeed) across clauses with (= yes) and without (= no) Direction expressions

In random forests, VerbSpeed is positioned as a variable of third importance (see Figure 75). It overrides information present in the other verb semantic variables, VerbType, HorVert, and MotionType. In particular, the variable VerbType has become less important in the model. At the same time, the variables Source and Goal continue to be highly effective variables, and the model has become more representative of the data by the inclusion of VerbSpeed ($C = 0.82$).

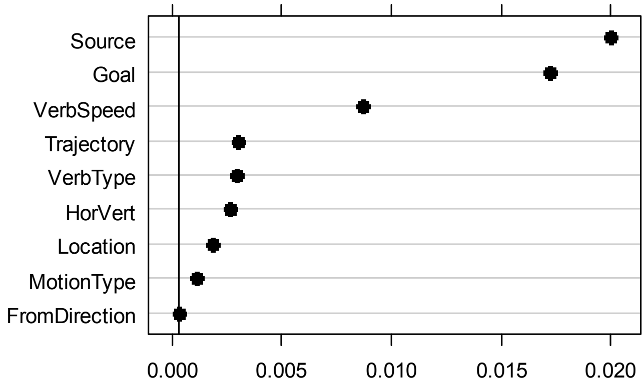

Figure 75. Conditional variable importance in predicting Direction (predictors to the right of the vertical line are significant): Direction ~ Source + FromDirection + Location + Trajectory + Goal + VerbType + MotionType + HorVert + VerbSpeed

The conditional inference tree with the three most influential variables (i.e., Source, Goal, and BinnedSpeed) is given in Figure 76. It shows that speed information classifies clauses if Goal is not expressed (see Nodes 4 and 11). VerbSpeed becomes particularly relevant if Source *is* expressed (see Node 1 and the branches to the left of it). Under this condition and if Goal *is not* expressed, fast motion verbs have a high rate of clauses with Direction expressions (see Node 8). This is illustrated in (139) where the verb of fast motion *kukkuma* 'fall' combines with the Source phrase *saanist* 'from the sleigh' and the Direction expression *välja* 'out'. A similar pattern is also frequent in the case of slow motion as can be seen from Node 7 and in (140). In this example, the verb of slow motion *hiilima* 'sneak' is used together with the Source (*toast* 'from the room') and Direction expression (*välja* 'out').

(139)	... *ja*	*siis*	*mina*	***kukku-si-n***	***saani-st***	***välja**.*
				[GV: fast speed]	**[Source]**	**[Direction]**
	and	then	I	**fall-PST-1SG**	**sleigh-ELA**	**out.LAT**

'and then I fell out of the sleigh' (FC)

(140)	*õhtuti*	***hiil-i-s***	*ta*	***toa-st***	***välja*** *...*
		[MMV: slow speed]		**[Source]**	**[Direction]**
	evenings	**sneak-PST-3SG**	(s)he	**room-ELA**	**out**

'In the evenings, (s)he sneaked out of the room.' (FC)

In general, Direction expressions have a tendency to be combined with fast or very fast motion verbs. The model of random forests shows the importance of VerbSpeed where it clearly precedes the other verb semantic variables. This position suggests, again, that this verb semantic factor is more accurate than the other factors (i.e., VerbType, MotionType, and HorVert). Furthermore, it can also be inferred from the improvement of the random forest model performance by the inclusion of the variable VerbSpeed that this variable associates significantly with the expression of Direction.

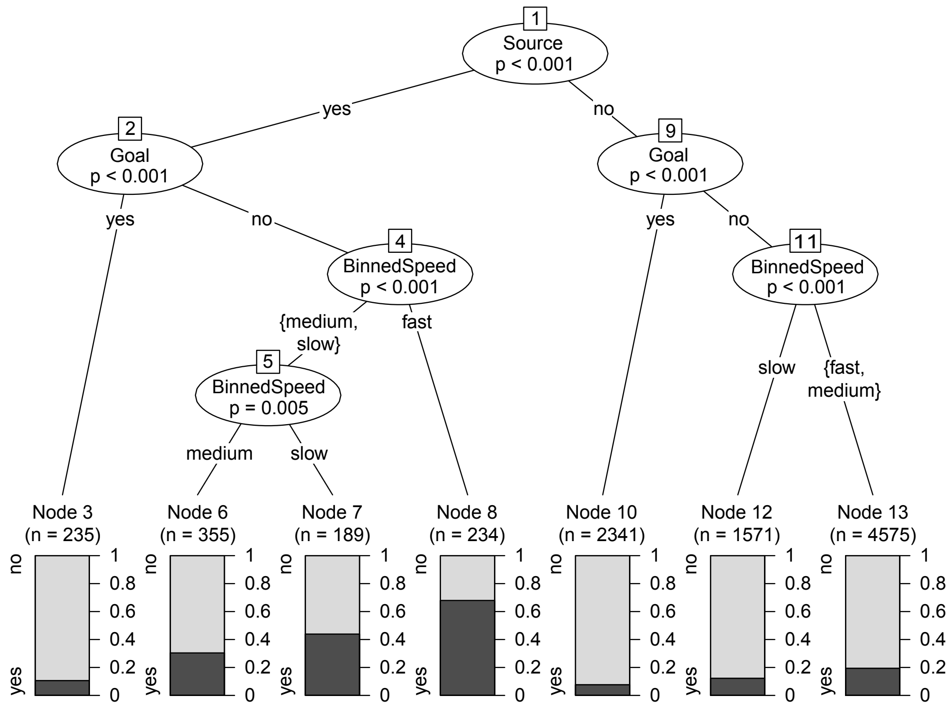

Figure 76. Conditional inference tree for Direction: Direction ~ Source + Goal + BinnedSpeed.

9.1.4.5. Goal

Goal is similar to Direction, and is shown to be somewhat more prone to being expressed in combination with verbs of fast motion as shown by the analysis of 'yes' values in Section 9.1.4 above. The inspection of spineplot and boxplots in Figure 77 confirms that verbs of fast motion are most likely to combine with Goal expressions even though some slow motion verbs have also a tendency for such patterns. Binary logistic regression yields unsurprising results in that the association is significant, but marginal: Nagelkerke's $R^2 = 0.004$, $df = 1$, $p < 0.001$, $C = 0.53$.

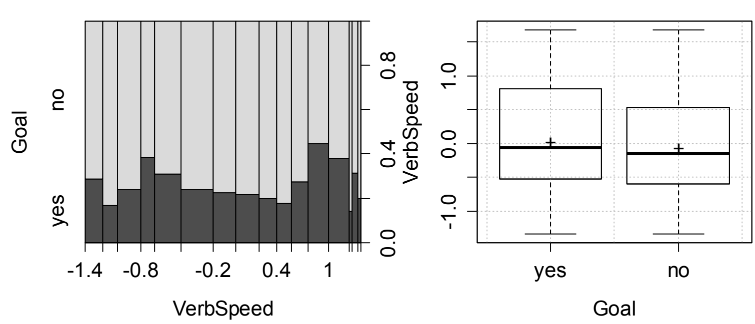

Figure 77. Spineplot (left figure) and boxplot (right figure) of verb speed ratings (VerbSpeed) across clauses with (= yes) and without (= no) Goal expressions

By including VerbSpeed into the model of random forests, an improvement in the performance of the model is achieved (C = 0.84). The importance of VerbSpeed, however, appears to be comparatively modest as can be seen in Figure 78. The three spatial variables (i.e., Direction, Trajectory, and Location) are the three most influential variables in predicting Goal. However, the verb semantic variable MotionType is now less important due to VerbSpeed, but it has still more importance than VerbSpeed.

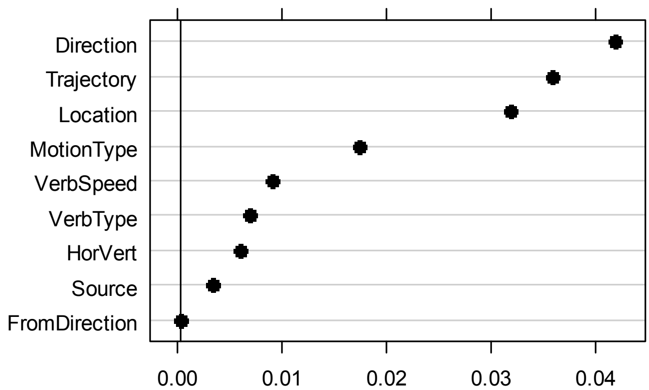

Figure 78. Conditional variable importance in predicting Goal (predictors to the right of the vertical line are significant): Goal ~ Source + FromDirection + Location + Trajectory + Direction + VerbType + MotionType + HorVert + VerbSpeed

The conditional inference tree for Goal with the variables Direction, Trajectory, Location, MotionType, and BinnedSpeed is presented in Figure 79. The tree shows that BinnedSpeed becomes important in Nodes 7, 11, and 20, whereas the other variables contribute to the structure of the data more prominently. Furthermore, verbs of fast motion combine more readily with Goal expressions than other verbs when, (i) a verb of translational motion is used in clauses that do not contain Trajectory, Location, and Direction expressions (see Node 12), or (ii) a verb of translational motion combines with Location, and Trajectory expressions are absent (see Node 9), or (iii) a verb of both motion is used in clauses without Location, Trajectory, and Direction expressions (see Node 23). Pattern (i) is the most typical one and is exemplified in (141) by the combination of the fast motion verb *kukkuma* ‘fall’ and the Goal phrase *ta kõhnale käsivarrele* ‘to his/her skinny arm’. The same Node 12 indicates that some verbs of slow motion share this pattern with verbs of fast motion. For example, in (142), the verb of slow motion *naasma* ‘return’ co-occurs with the Goal phrase *koju* ‘home’. In addition, verbs of medium speed occur frequently in this pattern (see Node 13).

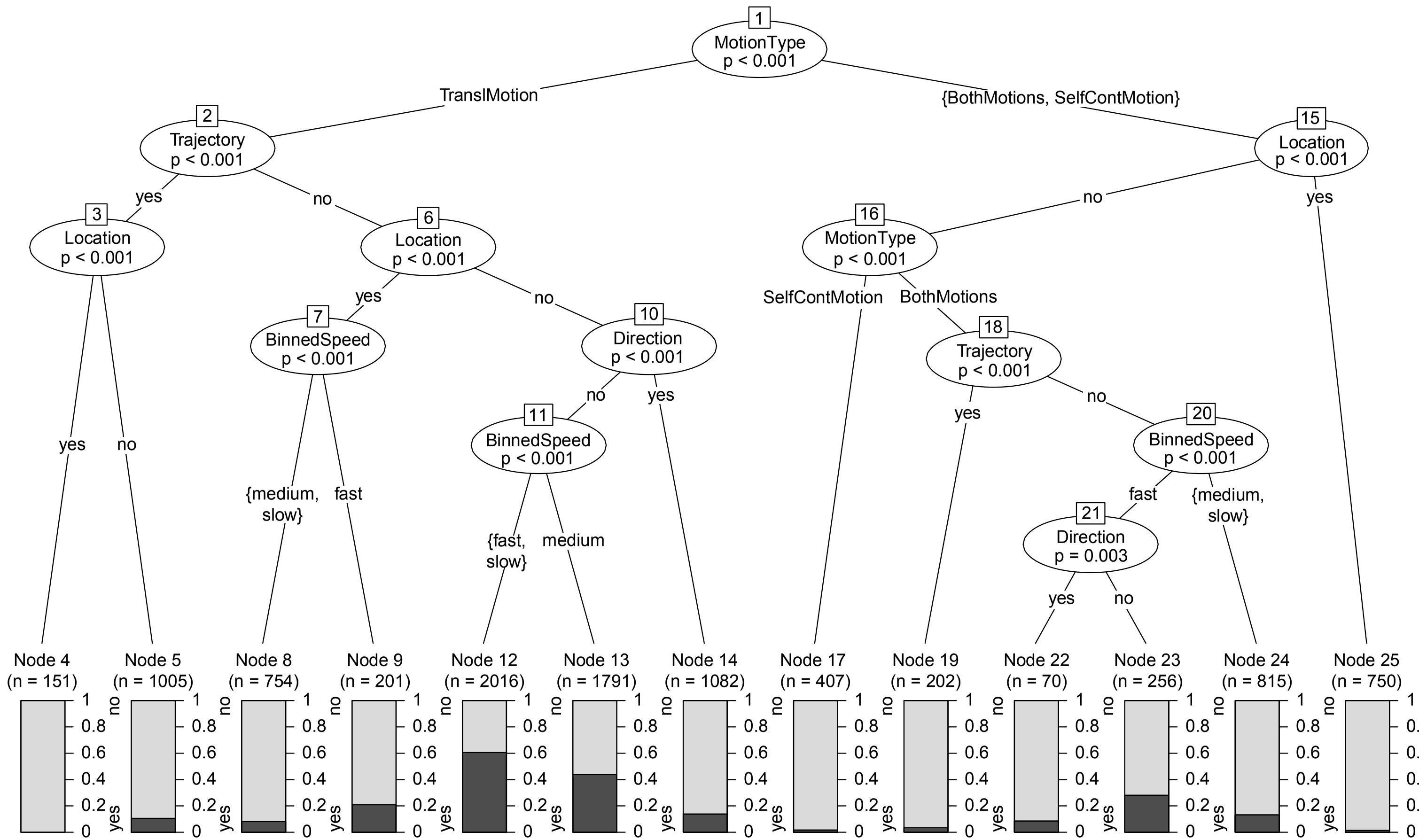

Figure 79. Conditional inference tree for Goal: Goal ~ Direction + Trajectory + Location + MotionType + BinnedSpeed

(141)	*Palav*	*pisar*	***kukku-s***	***ta***	***kõhna-le***	***käsivarre-le.***	
			[GV: fast speed]	**[Goal]**			
	hot	teardrop	**fall-PST.3SG**	**his/her**	**skinny-ALL**	**arm-ALL**	
	‘A hot teardrop fell on his/her skinny arm.’ (FC)						

(142)	*Kiryl*	*Bigart*	***naas-i-s***	*sõja-st*	***koju***	*nagu*	*sõdur*	*muistegi.*	
			[GV: slow speed]	[Source]	**[Goal]**				
	Kiryl	Bigart	**return-PST-3SG**	war-ELA	**home.ILL**	like	soldier	ever	
	‘Kiryl Bigart returned home from the war as a soldier ever after.’ (FC)								

Taken together, similar tendencies to Direction do occur for Goal. This is the case when examining the univariate relationship between VerbSpeed and Goal. The faster the motion is, the more likely a clause is to contain a Goal expression. In the context of the other variables, however, VerbSpeed performs less prominently in the model for Goal than in the model for Direction, and cannot override most spatial variables and MotionType. Even so, the model benefits from the inclusion of VerbSpeed as shown by the higher value of the index of concordance. The conditional inference tree indicates also that verbs of fast motion, as well as some of slow motion, have a slight tendency to co-occur with Goal expressions.

9.1.4.6. Summary and discussion

The ratings of the speed of motion, as attributed to motion verbs, appear to be significant in contributing to the patterns of motion clauses. The results of binary logistic regressions provide some evidence that the expression of different spatial categories associates with verb semantics in terms of the speed of motion a verb depicts. More specifically, significant associations are reported for the categories Location, Trajectory, Direction, and Goal. There is no significant association with regard to Source. In general, the results suggest that Location and Trajectory are somewhat more likely to combine with verbs expressing slow motion than those expressing fast motion, and vice versa for Direction and Goal. Based on these results, it is difficult to draw any conclusions concerning Source. These findings are in accordance with the psycholinguistic experiments which show that reaching this Goal entity takes less time in the case of a fast motion verb as opposed to a slow motion verb (Lindsay et al. 2013; Speed & Vigliocco 2013). In other words, fast motion is Goal-biased.

Interestingly, fast motion verbs tend to combine with Direction expressions more readily than with Goal expressions even though the difference is not large. If speed ratings do reflect the degree of directionality, then this finding is contrary to those presented in the previous sections where Goal was found to be the most directional spatial category. Based on speed values, the hierarchy of directionality is suggested to be as follows: Location > Trajectory > Source > Goal > Direction[55].

Furthermore, these findings are in accordance to what the consistent windowing hypothesis predicts in that the faster (i.e., the more directional) the motion is, the more likely the directional categories are described. However, the explanatory value of VerbSpeed remains modest, if not random, in pairwise analyses as the indices of concordances C are close to 0.5. In other words, the variable VerbSpeed alone is clearly not sufficient to explain the variation of the expression of spatial categories.

Having said that, the information about the speed of motion, as expressed by motion verbs, is highly important. This is in accord with the finding of Slobin et al. (2014: 728) who state that for the domain of manner of motion, speed is a "pervasive underlying dimension". This can also be seen from the results of conditional random forests which have become more accurate. In other words, all models of random forests improve in their performances due to VerbSpeed because the indices of concordances C have risen. In the previous five models without VerbSpeed, C is between 0.82 and 0.85. In the models that include VerbSpeed, C is between 0.79 and 0.84. These results indicate clearly better performances of the models with VerbSpeed than those without. VerbSpeed is particularly important in predicting Location, and Trajectory in which it is one of the most important influencing variables. VerbSpeed shows high importance also in predicting Direction.

Thus, VerbSpeed can function as a yardstick for directionality. This can be inferred from the fact that in several models of random forests, it often strongly devalues the importance of the other verb semantic variables. This is particularly evident in the case of Location, Trajectory, and Direction models. In predicting Location, the variable VerbType loses its prime spot in relative variable importances and appears to contribute to the outcome only modestly, whereas VerbSpeed gains the position of this primary importance. Similarly, in predicting Direction, VerbType falls into variables of little significance, while VerbSpeed has clearly more predictive power than any of the other verb semantic variables. As for Trajectory, VerbSpeed overrides both MotionType and HorVert. Only in the models of Source and Goal are there no great changes in the relative order of independent variables even though in the model of Goal, the otherwise highly effective MotionType does lose some of its significance.

As further support to this inference of speed and directionality, speed information seems to be one possible tool that can be used to measure the directionality of a motion verb. This is evidenced from the distribution of verbs of different types across speed ratings. In particular, two verbs of vertical motion which were predefined as goal verbs (i.e., *kerkima* 'rise' and *kukkuma* 'fall'; see Section 8.1.1) due to them seemingly incorporating directionality information more strongly than manner information, appear to behave as outliers of goal

[55] FromDirection is not represented in the cline. It is not analysed as a dependent variable due to its low number of occurrences (N = 56).

verbs on the basis of their speed ratings. That is, *kerkima* 'rise' is ranked for a considerably lower speed and *kukkuma* 'fall' for a much higher speed of motion as compared to the other goal verbs. This may indicate that the manner feature of speed overrides the importance of vertical motion (i.e., information about the direction) in their meanings. Thus, this suggests that they are much closer to manner of motion verbs than to goal verbs.

To conclude, speed information matters greatly. This result may, of course, be contributed to the fact that a variable with 95 levels of values can account for explaining a phenomenon better than those with three of four levels. Even so, if speed information was irrelevant or the results of the experiment, through which these speed ratings were collected, random, no such results as presented above could have been attained.

9.2. Verb semantic features of manner and the expression of manner

The previous sections have examined the spatial settings of motion clauses and show robust evidence for the hypothesised consistent windowing tendency. The analyses also indicate that there is much variation and complexity in the data. This section explores the manner settings of motion clauses.

As for manner, I hypothesise a consistent windowing of manner in that the expression of manner can be found in multiple places in a motion clause. More specifically, I predict that there would be a higher rate of combinations of manner of motion verbs and manner expressions, and a lower rate of combinations of directional verbs and manner expressions (see also Kopecka 2010; Slobin et al. 2014). Alternatively, following Talmy's (1985; 2000b: 19–212) lexicalisation patterns and the complementarity approach of Rappaport Hovav and Levin (Rappaport Hovav & Levin 2010; Levin & Rappaport Hovav 2013), one could expect the opposite to occur. In other words, if a manner of motion verb is used, there would be no need for other manner expressions, and if a directional verb is used, manner would be expressed by means of other elements in the clause.

These two opposite expectations with respect to manner expressions are studied in the following sections. Note that when referring to manner expressions, this includes also instrument expressions (see Section 4.4 and 6.1.2.2 for more details). For the sake of clarity, the variable is labelled as 'Manner-Instrument'. Instrument expressions are also analysed separately from 'pure' manner ones to account for a better understanding of the structure of the data. In this case, the variables 'Instrument' and 'Manner' are discussed.

9.2.1. Verb type and manner

The distribution of expressions of MannerInstrument is presented in Figure 80. Manner of motion verbs combine more often with manner expressions (21%) than goal (14%) or source verbs (16%). Surprisingly, the neutral verb *liikuma* 'move' co-occurs with manner expressions considerably more frequently than the other verbs (34%). However, these associations, albeit statistically significant ($\chi^2(2, N = 9500) = 50.13, p < 0.001$), are extremely weak (Cramér's V = 0.07).

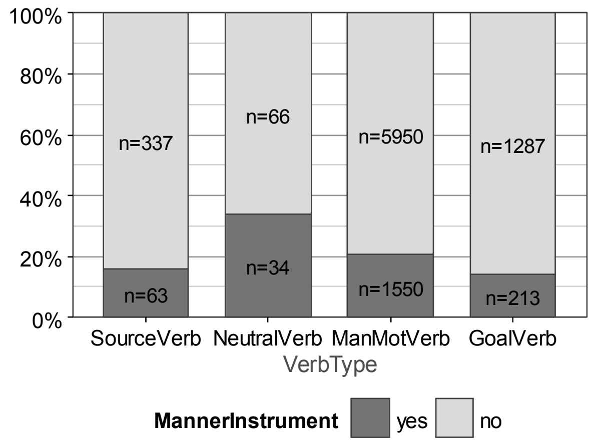

Figure 80. The presence (= yes) and absence (= no) of manner expressions across source verbs (= SourceVerb), the neutral verb (= NeutralVerb), manner of motion verbs (= ManMotVerb), and goal verbs (= GoalVerb)

A further analysis of Pearson's residuals (see Table 40) still indicates that manner of motion verbs, as well as the neutral verb, have somewhat more clauses containing manner expressions than the other verbs. Moreover and as a strong evidence for the hypothesis, goal and source verbs have considerably less combinations with manner expressions than if the data were evenly distributed.

Table 40. Pearson's residuals for MannerInstrument and VerbType

	SourceVerb	NeutralVerb	ManMotVerb	GoalVerb
MannerInstrument expression absent (= no)	0.85	−1.61	−1.05	2.32
MannerInstrument expression present (= yes)	−1.73	**3.26**	**2.13**	**−4.71**

At the same time, verbs vary greatly and, thus, individual verbs with respect to combinations of manner expressions are presented in Figure 81. The verbs are ordered on the basis of the number of combinations with expressions of Manner-Instrument. Verbs are assigned a number which indicates the relative order of verbs with respect to these combinations (01 indicates a verb that has the most, and 95 that has the least number of combinations with MannerInstrument expressions). In addition, the frequencies of Manner and Instrument expressions are also presented separately as stacked bars.

As a general result, goal verbs (with numbers 21, 24, 31, 43, 49, 50, 56, 67, 73, 83, 85, 87, 88, 90, and 93 in Figure 81; shown in grey) and source verbs (with numbers 18, 42, 70, and 94; shown in blue) are comparatively evenly distributed across different frequencies of combinations with MannerInstrument expressions (see Figure 81). The goal verb *lähenema* 'approach' (verb number 21) and the source verb *eemalduma* 'move away' (verb number 18) co-occur most frequently with manner expressions, as in (143) and (144). In (143), *lähenema* 'approach' is used together with the Manner phrase *omal vilunud ametisammul* 'at their proficient pace of profession'. In (144), *eemalduma* 'move away' is combined with the Manner phrase *kiirete jõudsate sammudega* 'with fast strong steps'. The verbs *saabuma* 'arrive' (goal verb; verb number 93) and *eralduma* 'detach, separate' (source verb; verb number 94) of directional verbs occur least frequently with manner expressions.

(143) *Idabloki* *parteijuhi-d* ***lähene-vad*** *kuju-le*
[GV]
Eastern.block.GEN party.leader-PL.NOM **approach-PRS.3PL** statue-ALL
oma-l vilu-nud ametisammu-l ...
[Manner]
their-ADE proficient-APP profession.step-ADE
'The party leaders of the Eastern Block are approaching the statue in their experienced professional pace.' (FC)

(144) ... ***eemaldu-s*** ***kiire-te jõudsa-te sammu-de-ga***
[SV] **[Manner]**
move.away-PST.3SG fast-PL.GEN strong-PL.GEN step-PL-COM
avakõrbe poole.
open.desert.GEN towards
'(S)he withdrew with hasty vigorous strides towards the open desert.' (FC)

The same applies to manner of motion verbs (shown in yellow in Figure 81) which range from frequent combinations with manner expressions such as *tammuma* 'stamp, tread' (number 01) and *vajuma* 'sink' (number 10) to very low number of combinations as in the case for the verb *põikama* 'dodge, swerve' (number 95). This is exemplified in (145), where the verb *vajuma* 'sink' co-occurs with the Manner phrase *tusaselt* 'glumly'. The verb *tammuma* 'stamp, tread' seems to be exceptionally prone to manner expressions. This is because 34 of these 51 manner expressions are the same fixed expression *jalalt jalale* 'from foot to foot', as in (146). This suggests that *jalalt jalale tammuma* 'stamp/ tread from foot to foot' is a strong collocation rather than a free combination of the verb and manner expression.

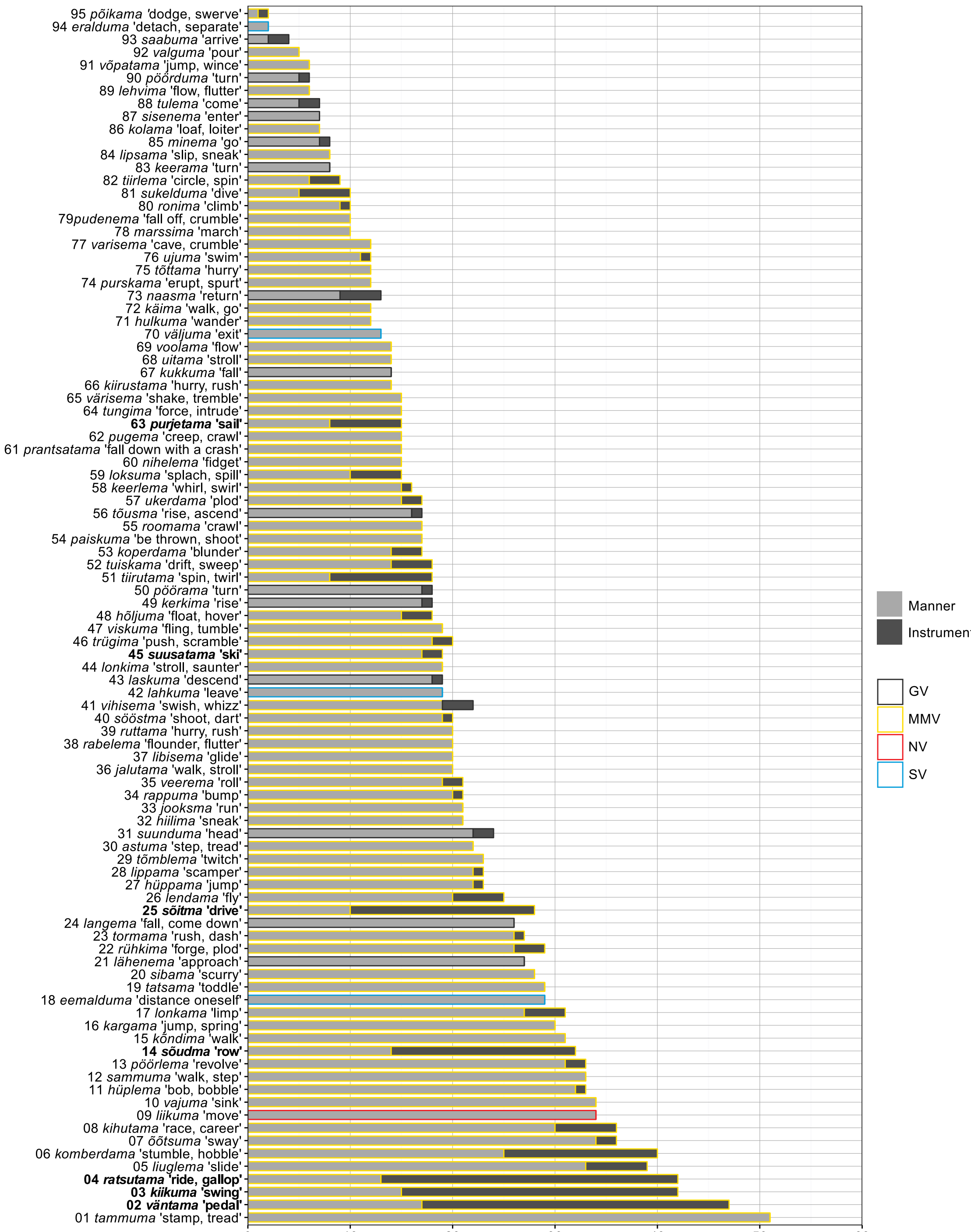

Figure 81. Distribution of Manner (shown in light grey) and Instrument expressions (shown in dark grey) across motion verbs. The number of verb labels indicates the relative order of verbs with respect to the number of combinations with expressions of the combined category MannerInstrument. Manner of motion verbs of instrument are in bold; SV = source verbs, NV = the neutral verb, MMV = manner of motion verbs, GV = goal verbs

(145)	*Erik*	***vaju-s***	***tusaselt***	*tooli.*
		[MMV]	**[Manner]**	
	Erik	**sink-PST.3SG**	**glumly**	chair.ILL

‘Erik sank glumly into the chair.’ (FC)

(146)	*Nad*	***tammu-si-d***	*Estonia*	*teatri*	*ees*
		[MMV]			
	They	**tread-PST-3PL**	Estonia.GEN	theatre.GEN	in.front.of
	jala-lt	***jala-le*** ...			
	[Manner]				
	foot-ABL	**foot-ALL**			

‘They were treading in front of the Estonia theatre from foot to foot.’ (NC)

The neutral verb *liikuma* ‘move’ (number 09; shown in red in Figure 81) has a tendency to co-occur with manner expressions as shown in Figure 80, and also in Figure 81. This combination is illustrated in (147) where the verb *liikuma* ‘move’ is used together with the Manner phrase *lohinal* which refers to a particular sound when something is dragged over the surface.

(147)	*Kelk*	***liiku-s***	*ema*	*järel*	***lohina-l***
		[NV]			**[Manner]**
	sled	**move-PST.3SG**	mother.GEN	after	**sound.of.dragging-ADE**
	värava-st	*välja.*			
	gate-ELA	out			

‘The sled moved out of the gate making a dragging noise.’ (FC)

To analyse any differences in preferences to different manner expressions, the expressions of Manner and Instrument may also be addressed separately. This means that Manner refers only to non-instrumental expressions, whereas Instrument refers to expressions which specify the means of motion (e.g., vehicle). The distribution of Manner and Instrument expressions across motion verbs is given also in Figure 81 by different colours. The light grey colour refers to Manner, and dark grey to Instrument expressions.

The figure shows that the expressions of Instrument are different to the other Manner expressions. Most importantly, there seems to be an association between the semantics of the verb and the presence of Instrument expression. Manner of motion verbs which specify the instrument are more likely to combine with Instrument expressions than the other verbs. This finding is exemplified by the combination of the verb *väntama* ‘pedal’ and the Instrument expression *jalgrattal* ‘by bicycle’ in (148), and the verb *ratsutama* ‘ride, gallop’ and the Instrument expression *hogustega* lit. ‘with horses’ in (149). The verb *komberdama* ‘stumble, hobble’, though not perhaps an instrument verb, is also often combined with Instrument expressions presumably because it expresses difficult and laborious gait which is typically hard to conduct without any means such as a crutch, as in (150). In addition, the verb *lendama* ‘fly’ can also function as an instrument verb when it describes a human motion, as in (151).

(148) ... *üliõpilase-d* ***vänta-vad*** *koha-le* ***jalgratta-l****.*
[MMV] **[Instrument]**
student-PL **pedal-PRS.3PL** place-ALL **bicycle-ADE**
'Students pedal here by bicycle.' (NC)

(149) ... ***ratsuta-takse*** ***hobus-te-ga****.*
[MMV] **[Instrument]**
ride-IMPERS.PRS **horse-PL-COM**
'They are riding horses.' (NC)

(150) ***Komberda-n*** ***karku-de-l*** *ringi.*
[MMV] **[Instrument]**
stumble-PRS.1SG **crutch-PL-ADE** around
'I'm stumbling around on crutches.' (NC)

(151) *Pavka* ***lenda-s*** ***lennuki-ga*** *ette* *meie* *saabumis-t* *ja*
[MMV] **[Instrument]**
Pavka **fly-PST.3SG** **plane-COM** ahead our arrival-PART and
majutamis-t *korralda-ma.*
accommodation-PART arrange-INF
'Pavka flew by plane in advance to arrange our arrival and accommodation.' (FC)

Amongst motion verbs, there are seven verbs that are clearly instrument verbs (shown in bold in Figure 81): *kiikuma* 'swing', *purjetama* 'sail', *ratsutama* 'ride, gallop', *suusatama* 'ski', *sõitma* 'drive', *sõudma* 'row', and *väntama* 'pedal'. Comparing these instrument verbs to the other verbs (see Figure 82), there are significant associations between the semantics of the verb and the presence of Instrument expressions with a close to medium effect size: $\chi^2(2, N = 9500) = 788.61$, $p < 0.001$, Cramér's $V = 0.29$.

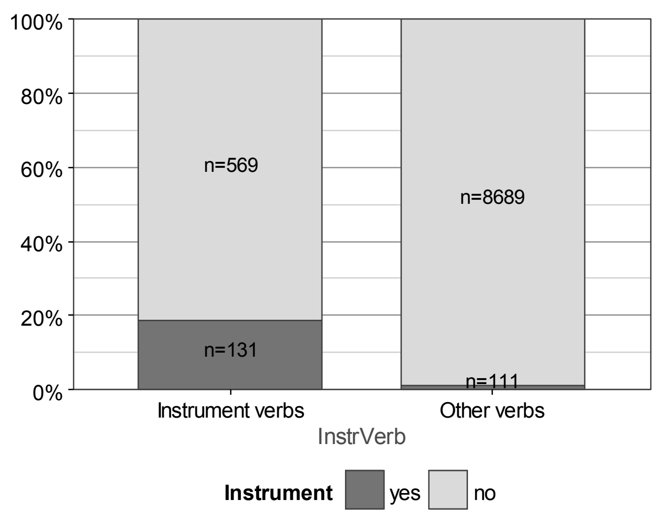

Figure 82. The presence (= yes) and absence (= no) of Instrument expressions across instrument verbs and non-instrument verbs (= other verbs)

Pearson's residuals (see Table 41) provide support for the fact that instrument verbs have a strong tendency to combine with instrument expressions. This is opposed to the other verbs which have a strong tendency not to have such clauses.

Table 41. Pearson's residuals for Instrument and the type of manner of motion verb

	Instrument verbs	Other verbs
Instrument expression absent (= no)	–4.33	1.22
Instrument expression present (= yes)	**26.80**	**–7.56**

This offers persuasive evidence for the hypothesis of consistent windowing. As one group, manner expressions associate with the type of verb only weakly. However, and with regard to semantic subcategories of manner expressions, semantic agreements clearly emerge. This suggests that other manner features, besides Instrument, may show similar tendencies. For instance, it may be that verbs expressing fast motion have a tendency to combine with manner expressions of fast motion, whereas slow motion verbs combine with slow motion expressions. An example of the former would be in (152) where the fast motion verb *kihutama* 'race, career' combines with the Manner expression of fast speed *meeletu kiirusega* 'at a frantic speed'. The latter is illustrated in (153) where the verb of slow motion *lonkima* 'stroll, saunter' is used together with the slow motion expression *aeglaselt* 'slowly'.

(152) *Kotka-d ...* ***kihuta-si-d*** ***meeletu*** ***kiiruse-ga***
[MMV: fast speed] **[Manner: fast speed]**
eagle-PL **race-PST-3PL** **frantic.GEN** **speed-COM**
põhja *suuna-s ...*
north.GEN direction-INE
'The eagles raced north at a frantic speed.' (FC)

(153) *Mati,* *kes* ***longi-b*** ***aeglaselt*** *läbi* *pargi ...*
[MMV: slow speed] **[Manner: slow speed]**
Mati who **stroll-PRS.3SG** **slowly** through park.GEN
'Mati who is slowly strolling through the park' (NC)

In addition, if the verb provides information about a specific part of the body responsible for conducting the motion, it might be that these parts of the body are also expressed by means of a Manner expression. This can be seen in (154) where the walking verb *kõndima* 'walk' combines with the phrase that refers to legs (*jalgsi* 'on foot'). Verbs that do not comprise such explicit information about a part of the body (such as directional verbs) may combine with expressions that specify a part of the body which are not directly connected to the conduction of the motion. This is illustrated in (155) by a combination of the goal verb *suunduma* 'head' and the Manner expression which depicts the face of the mover (i.e., *iseteadlikul ilmel* 'with a self-assertive look'). Unfortunately, these hypotheses cannot be tested in the current study. The coding of semantic features of manner expressions other than Instrument is extremely difficult and would call for a different type of study.

(154) *Me* ***kõndi-si-me*** *need* *kolmsada* *meetri-t* ***jalgsi****.*
[**MMV**] [**Manner**]
we **walk-PST-1PL** these three.hundred metre-PART **on.foot**
'We walked these three hundred metres on foot.' (FC)

(155) *... kes nähtavasti* ***suundu-si-d,*** ***iseteadliku-l*** ***ilme-l,***
[**GV**] [**Manner**]
who apparently **head-PST-3PL** **self-assertive-ADE** **look-ADE**
katedraali poole.
cathedral.GEN towards
'who apparently, with a self-assertive look, headed towards the cathedral' (FC)

So far, I have concentrated only on the 'mannerness' of motion verbs and the expression of manner. For the sake of consistency, the possible impact of the other variables on the variable MannerInstrument should also be examined. To assess the importance of these variables, the model of random forests, particularly the analysis of variable importance, is, again, a suitable method to use.

These results are presented in Figure 83. The most important, and almost only, factor that contributes to the variation of MannerInstrument is Location. BinnedSpeed and MotionType are marginally significant, and the other variables, including VerbType, are insignificant. The index of concordance is C = 0.64. This suggests that the model performs poorly. In other words, verb semantic and spatial variables can only very modestly predict whether MannerInstrument is expressed or not expressed.

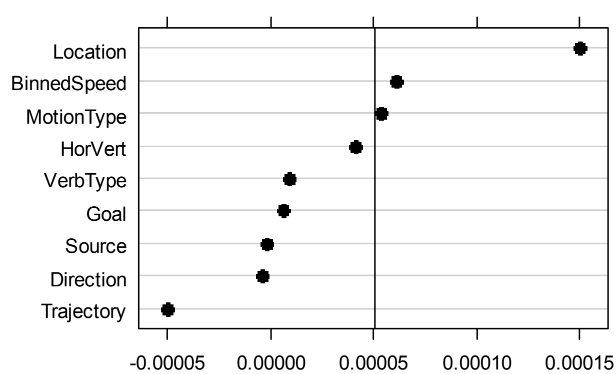

Figure 83. Conditional variable importance in predicting MannerInstrument (predictors to the right of the vertical line are significant): MannerInstrument ~ Source + FromDirection + Location + Trajectory + Direction + Goal + VerbType + MotionType + HorVert + BinnedSpeed[56]

[56] In this model, the categorical speed variable BinnedSpeed is used instead of the continuous VerbSpeed. This is because there are computational limits of the technique, and models with high computational cost are impractical for this study.

The conditional inference tree with the independent variables Location, BinnedSpeed, and MotionType (see Figure 84) shows that the expression of MannerInstrument is somewhat more likely if Location is not described (see Node 1). It also indicates that verbs of both motions which express either slow or fast motion are slightly more biased towards combinations with MannerInstrument (see Node 9). This is exemplified in (156) where the verb of both motions *hüppama* 'jump' is used together with the Manner expression *röögatades* 'yelling out'. However, these differences are extremely small.

(156)	... ***hüppa-si-n***	***röögata-des***	*tagasi.*
	[MMV: BothMotions: fast speed]	**[Manner]**	
	jump-PST-1SG	**yell-GER**	back

'I jumped back, yelling out.' (NC)

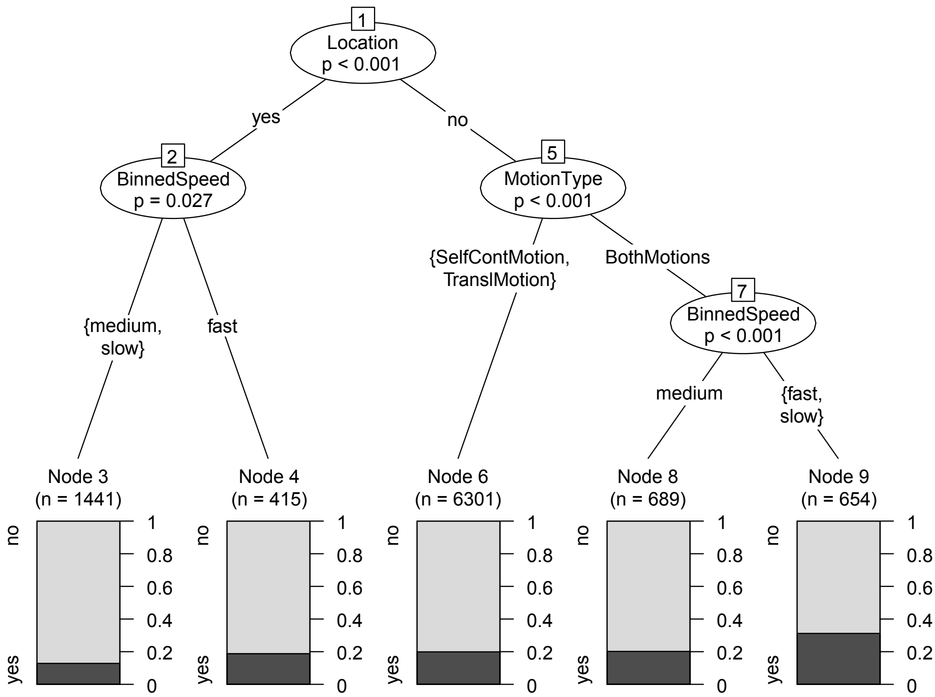

Figure 84. Conditional inference tree for MannerInstrument: MannerInstrument ~ Location + BinnedSpeed + MotionType

To summarise, the category MannerInstrument has some sensitivity to the type of verb. Manner of motion verbs have a slight tendency to combine more frequently with manner expressions than directional verbs. However, the differences between proportions are small, and the strength of the association is extremely weak. The model of random forests shows that MannerInstrument associates mainly with Location and only modestly with BinnedSpeed and MotionType. More specifically, MannerInstrument is somewhat more likely if Location is not expressed and the verb expresses either fast or slow motion.

Nonetheless, when taking a closer look at the semantics of manner expressions, the tendency of emphasising particular semantic features becomes evident. The tendency is clearly present with regard to verbs which express the instrument of motion. These verbs (i.e., manner of motion verbs that depict the instrument) combine frequently with manner expressions that specify the instrument. Further investigation is needed to determine whether the other manner features, as expressed by motion verbs and other manner expressions, show similar associations.

9.2.2. Verb type and verbal particles

The previous section tested the hypothesis of consistent windowing by examining the combinations which manner of motion verbs have. This section assesses the hypothesis by analysing the combinations which manner of motion verbs should not have if the hypothesis were correct. That is, following the hypothesis of consistent windowing, manner of motion verbs should occur mostly in clausal patterns where manner information is enhanced. One way to achieve this enhancement is by means of reducing the prominence of spatial information. In this section, I concentrate on one possible linguistic unit of which its expression or non-expression may achieve this purpose: the verbal particle. As explained in Section 4.3.1.3, the verbal particle stands for Talmy's (2000b: 102) 'satellite'. Due to controversies with using the term, 'satellite', I use the term 'verbal particle'.

Following Talmy's (1985; 2000b: 19–212) lexicalisation patterns, one would expect to have patterns in which directional verbs are not accompanied by verbal particles, and manner of motion verbs are. This is in contrast to my following argument: manner of motion verbs *should not* combine frequently with verbal particles (e.g., *tüdruk jooksis* 'the girl ran'). Directional verbs, on the contrary, *should* combine easily with verbal particles in order to emphasise path information (e.g. *tüdruk naasis <u>tagasi</u> (koju)* 'the girl returned <u>back</u> (home)'). In the following analysis, combinations of verbs of different verb types and verbal particles are presented. It should be noted that in the process of tagging the data for verbal particles, I took a strict stance. That is, only clear verbal particles are included (e.g., *ringi* 'around', *välja* 'out', *alla* 'down'), whereas lemmas that are difficult to analyse as either verbal particles or free adverbs are excluded. In addition, only directional particles are included, while resultative ones are excluded. Thus, these tagging decisions may impact on the results presented below.

The distribution of verbal particles across verb types is given in Figure 85. One can observe that the neutral, manner of motion, and goal verbs are rather similar in relative proportions of clauses that contain verbal particles (14%, 21%, and 16% respectively). Source verbs are different in that they rarely combine with verbal particles. Given that the vast majority of particles express Goal-oriented, rather than Source-originated directional information, this result supports the current hypothesis. This is because source verbs should also combine with source particles. There is only one clause where a source verb combines with a verbal particle and for this reason, source verbs are excluded from the following analysis.

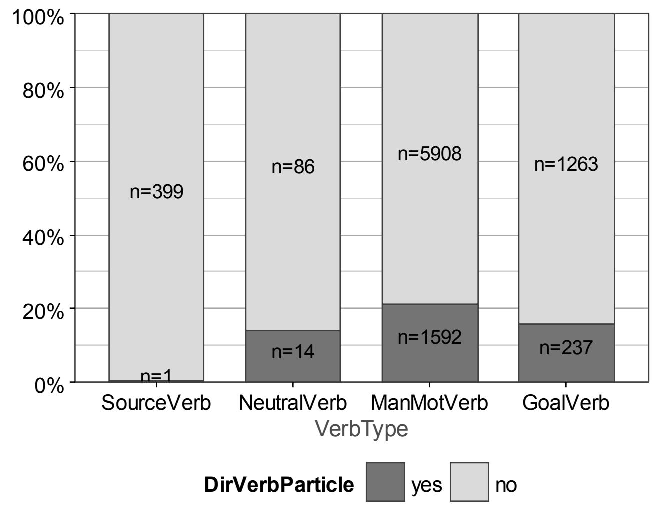

Figure 85. The presence (= yes) and absence (= no) of directional verbal particles across source verbs (= SourceVerb), the neutral verb (= NeutralVerb), manner of motion verbs (= ManMotVerb), and goal verbs (= GoalVerb)

Neutral, manner of motion, and goal verbs show comparatively equal proportions, even though manner of motion verbs are slightly more biased towards verbal particles (see Figure 85). Regarding the three types of verbs, the difference in proportions is significant, but the effect size indicates that the differences are too small to be meaningful: $\chi^2(2, N = 9100) = 25.24$, $p < 0.001$, Cramér's V = 0.05. The Pearson's residuals (see Table 42) are also between −2 and +2 which shows that there are no strong deviances. Only in the case of the goal verbs is the residual smaller than −2, which indicates that these verbs combine with directional verbal particles less frequently than would be expected if there were no relationship.

Table 42. Pearson's residuals for DirVerbParticle and VerbType

	NeutralVerb	ManMotVerb	GoalVerb
Verbal particle absent (= no)	0.70	−0.94	1.93
Verbal particle present (= yes)	−1.39	1.87	**−3.83**

If anything, manner of motion verbs are, thus, slightly more biased towards combining with directional verbal particles than goal verbs are, as in (157), where the verbal particle *välja* 'out', the manner of motion verb *kõndima* 'walk', and the Source phrase *toast* 'from the room' occur. However, it should be stressed that this is an extremely weak tendency.

(157) *Mare ...* ***kõnd-i-s*** *lihtsalt* ***toa-st*** ***välja***.
[MMV] **[Source]** **[Direction: Particle]**
Mare **walk-PST-3SG** simply **room-ELA** **out**
'Mare simply walked out of the room.' (FC)

Taken together, the expression of verbal particles does not seem to confirm clearly the consistent windowing hypothesis, nor does it provide good evidence for the prediction that could have been expected from Talmy's (1985; 2000b: 19–212) lexicalisation patterns. Manner of motion verbs have a slightly stronger tendency to combine with verbal particles than goal verbs. However, the strength of this association appears to be very marginal. This means that the presence of verbal particles cannot be clearly associated with the type of verb.

9.2.3. Summary and discussion

The results suggest that the hypothesis of consistent windowing applies also to the expression of manner information (variable MannerInstrument). As a general tendency, manner of motion verbs are slightly more prone to combine with manner expressions than directional verbs, which are mostly goal verbs. However, the strength of this association is very weak. Albeit very modestly, these results behave as counterevidence to the complementarity view (Rappaport Hovav & Levin 2010; Levin & Rappaport Hovav 2013), which is based on the lexicalisation patterns of Talmy (1985; 2000b: 19–212). However, these results are in accordance with the results for English (Özçalışkan & Slobin 2003; Slobin et al. 2014), and also Polish (Kopecka 2010), and show that Estonian is a satellite-framed language that employs combinations of manner of motion verbs and manner expressions (outside the verb) to enhance the manner settings of motion.

Furthermore, manner subcategories provide clear evidence for the consistent windowing. Taking the subcategory, Instrument, as an example, it appears that instrument verbs are strongly biased towards combining with Instrument expressions. As it is difficult to operationalise manner expressions in such a detailed manner, other subcategories are not analysed in depth. The findings indicate, however, that the category, manner, is highly heterogeneous, and this may explain why the consistent windowing tendency is comparatively weak. That is, the consistent windowing tendency applies presumably to the same or similar individual manner features. As the entire category of manner is very diverse, such sameness does not occur. This same principle applies to the spatial data in that the tendency occurs with regard to the individual spatial categories, and not with regard to the general domain of space. This may suggest that not only the distinction between spatial categories should be taken as self-evident, but also that between manner subcategories. These results and observations, thus, indicate that manner of motion is a very diverse domain in terms of its semantic richness (see also Slobin 1996; 2004; Slobin 2006; Cardini 2008; Kopecka 2010; Mani & Pustejovsky 2012; Slobin et al. 2014).

The analysis of the association between the type of the verb and the directional particles (known as ‘satellites’ in the strict framework of Talmy (2000b: 102)) shows that, if anything, manner of motion verbs are very slightly biased towards directional verbal particles, and goal verbs are slightly biased away from clauses with verbal particles. This is contrary to the tendencies of which could have been predicted based on the consistent windowing hypothesis. However, the strength of this association is extremely weak, which suggests that this result should be treated with caution. What this finding, nevertheless, shows is that verbal particles are not exclusively connected to manner of motion verbs, as can be inferred from the theory of lexicalisation patterns (Talmy 1985; 2000b: 19–212).

9.3. Other influencing factors

The discussion of the data and results has, thus far, concentrated only on the main categories that are primarily relevant for testing the consistent windowing hypothesis. However, there are also many other factors that could potentially influence the results and that are not addressed in the previous analyses. The current section discusses some of the more important factors: (i) animacy of the mover, (ii) genre of the text, (iii) general frequency of the verb, and (iv) other semantic elements in motion clauses.

As such, many other possible effective factors stay beyond the scope of the current study. For instance, the study does not discuss the morphosyntactic features of the verb in a motion clause (such as, tense and aspect constructions), word order, clause type, and textual context of the motion clause. Amongst these, the aspectual properties of motion clauses, and the agentivity of motion, would be particularly relevant for the current hypothesis. However, these issues would warrant a separate study, and are, thus, not covered in this thesis.

9.3.1. Animacy of the mover

Linguistic studies often discuss animacy as one of the factors that might and does influence language patterns (e.g., Comrie 1989; Dahl & Fraurud 1996; Yamamoto 1999; Mak et al. 2002; Stefanowitsch & Rohde 2004; Bresnan et al. 2007; Batoréo 2008; Bresnan & Hay 2008; Malchukov 2008; Klavan 2012; Taremaa 2013). Regarding the current data, the animacy of the mover is also relevant. This is for two main reasons: (i) this meaning is part of the semantics of motion verbs, and (ii) animate and inanimate movers move fundamentally differently. Consequently, the type of mover may also influence the structure of clausal patterns of motion verbs.

The type of mover may be specified by at least two main linguistic means in motion clauses. First, the motion verb itself may provide clear information about the animacy of the typical mover of such activity. For example, walking verbs (e.g., *kõndima* ‘walk’ and *jalutama* ‘walk, stroll’) evoke an understanding of an animate mover, whereas flowing (e.g., *voolama* ‘flow’) or rolling verbs (e.g., *veerema* ‘roll’) evoke an understanding of an inanimate mover. Second, the mover, as a trajector or figure, is always specified by some other semantic unit in a clause. In Estonian, such a semantic element may by expressed by a noun phrase (functioning as a grammatical subject) or by a verb morphology. Nevertheless, the exact interpretation of the animacy of the mover in a particular clause may be deduced from the general meaning of the clause in which the semantics of the verb has a major role to play.

Thus, two variables for mover animacy are introduced. The variable **VerbAnimacy** corresponds to the verb semantic feature of animacy, and **MoverAnimacy** to the semantic element of the mover as specified in the motion clause. VerbAnimacy is tagged for each of the 95 motion verbs. The variable has three values, as explicated in Section 6.1.3, of coding schema: ‘AnimVerb’ for verbs that express dominantly animate motion (N = 69; e.g., *kõndima* ‘walk’); ‘InanimVerb’ for verbs that express dominantly inanimate motion (N = 14; e.g., *veerema* ‘flow’), and ‘AmbigVerb’ for ambiguous verbs (N = 12; e.g., *tõusma* ‘rise, ascend’).

The variable MoverAnimacy specifies the type of the mover in a particular motion clause as expressed by the syntactic subject of the clause. The variable has three levels: ‘animate’, ‘inanimate’, and ‘vehicle’. Animate means that the mover is human or is some other animate being (e.g., *tüdruk jookseb* ‘the girl is running’; N = 7150) and inanimate means that the mover is not a living being (e.g., *pall veereb* ‘the ball is rolling’; N = 1899). Vehicle stands for vehicles that are expressed as self-moving objects (e.g., *auto sõidab* ‘the car is driving’; N = 451). As such, a vehicle is an intermediary case between animate and inanimate movers. It may visually be seen as an independent self-mover (for instance, when observing a flying plane). Alternatively, it could be seen as a metonymic relationship between the vehicle and the animate mover who typically drives the vehicle. This, in turn, adds the features of animate movers to vehicles as movers.

The following analysis concentrates on two aspects of animacy. Firstly, the association between the two variables of animacy (i.e., VerbAnimacy and MoverAnimacy) is examined. Then, the relationship between the animacy variables and spatial variables is discussed.

Figure 86 presents the variables VerbAnimacy and MoverAnimacy. It shows that if the verb expresses primarily animate motion, it is highly likely that the clause expresses also animate motion (88%). Verbs of animate motion are also likely to combine with expressions of vehicles as movers (51%). If the verb expresses inanimate motion, then there is a tendency that the verb co-occurs with expressions of inanimate movers (51%). The difference in proportions is significant with a moderate, close to strong effect size: $\chi^2(4, N = 9500) = 3776.65$, $p < 0.001$, Cramér’s $V = 0.45$.

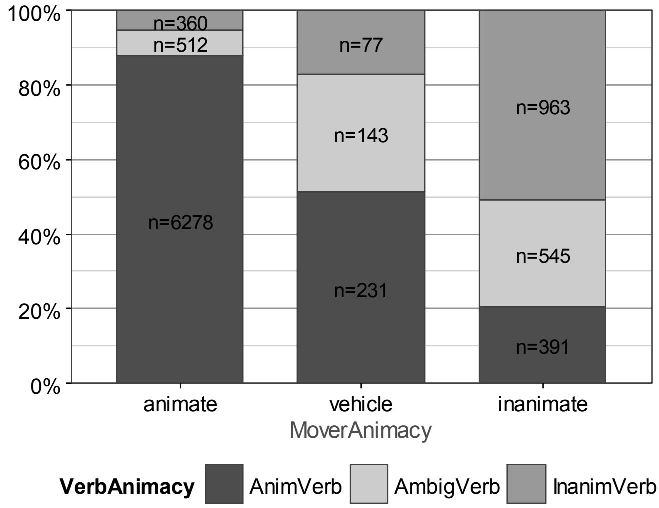

Figure 86. Animacy of the mover as entailed in the semantics of a motion verb (= VerbAnimacy) across animacy of the mover as expressed by a syntactic subject in a motion clause (= MoverAnimacy)

This finding is not surprising as the semantics of a motion verb is often enough to infer the animacy of the mover. At the same time, this pattern can also be seen as a pattern of consistent windowing in that the information about the type of mover tends to be presented consistently in a motion clause. For example, walking and running verbs are mainly used in combination with the expressions of an animate mover (e.g., *poiss jooksis õues* 'the boy ran outside'). Moreover, and in Estonian, the reference to the mover (to the subject in syntactic terms) may be done solely by person markers of the verb. In this case, the interpretation of the type of the mover in this particular clause can be done only by means of the semantics of the verb and the general context.

As for animacy and the expression of spatial information, this can be examined from the perspectives of both variables of animacy (i.e., VerbAnimacy and MoverAnimacy). As the results are similar, the analyses of VerbAnimacy and MoverAnimacy are presented in parallel in Figure 87 and Table 43. The left figures represent the expressions of spatial categories across VerbAnimacy, and the right figures represent the expressions of spatial categories across MoverAnimacy.

The results indicate that both VerbAnimacy and MoverAnimacy associate with spatial expressions of motion clauses (see Figure 87 and Table 43). More specifically, verbs of animate motion have a slight tendency to combine with Trajectory, and Direction expressions (see left figures in Figure 87 and Table 43; e.g., *kõndis mööda teed* '(s)he walked along the road' and *kõndis tagasi* '(s)he walked back'), and verbs of inanimate motion have a slight tendency to combine with Location, and Source expressions (e.g., *veeres põrandal* 'it rolled on the floor' and *veeres kotist (välja)* 'it rolled (out) from the bag'). Verbs of ambiguous motion, like verbs of inanimate motion, are most likely to combine with Source expressions (e.g., *tõusis põrandalt* 'it/(s)he rose from the floor').

The difference in proportions is significant, but the association strength is very weak: $\chi^2(8, N = 8492) = 213.55$, $p < 0.001$, Cramér's V = 0.11.

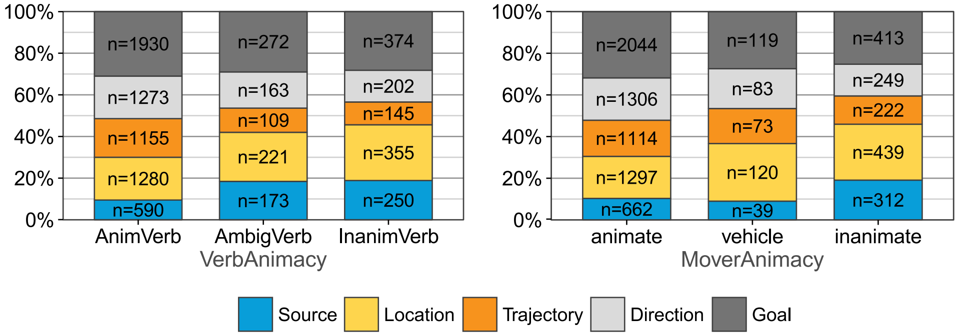

Figure 87. Distribution of spatial expressions of Source, Location, Trajectory, Direction, and Goal across verbs of animate, inanimate, and ambiguous motion (= VerbAnimacy; left figure); and other expressions of animate, inanimate, and vehicle movers in the clause (= MoverAnimacy; right figure)

Table 43. Pearson's residuals for the spatial variables and VerbAnimacy (left figure) and MoverAnimacy (right figure)

	Anim-Verb	Ambig-Verb	Inanim-Verb
Goal	0.94	−0.74	−1.41
Direction	**2.07**	−1.33	−3.36
Trajectory	**3.78**	−3.74	−5.06
Location	−2.20	1.12	**3.83**
Source	−5.61	**5.78**	**7.30**

	animate	vehicle	inanimate
Goal	**2.17**	−1.10	−3.73
Direction	1.91	−0.08	−3.74
Trajectory	1.48	0.12	−2.99
Location	−2.85	**2.58**	**4.32**
Source	−3.76	−1.77	**8.38**

Similarly, if an inanimate mover is expressed in a motion clause, then there is a bias towards Location, and Source expressions (see right figures in Figure 87 and Table 43; e.g., *pall veeres põrandal* 'the ball rolled on the floor' and *pall veeres kotist (välja)* 'the ball rolled (out) from the bag'). In a slightly different way, if the mover is an animate being, then Goal tends to be expressed. However, a small bias towards Direction, and Trajectory can also be observed as is in the case of VerbAnimacy. This is epitomised by *poiss jooksis metsa* 'the boy ran to the forest'. Vehicle movers are inclined towards combining with Location expressions (e.g., *auto sõitis metsas* 'the car drove in the forest'). These proportions differ significantly, but the association is, again, very weak: $\chi^2(8, N = 8492) = 169.46$, $p < 0.001$, Cramér's V = 0.10.

The two variables of animacy, VerbAnimacy (standing for the semantics of the verb) and MoverAnimacy (standing for the type of mover, as expressed in the motion clause itself), associate significantly and strongly with each other. This simply means that if a motion clause describes a motion of an animate mover, then the verb expresses typically also animate motion. The two variables associate also with the expression of the five spatial variables in that animate motion tends to combine with the expression of Trajectory, Direction, or Goal, but inanimate motion with the expression of Source or Location. Furthermore, spatial expressions behave comparatively similarly with regard to the two variables of animacy. This can be explained by the strong association between these variables of animacy. This strong association, itself, is also clear proof for the consistent windowing tendency.

9.3.2. Genre of the text and frequency of the verb

The statistical techniques that are employed in testing the hypothesis of consistent windowing do not take into account the difference between fixed and random effects. This means that the results presented, thus far, do not account for several constant factors (in addition to VerbType, MotionType, and VerbSpeed which are also constant across verbs) that may influence the form of motion patterns. To compensate for this limitation, two such fixed-effect factors are discussed in this section: (i) genre of the text and, (ii) general frequency of the verb. Furthermore, half of the data originates from the fiction corpus, and half from the newspaper corpora (see Section 5.2). As the fiction corpus was used to collect the data with the most frequent verbs (i.e., fourth quartile verbs) and the newspaper corpora for the less frequent verbs (i.e., the third quartile verbs), the results of the genre simultaneously represent the frequency of the verbs.

The results of this analysis are presented in Figure 88. It indicates that motion clauses of fiction texts (i.e., clauses with high frequency verbs) are much more likely to combine with Direction, and Goal expressions (26% and 37% respectively) than clauses of newspaper texts (13% and 24% respectively). Instead, the newspaper clauses are strongly inclined towards Location (34%), and Trajectory (20%) expressions. The difference in proportions is significant with a moderate effect size: $\chi^2(4, N = 8492) = 1010.66$, $p < 0.001$, Cramér's $V = 0.34$.

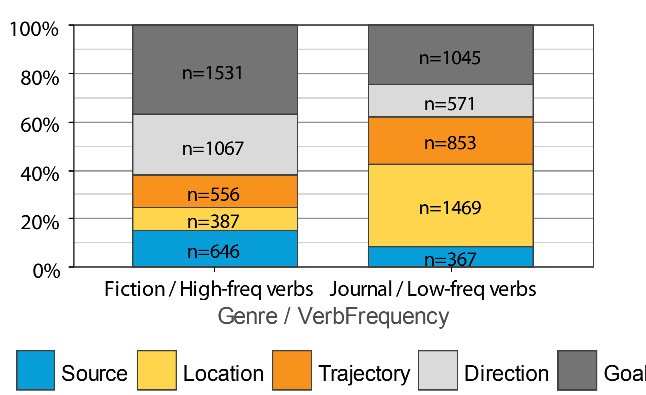

Figure 88. Distribution of spatial expressions of Source, Location, Trajectory, Direction, and Goal across two genres of motion clauses (Fiction vs. Journal). Fiction represents simultaneously high-frequency verbs (= High-freq verbs), and Journal represents verbs of lower frequency (= Low-freq verbs)

The distribution of spatial expressions across verbs of different frequencies is presented in Figure 89. It shows a general tendency that the more frequent the verb is (the upper verbs in the figure), the more frequently Direction, Goal, and Source, are expressed. The less frequent the verb is (the lower verbs in the figure), the more frequently the Location, and Trajectory are expressed. However, much variation can also be observed. For example, some high-frequency verbs (e.g., *käima* 'walk, go') are inclined towards combining with Location and disinclined from combining with the other spatial expressions[57], and some low-frequency verbs (e.g., *prantsatama* 'fall down with a crash') are inclined towards combining with Goal and away from combining with the other spatial expressions. Consequently, these findings for Frequency are very general tendencies, as this current analysis of frequency does not account for the verb's semantic factors.

Both genre of the text and frequency of the verb associate with the expression of spatial categories. Moreover, the two variables overlap considerably in that Genre can be seen as a two-level, binned variable of the variable Frequency. As such, the analysis cannot establish which of the factors, Genre or Frequency, affects the results primarily. Thus, it may be that verbs in fiction and of high frequency have a tendency to combine with expressions of the final portion of the path (Direction and Goal), and also with expressions of the initial portion of the path (Source). Verbs in newspaper clauses and of a lower frequency are likely to co-occur with expressions of the medial portion of the path (Location and Trajectory).

[57] However, this is due to coding decisions. For practical reasons, in the case of *käima* 'walk, go', the spatial category was assigned based on the form of the spatial expression (e.g., *käis metsas* lit. '(s)he walked in the forest'). However, in combination with this verb, the spatial expression may refer simultaneously to Goal, Location, and Source in Estonian.

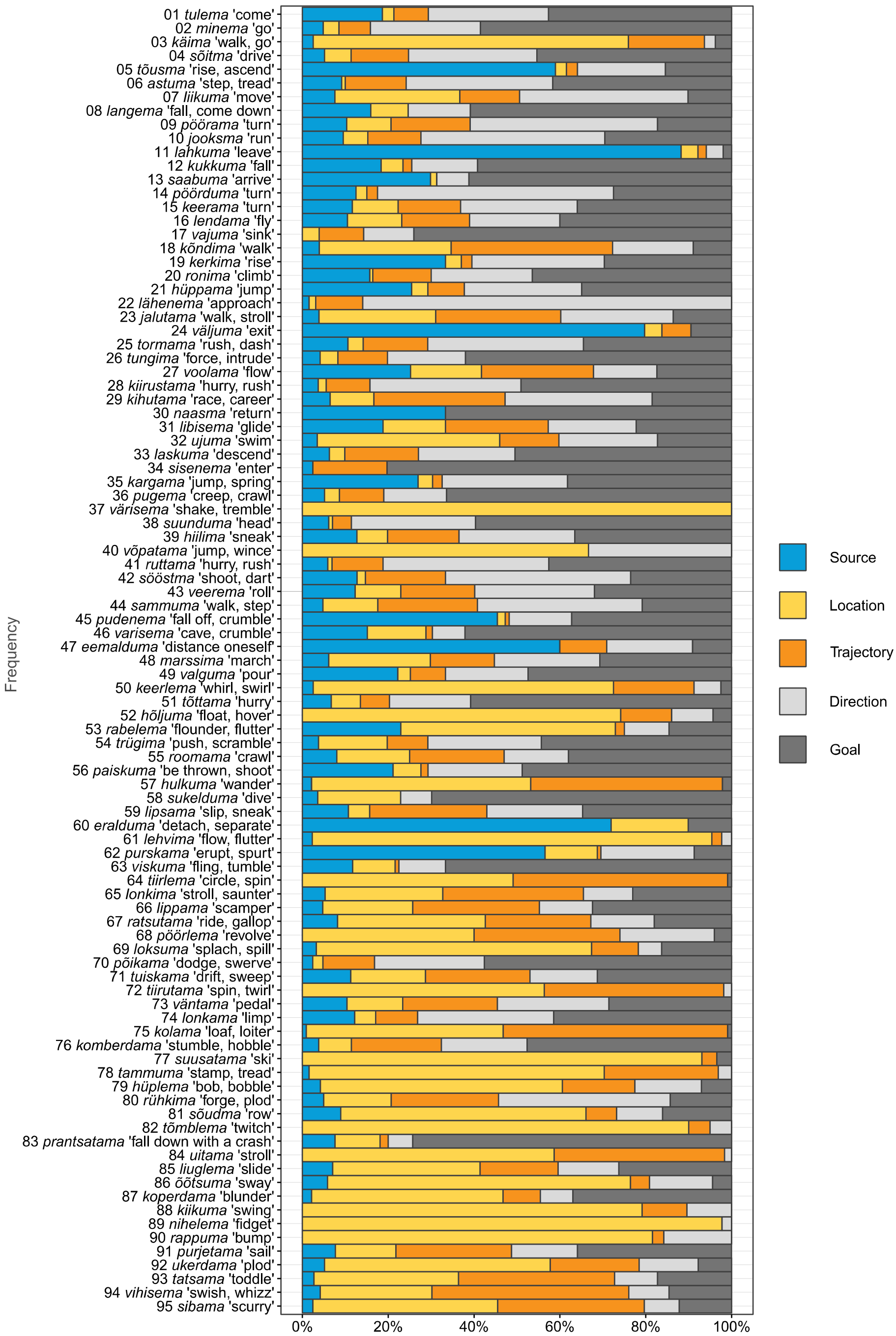

Figure 89. Distribution of spatial expressions of Source, Location, Trajectory, Direction, and Goal across motion verbs. Verbs are arranged according to their frequencies (from top to down in descending order) in the frequency list which is based on the Balanced Corpus of Estonian. Verbs labelled from 1–47 are fourth quartile verbs, and verbs labelled from 48–95 are third quartile verbs

9.3.3. Other semantic elements in motion clauses

A clause may contain many other semantic units besides the spatial, manner, and mover-related ones. All these other elements may also contribute to the characteristic patterns of motion verbs. In this section, six such semantic elements are examined briefly. These factors have only limited capacity to influence the main results as shown in the following analysis.

These six semantic variables are Purpose, Result, Time, Cause, Co-mover, and Distance. Purpose shows the aim of motion, Result the final state of the mover, Time the time when motion was started, conducted, or finished, Cause the reason for moving, Co-mover the accompanying movers, and Distance the length of the path (see also Section 6.1.3 of coding schema). Purpose is expressed in 4% (N = 359), Result in 5% (N = 457), Time in 18% (N = 1751), Cause in 2% (N = 225), Co-mover in 2% (N = 178), and Distance in 1% (N = 111) of the 9500 motion clauses. This shows that only Time expressions occur frequently in motion clauses. Other semantic elements are comparatively rare.

The variables are binary ones with 'yes' and 'no' values indicating the presence or absence of the respective expression. Each of these binary variables is analysed with respect to the count data of the spatial variables. The proportions of clauses with expressions of spatial variables are, thus, presented across the 'yes' and 'no' values of the respective variable (see Figure 90). The results of the Chi-square tests are given in Table 44.

The results show that only the variables Purpose, Result, and Time associate significantly ($p < 0.05$) with the expression of spatial variables Source, Location, Trajectory, Direction, and Goal. More specifically, Purpose and Result expressions are biased towards co-occurring with Goal expressions (e.g., *ta läks koju* [Goal] *sööma* [Purpose] '(s)he went home to eat'; *ta kukkus põrandale* [Goal] *selili* [Result] '(s)he fell to the floor on his/her back'; see also Figure 90). However, as the effect sizes indicate, the significant associations are extremely weak (the values of Cramér's V are below 0.10). Cause, Co-mover, and Distance do not associate with the expression of space.

Table 44. The results of the Chi-square tests for the variables Result, Distance, Cause, Co-mover, Purpose, and Time. The association between each of the variable and spatial variables is calculated separately

Variable	N	χ^2	df	p	Cramér's V
Purpose	**8492**	**52.54**	**4**	**$p < 0.001$**	**0.08**
Result	**8492**	**42.39**	**4**	**$p < 0.001$**	**0.07**
Time	**8492**	**42.55**	**4**	**$p < 0.001$**	**0.07**
Cause	8492	9.24	4	$p = 0.055$	0.03
Co-mover	8492	6.26	4	$p = 0.181$	0.03
Distance	8492	5.59	4	$p = 0.232$	0.03

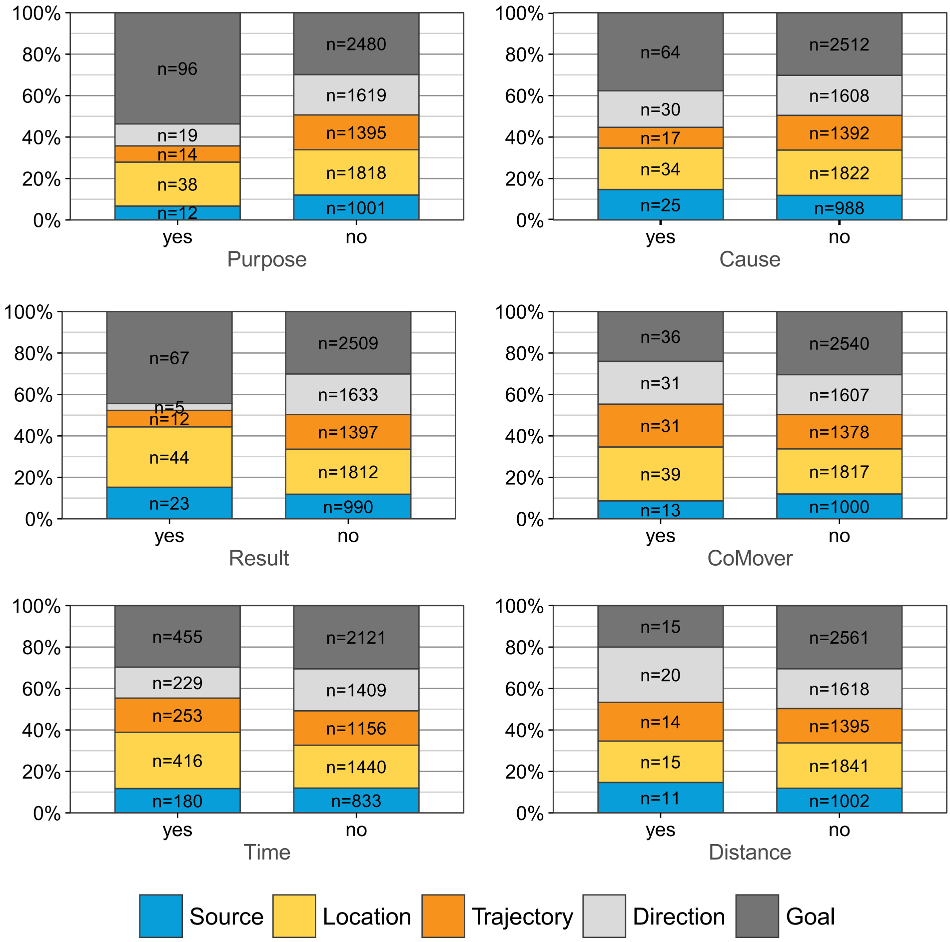

Figure 90. Distribution of spatial expressions of Source, Location, Trajectory, Direction, and Goal across clauses, with (= yes), and without (= no) (i) Purpose, (ii) Result, (iii) Time, (iv) Cause, (v) Co-mover, and (vi) Distance expressions

Regarding the six semantic units that can be expressed in motion clauses in addition to spatial, manner, and mover ones, only Purpose, Result, and Time are significant. However, the magnitude of the effects indicates that even these three variables are only marginally related to spatial expressions.

9.3.4. Summary and discussion

The analysis of other factors that can affect the results of spatial patterns of motion clauses reveals that factors of animacy (VerbAnimacy and Mover-Animacy) and Genre/Frequency are important. The other variables of semantic units in motion clauses (Purpose, Result, Time, Cause, Co-mover, and Distance) do not associate, or associate extremely weakly, with the expression of spatial categories.

As for animacy, the semantics of motion verbs (variable VerbAnimacy) and the expression of the mover in a particular clause (variable MoverAnimacy), strongly agrees. More specifically, verbs of animate motion tend to occur in clauses where animate motion is depicted (e.g., *tüdruk jooksis* 'the girl was running'), and verbs of inanimate motion in clauses where inanimate motion is depicted (e.g., *pall veeres* 'the ball was rolling'). This unsurprising pattern can be seen as a case of consistent windowing. It clearly shows that the mechanism of consistent windowing applies also to mover animacy in a similar way as it does to spatial information.

The results also show that the animacy of the mover (both in terms of VerbAnimacy and MoverAnimacy) associate with the expression of space in motion clauses. Animate motion tends to be expressed in combination with Trajectory, Direction, and Goal expressions (e.g., *tüdruk jooksis majja* 'the girl ran into the house'), whereas inanimate motion is expressed in combination with Source, and Location expressions (e.g., *pall veeres põrandal* 'the ball rolled on the floor'). This means that, generally, animate motion prefers the final, and inanimate motion prefers the medial or initial windowing of the path. This finding is in agreement with the *goal-over-source* principle according to which animate motion is particularly Goal-biased (Ikegami 1987; Dirven & Verspoor 1998: 87–89).

As for Genre and Frequency, these variables overlap and are highly multi-collinear due to the data collection methods. High frequency verbs simultaneously represent texts of fiction corpus, and lower frequency verbs represent texts of newspaper corpora. The examination of both of these variables show that clauses of fiction (i.e., with fourth quartile verbs) are, as a rough generalisation, biased towards Direction, and Goal. On the contrary, clauses of newspapers (i.e., with third quartile verbs) are inclined towards Location, and Trajectory.

Thus, many high-frequency verbs are inclined towards combining with Direction, and Goal expressions. Consequently, the expressions of the final portion of the path are used far more frequently than those of the medial portion of the path. This suggests that language, in general, is Goal-biased. Furthermore, this also explains why the Goal-bias has been reported in a number of studies (Lakusta & Landau 2005; Pajusalu & Orav 2007; Pléh 2010; Hoffmann 2012; Lewandowski 2012; Kabata 2013; Pajusalu et al. 2013). These studies have ignored verb-specific differences, and has focussed mainly on typical, frequent verbs of motion.

However, one question this section does not address is how these variables relate to the verb semantic variables (VerbType, MotionType, HorVert, and VerbSpeed) in predicting the presence or absence of spatial and manner expressions. The following section assesses whether such influences occur in the data.

9.4. Lay of the land

Previous sections have demonstrated that the encoding of spatial and manner information is in accordance with the hypothesis of consistent windowing. This is obtained by analysing the data slice by slice. The aim of this section is to bring the slices together and provide a unified analysis of all the factors from a different angle. By doing this, the current section also presents a classification of the studied 95 motion verbs.

The analysis, thus far, has also shown that the data are highly complex. This finding is not surprising as the multivariate nature of language is well known. However, the more complex the data are, the more difficult it is to find a system to represent the data. Once again, the issue of accuracy and interpretability arises. For instance, it would be possible to create and even interpret conditional inference trees with all the variables discussed so far. However, presenting such trees would make this thesis very difficult to read. Moreover, conditional random forests, which allow all the variables to be assessed simultaneously, have a very high computational cost. This means that this method cannot handle too much data.

Consequently, I take a slightly different approach in order to access this complexity. That is, by applying hierarchical agglomerative cluster analysis, I classify the verbs on the basis of the six spatial variables (i.e., Source, FromDirection, Location, Trajectory, Direction, and Goal). That is, based on the combinations with the spatial expressions, all 95 motion verbs are automatically grouped.

If the hypothesis of consistent windowing holds, the resulting classes of motion verbs should behave differently with respect to the other primary variables (i.e., VerbType, MotionType, HorVert, and VerbSpeed; but also MannerInstrument). In what follows, I present the tree-structured classification of motion verbs. Then, I examine the classes with regard to the (i) spatial variables on the basis of which the clustering is performed; (ii) verb semantic categorical variables, VerbType, MotionType, and HorVert; (iii) verb semantic continuous variable VerbSpeed; and (iv) variable MannerInstrument. Finally, I bring all variables together and evaluate the verb classes by creating multiple random forests.

9.4.1. Classification of motion verbs

The dendrogram of the hierarchical agglomerative clustering is presented in Figure 91. It clusters the 95 motion verbs into a number of subclasses on the basis of the clausal patterns of these verbs. More specifically, the basis for this classification is the presence of the expressions of the six spatial categories in the form of a contingency table. Importantly, the semantic features of motion verbs (such as the type of verb) and the other variables are not taken into account in this tree. Each major verb class is assigned a label. The label represents the most typical spatial category that the verbs in the class are likely to combine with. For instance, verbs in the class 'LocClass' are biased towards co-occurring with

Location expressions. This information about the clausal patterns is taken from the analysis of Figure 92 and Table 45, and it is presented and discussed below.

It should be stressed, however, that the labels represent only the most typical spatial categories the verbs have a tendency to combine with, and all verb classes show also patterns with all the other spatial expressions. For example, even though the class may be labelled as SourceClass, this does not mean that all verbs in this class combine exclusively with Source expressions. The fact is that, in general, verbs in this class combine with Source expressions frequently only if compared to the other classes of the verbs. They also combine frequently with Direction, and Goal expressions. In other words, not all verbs in this class may be Source-biased, but are included in the class by the frequencies of the other spatial variables. The same applies also to the other five verb classes.

As a general characterisation of the cluster analysis (see Figure 91), group sizes vary greatly. LocTrajClass and TrajClass are the smallest (both N = 12), and DirGoalClass is the largest (N = 23). It can also be seen that there are two main clusters of verbs, as indicated by the first split in the dendrogram. That is, two verb classes, LocClass and LocTrajClass, are distinct from the other four verb classes. These verb classes also show a comparatively heterogeneous nature in terms of the semantic features of the verbs. This issue is addressed in Section 9.4.2.

As could be inferred from the labels, the count data that was the input for the cluster analysis (see Figure 92) shows that verbs in LocClass, LocTrajClass, and TrajClass strongly prefer expressions of the medial portion of the path (i.e., Location, and Trajectory expressions). SourceClass, as the name suggests, is different in that it exhibits a large amount of clauses with Source expressions[58], while GoalClass and DirGoalClass are inclined towards clauses with expressions of the final portion of the path (i.e., Direction, and Goal). Not surprisingly, the difference in proportions is significant (otherwise the clustering technique would not be reliable) with a moderate effect size: $\chi^2(20, N = 9500) = 4551.4$, $p < 0.001$, Cramér's $V = 0.37$.

[58] The question that speakers of Estonian might ask is whether the two verbs of self-contained motion in SourceClass (i.e., *võpatama* 'jump, wince' and *värisema* 'shake, tremble') actually combine with Source expressions or whether these are Cause expressions instead. This is because Cause is frequently inflected for elative in Estonian (e.g., *värises hirmust* '(s)he was trembling with fear'). This is not the case, however, as such phrases (e.g., *hirmust* lit. 'from the fear') were tagged as Cause expressions and not as Source expressions (see also Sections 6.1.3 and 9.3.3).

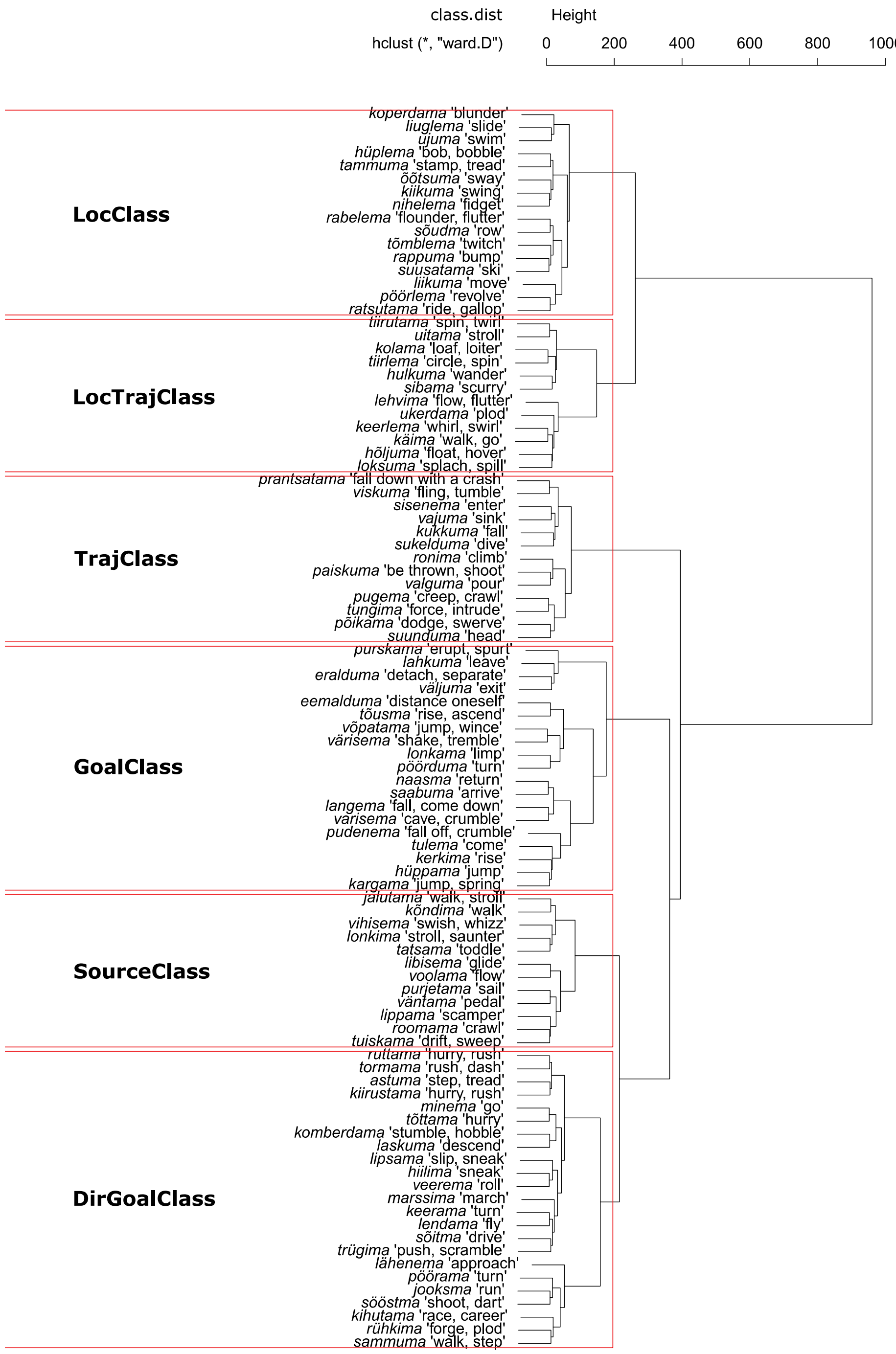

Figure 91. On the right: hierarchical agglomerative clustering and classes of motion verbs on the basis of spatial variables Source, FromDirection, Location, Trajectory, Direction, and Goal. On the left: labels of verb classes derived from the typical clausal patterns of clustered verbs

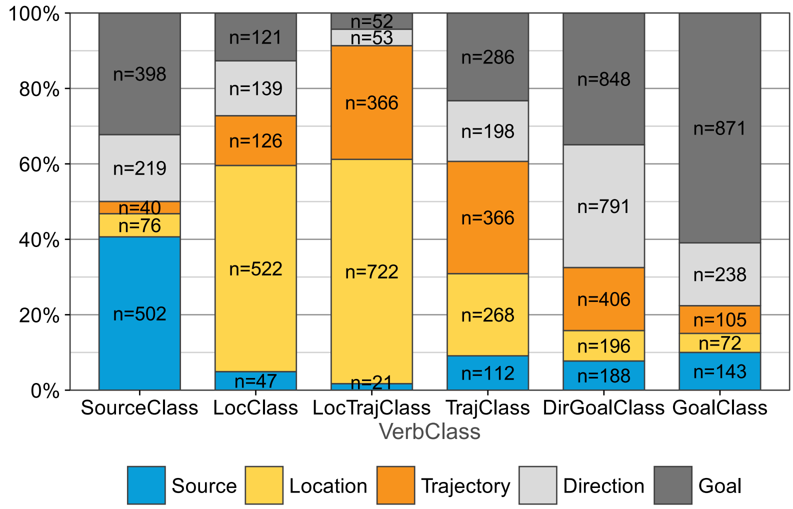

Figure 92. Distribution of spatial expressions across verb classes. FromDirection is omitted from the figure due to it having very low frequencies.

Pearson's residuals (see Table 45) confirm the observations in a more detailed way for the initial windowing, medial windowing and final windowing. For the initial windowing, SourceClass prefers Source. For the medial windowing, LocClass prefers Location, LocTrajClass Location and Trajectory, and TrajClass Trajectory. For the final windowing, DirGoalClass is strongly inclined towards Direction, and GoalClass is strongly inclined towards Goal.

Table 45. Pearson's residuals for the spatial variables and Class

	Source-Class	Loc-Class	LocTraj-Class	Traj-Class	DirGoal-Class	Goal-Class
Goal	1.21	−9.91	−16.48	−4.51	**4.10**	**21.01**
Direction	−1.25	−3.33	−11.84	−2.55	**14.90**	−2.27
Trajectory	−11.52	−2.58	**11.60**	**11.33**	0.15	−8.58
Location	−11.80	**21.68**	**28.04**	−0.05	−14.53	−13.60
Source	**29.22**	−6.27	−10.29	−2.87	−5.98	−2.10

Verb classes reached by clustering may, thus, be presented as a cline (see Figure 93). It shows verb classes with respect to their biases towards co-occurring with expressions of different portions of the path. However, it should be noted that the cline represents only general tendencies and does not fully account for all individual verbs, and their typical and less typical patterns.

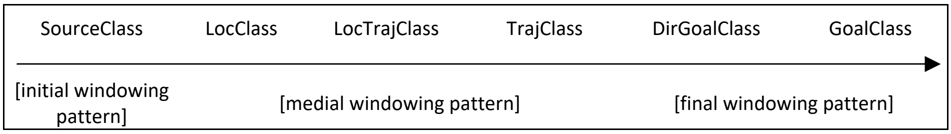

Figure 93. The windowing cline: the cline of verb classes based on the tendencies of combining with spatial expressions that window the initial, medial, and final portion of the path

Taken together, verbs can be classified on the basis of their clausal patterns of spatial information. The resulting classes of verbs show that 19 verbs (i.e., verbs in SourceClass; e.g., *purskama* 'erupt, spurt') prefer combinations with initial windowing expressions; 40 verbs (i.e., verbs in LocTrajClass (e.g., *tiirutama* 'spin, twirl'), LocClass (e.g., *koperdama* 'blunder'), and TrajClass (e.g., *jalutama* 'walk, stroll')) prefer combinations with medial windowing; and 36 verbs (those in DirGoalClass (e.g., *ruttama* 'hurry, rush') and GoalClass (e.g., *prantsatama* 'fall with a crash')) prefer combinations with final or close to final windowing. The objective of the following section is to determine whether these verb classes differ also in terms of their verb semantic features.

9.4.2. Verb classes with respect to the verb semantic variables

The current section evaluates the verb classes from the perspective of the semantic features of motion verbs. In Section 9.4.1, the classes are obtained by clustering the verbs on the basis of the combinations with spatial expressions representing the categories Source, FromDirection, Location, Trajectory, Direction, and Goal. The verb semantic variables VerbType, MotionType, HorVert, and VerbSpeed are not taken into account when performing the clustering. However, the following analyses show that the verb classes are highly sensitive to these verb semantic variables. These findings replicate the ones presented in Section 9.1, and strongly support the consistent windowing hypothesis.

9.4.2.1. Verb classes and verb type

The distribution of verbs of different types (i.e., **VerbType**) across verb classes is given in Figure 94. It shows that verb classes that are inclined towards the expressions of medial windowing (i.e., **LocClass**, **LocTrajClass**, and **TrajClass**; see Figure 92 and Table 45 in Section 9.4.1 above) consist almost exclusively of manner of motion verbs. The only non-manner verb in these classes is the neutral verb *liikuma* 'move' in LocClass which has been shown in this study to behave often like manner of motion verbs. To exemplify this, the manner of motion verb *tiirutama* 'spin, twirl' appears in LocTrajClass, *koperdama* 'blunder' in LocClass, and *jalutama* 'walk, stroll' in TrajClass (see also Table 46). As not all types of verbs are represented in all the verb classes, the Chi-square test is not computed. The same applies to the other verb semantic variables as discussed below.

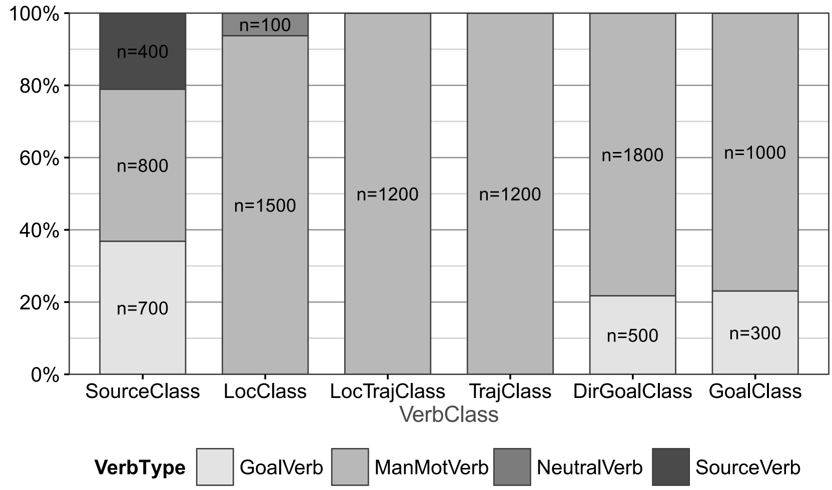

Figure 94. Distribution of motion verbs of different semantics across verb classes: VerbType

Nevertheless, manner of motion verbs are represented in the other three verb classes too, but these classes also include goal verbs (in SourceClass, DirGoalClass, and GoalClass), and the source verbs (in SourceClass). Verbs in these three classes are inclined towards the expressions of the initial or final portion of the path (see Section 9.4.1 above), and also seem to be highly directional verbs.

In fact, the distribution of verb semantic features (see Figure 94) shows that verbs in **DirGoalClass** and **GoalClass** are fairly similar in terms of verb type. That is, approximately 78% of verbs in both classes are manner of motion verbs (e.g., *ruttama* 'hurry, rush' in DirGoalClass and *prantsatama* 'fall with a crash' in GoalClass), and approximately 22% of verbs are goal verbs (e.g., *minema* 'go' in DirGoalClass and *suunduma* 'head' in GoalClass). This is in accordance with the findings discussed in Section 9.1.1 where manner of motion verbs are shown to have a slight tendency to combine with Direction, and with Goal (in addition to the main tendency to combine with Location, and Trajectory), and goal verbs are shown to combine mainly with Direction, and Goal expressions. As such, not only goal verbs are directional, but also manner of motion verbs in these verb classes are comparatively directional.

According to the windowing cline presented in the previous section (see Figure 93), **SourceClass** is very different to the other verb classes because it is biased towards Source expressions. The expression of Source was previously shown to associate mainly with the type of verb (see Section 9.1.1). The current results confirm these findings, as only this class contains source verbs (e.g., *lahkuma* 'leave'; see Figure 94). SourceClass is rather heterogeneous, however, as in addition to source verbs (21%), there are also goal verbs (37%; e.g., *tõusma* 'rise, ascend') and manner of motion verbs (42%; e.g., *purskama* 'erupt, spurt').

Table 46. Verb classes determined by cluster analysis. Motion verbs are clustered on the basis of their combinations with expressions of the spatial categories Source, FromDirection, Location, Trajectory, Direction, and Goal

Verb class label	Characterisation of the verbs in the class	Motion verbs in the class
SourceClass	Verbs that have a tendency to combine with Source expressions	***purskama*** 'erupt, spurt', ***lahkuma*** 'leave', ***eralduma*** 'detach, separate', ***väljuma*** 'exit', ***eemalduma*** 'move away', ***tõusma*** 'rise, ascend', ***võpatama*** 'jump, wince', ***värisema*** 'shake, tremble', ***lonkama*** 'limp', ***pöörduma*** 'turn', ***naasma*** 'return', *saabuma* 'arrive', ***langema*** 'fall, come down', ***varisema*** 'cave, crumble', ***pudenema*** 'fall off, crumble', ***tulema*** 'come', ***kerkima*** 'rise', *hüppama* 'jump', ***kargama*** 'jump, spring'
LocClass	Verbs that have a tendency to combine with Location expressions	***koperdama*** 'blunder', ***liuglema*** 'slide', ***ujuma*** 'swim', ***hüplema*** 'bob, bobble', ***tammuma*** 'stamp, tread', ***õõtsuma*** 'sway', ***kiikuma*** 'swing', ***nihelema*** 'fidget', ***rabelema*** 'flounder, flutter', ***sõudma*** 'row', ***tõmblema*** 'twitch', ***rappuma*** 'bump', ***suusatama*** 'ski', ***liikuma*** 'move', ***pöörlema*** 'revolve', ***ratsutama*** 'ride, gallop'
LocTrajClass	Verbs that have a tendency to combine with Location, and Trajectory expressions	***tiirutama*** 'spin, twirl', ***uitama*** 'stroll', ***kolama*** 'loaf, loiter', ***tiirlema*** 'circle, spin', ***hulkuma*** 'wander', ***sibama*** 'scurry', ***lehvima*** 'flow, flutter', ***ukerdama*** 'plod', ***keerlema*** 'whirl, swirl', ***käima*** 'walk, go', ***hõljuma*** 'float, hover', ***loksuma*** 'splash, spill'
TrajClass	Verbs that have a tendency to combine with Trajectory expressions	***jalutama*** 'walk, stroll', ***kõndima*** 'walk', ***vihisema*** 'swish, whizz', ***lonkima*** 'stroll, saunter', ***tatsama*** 'toddle', ***libisema*** 'glide', ***voolama*** 'flow', ***purjetama*** 'sail', ***väntama*** 'pedal', ***lippama*** 'scamper', ***roomama*** 'crawl', ***tuiskama*** 'drift, sweep'
DirGoalClass	Verbs that have a tendency to combine with Direction, and Goal expressions	***ruttama*** 'hurry, rush', ***tormama*** 'rush, dash', ***astuma*** 'step, tread', ***kiirustama*** 'hurry, rush', ***minema*** 'go', ***tõttama*** 'hurry', ***komberdama*** 'stumble, hobble', ***laskuma*** 'descend', ***lipsama*** 'slip, sneak', ***hiilima*** 'sneak', ***veerema*** 'roll', ***marssima*** 'march', ***keerama*** 'turn', ***lendama*** 'fly', ***sõitma*** 'drive', ***trügima*** 'push, scramble', ***lähenema*** 'approach', ***pöörama*** 'turn', ***jooksma*** 'run', ***sööstma*** 'shoot, dart', ***kihutama*** 'race, career', ***rühkima*** 'forge, plod', ***sammuma*** 'walk, step'
GoalClass	Verbs that have a tendency to combine with Goal expressions	***prantsatama*** 'fall with a crash', ***viskuma*** 'fling, tumble', ***sisenema*** 'enter', *vajuma* 'sink', ***kukkuma*** 'fall', ***sukelduma*** 'dive', ***ronima*** 'climb', ***paiskuma*** 'be thrown, shoot', ***valguma*** 'pour', ***pugema*** 'creep, crawl', ***tungima*** 'force, intrude', ***põikama*** 'dodge, swerve', ***suunduma*** 'head'

9.4.2.2. Verb classes and motion type

As for the type of motion (i.e., **MotionType)**, it appears that verb classes are also different in that they consist of different types of motion (see Figure 95 and also Table 46). Most importantly, the verb classes of **TrajClass**, **DirGoalClass**, and **GoalClass** contain almost only verbs of translational motion. All the verbs (100%) in TrajClass and GoalClass, and most of the verbs (91%) in DirGoal-Class, describe translational motion (e.g., *jalutama* 'walk, stroll' in TrajClass; *prantsatama* 'fall with a crash' and *suunduma* 'head' in GoalClass; and *ruttama* 'hurry, rush' and *minema* 'go' in DirGoalClass). Again, this replicates the finding for MotionType (see Section 9.1.2) whereby translational motion is slightly biased towards Trajectory, and Direction, and more likely biased towards Goal.

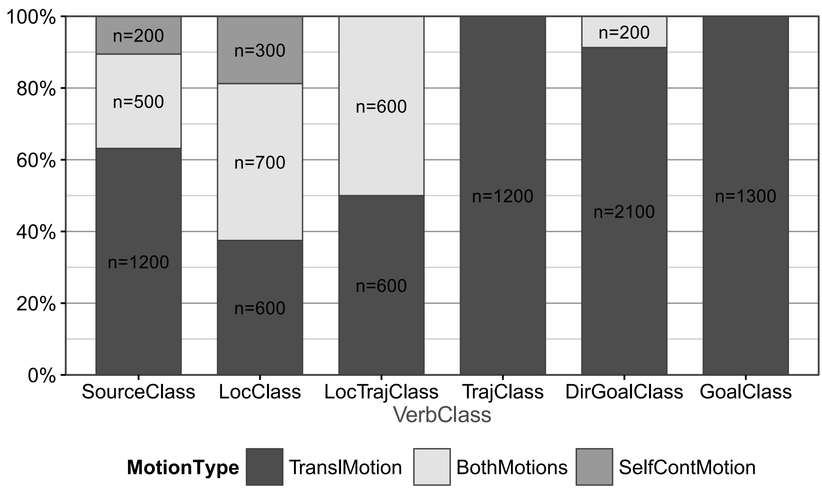

Figure 95. Distribution of motion verbs of different semantics across verb classes: MotionType

The other three verb classes have a mixed structure of verbs of different motion types. **LocTrajClass** consists of verbs that express either translational (50%; e.g., *uitama* 'stroll') or both motions (50%; e.g., *tiirutama* 'spin, twirl'). **LocClass** is similar to LocTrajClass in this respect, but contains also verbs of self-contained motion. That is, in LocClass, verbs express either translational (38%; e.g., *koperdama* 'blunder'), self-contained (19%; e.g., *nihelema* 'fidget'), or both motions (44%; e.g., *hüplema* 'bob, bobble').

All three motion types are also represented in **SourceClass**. However, verbs of translational motion are more common in this class than in LocClass and LocTrajClass. That is, 63% of verbs express translational motion (e.g., *lahkuma* 'leave' and *purskama* 'erupt, spurt'), 11% self-contained motion (e.g., *võpatama* 'jump, wince'), and 26% both motions (e.g., *tõusma* 'rise, ascend' and *hüppama* 'jump'). This corresponds to the findings of MotionType and Source, as presented in Section 9.1.2 where it was shown that verbs of translational motion, in particular, have a tendency to combine with Source expressions.

The current findings of verb classes, thus, generally replicate the results obtained in Section 9.1.2. That is, verbs of translational motion are biased towards expressions of the final portion of the path (Direction and Goal, but also Trajectory), whereas verbs of both motions are biased towards Location.

9.4.2.3. Verb classes and horizontal/vertical motion

The distribution of verbs with respect to their semantic feature of expressing motion along the horizontal or vertical axes (i.e., **HorVert**) is presented in Figure 96 (see also Table 46). As a general observation, verb classes are pairwise similar. That is, LocClass and LocTrajClass contain verbs of horizontal or directionally ambiguous motion, TrajClass and DirGoalClass contain mainly verbs of horizontal motion, and SourceClass and GoalClass contain all three types of verbs.

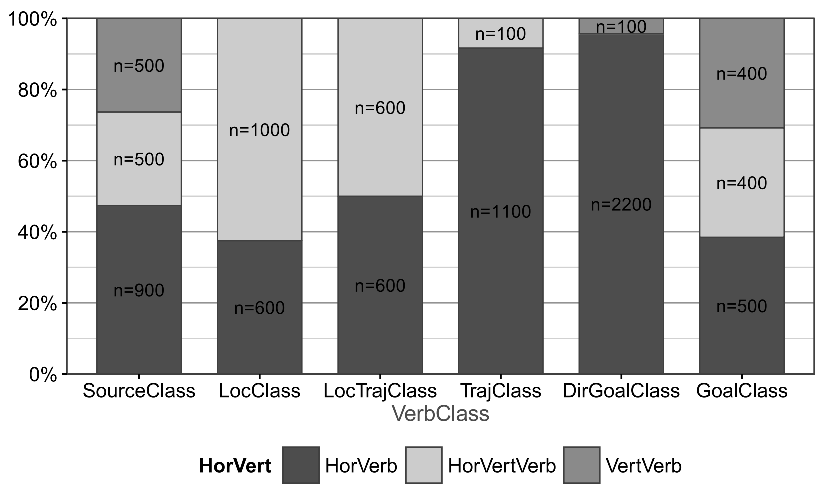

Figure 96. Distribution of motion verbs of different semantics across verb classes: HorVert

Thus, verbs in **LocClass** and **LocTrajClass** (i.e., verbs of medial windowing) express either horizontal (38% and 50% respectively; e.g., *ujuma* 'swim' in LocClass and *uitama* 'stroll' in LocTrajClass), or directionally ambiguous motion (62% and 50% respectively; e.g., *hüplema* 'bob, bobble' in LocClass and *tiirutama* 'spin, twirl' in LocTrajClass). This matches the finding presented in Section 9.1.3 in that expressions of the medial windowing are strongly inclined towards horizontal and directionally ambiguous motion.

Verbs in **TrajClass** and **DirGoalClass** are mainly verbs of horizontal motion (92% and 97% respectively; e.g., *jalutama* 'walk, stroll' in TrajClass and *ruttama* 'hurry, rush' in DirGoalClass). TrajClass contains also one verb of ambiguous motion (*voolama* 'flow'), and DirGoalClass one verb of vertical motion (*laskuma* 'descend'). This is, again, the result obtained in Section 9.1.3. Verbs of horizontal motion do tend to be expressed alongside Trajectory, and Direction expressions.

As for the most mixed verb classes in terms of horizontal and vertical motion, verbs in **SourceClass** and **GoalClass** are very similar. In SourceClass, 48% of verbs express horizontal motion (e.g., *väljuma* 'exit'), 26% of verbs express ambiguous motion (e.g., *purskama* 'erupt, spurt'), and 26% of verbs express vertical motion (e.g., *tõusma* 'rise, ascend'). In GoalClass, 38% of verbs depict horizontal motion (e.g., *sisenema* 'enter'), 31% of verbs depict ambiguous motion (e.g., *paiskuma* 'be thrown, shoot'), and 31% of verbs depict vertical motion (e.g., *kukkuma* 'fall'). As shown in Section 9.1.3, verbs of vertical motion are strongly inclined towards Source, and Goal expressions. Thus, the results concur with the ones presented in Section 9.1.3. In addition, the majority of verbs in these classes are highly directional or express forceful motion (see Table 46 for verbs) that may occur as horizontal or directionally ambiguous motion. This explains the mixed structure of these classes.

9.4.2.4. Verb classes and verb speed

As for the speed of motion, as implied by motion verbs (i.e., **VerbSpeed**), the prediction is that speed information embedded in the meaning of motion verbs represents directionality. In other words, the faster the motion is, the more directional the verb may be. This, in turn, would result in different clausal patterns. The results presented in Section 9.1.4 show that these expectations are confirmed in that verbs of fast motion are much more likely to combine with the highly directional categories (Source, and Goal) than verbs of slow motion. If the speed ratings differed across the classes of verbs, this would provide further evidence for the tendency of consistent windowing.

The speed values of verbs across the classes do differ, as can be seen in Figure 97. In particular, verbs in **DirGoalClass** (e.g., *ruttama* 'hurry, rush' and *tormama* 'rush, dash'; see Node 2 in the left branch of the tree) are different to all the other verbs. Verbs in this class exhibit significantly higher speed ratings than the other verbs. **GoalClass** (e.g., *prantsatama* 'fall with a crash' and *kukkuma* 'fall'; see Node 5 to the left of the tree) shows also comparatively high speed ratings. As shown in Section 9.4.1, GoalClass, in particular, and to a lesser extent DirGoalClass, are both inclined towards the expressions of Direction, and Goal (see Figure 92, Table 45, and the discussion of the other verb semantic features above). Thus, the results clearly show that verbs that depict faster motion are very likely to be used in combination with the expressions of the final windowing.

By contrast, verbs in **LocTrajClass** (e.g., *ukerdama* 'plod') are ranked for much slower motion than the other verbs (see Node 9 to the right of the figure), and appear in the tree separately. Once again, this class is more inclined than any of the other classes towards the expressions of the medial windowing as shown in Section 9.4.1 (see Figure 92 and Table 45). In other words, the results provide evidence that verbs of slow motion have a tendency to combine with the expressions of the medial windowing.

LocClass (e.g., *koperdama* 'blunder'), **SourceClass** (e.g., *eralduma* 'detach, separate'), and **TrajClass** (e.g., *jalutama* 'walk, stroll') form intermediate stages between fast and slow motion verbs (see Figure 97). The verbs in SourceClass and TrajClass are extremely similar in terms of speed ratings and fall into the same leaf of the tree (see Node 8). These results are convergent with clausal patterns of the verb classes: LocTrajClass, the slowest verbs (e.g., *uitama* 'stroll'), are strongly inclined towards expressions of Location and Trajectory; DirGoal-Class, the fastest verbs (e.g., *ruttama* 'hurry, rush'), are biased towards Direction, and Goal (Figure 92), or towards Trajectory, and Direction (see Table 45).

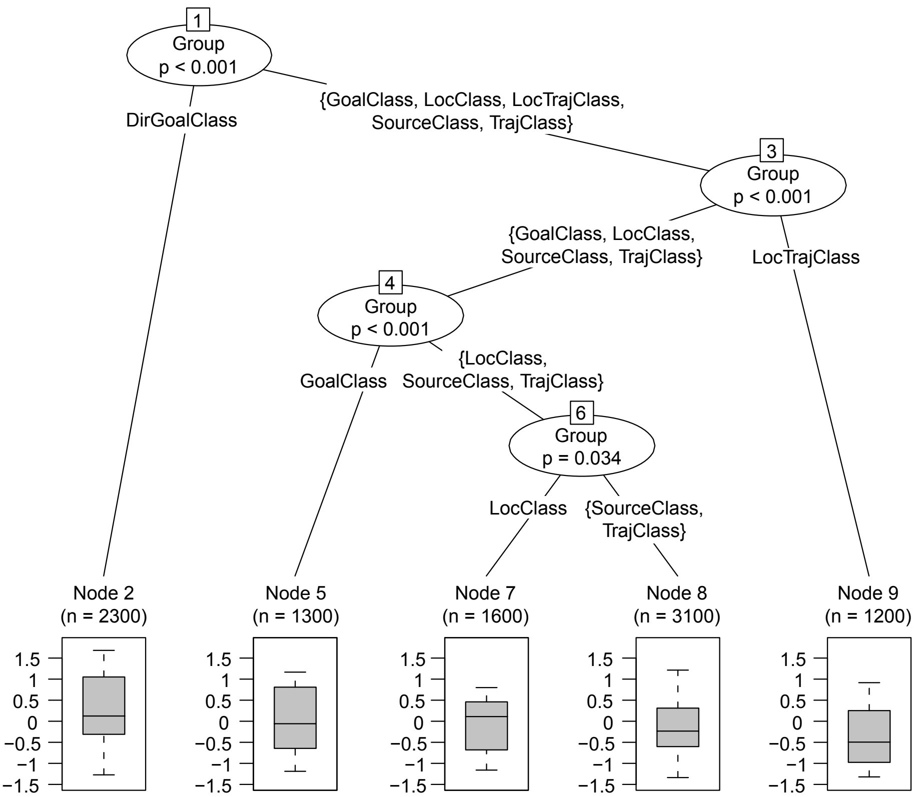

Figure 97. Conditional inference tree for VerbSpeed: VerbSpeed ~ Class

To summarise, the verb classes that are obtained through the analysis of both the clausal patterns of spatial expressions, and of the hierarchical agglomerative clustering, associate with the verb semantic variables VerbType, MotionType, HorVert, and VerbSpeed. This provides strong support for the consistent windowing hypothesis.

9.4.3. Verb classes with respect to the variable of manner

This section examines the verb classes with respect to manner information. In the clustering of the verbs, manner expressions (i.e., **MannerInstrument**) are not considered. However, according to the hypothesis of consistent windowing, verb classes should show differences with regard to combining with expressions of MannerInstrument.

The results of the univariate analysis of MannerInstrument and Class are presented in Figure 98. It shows that there are differences across the classes in the proportions of clauses that contain manner expressions. More specifically, verbs in LocClass (e.g., *hüplema* 'bob, bobble') are the most prone to combine with manner expressions (29%), followed by TrajClass (23%; e.g., *kõndima* 'walk'), and finally by DirGoalClass (21%; e.g., *kihutama* 'race, career'). Verbs in SourceClass (e.g., *purskama* 'erupt, spurt'), LocTrajClass (e.g., *tiirlema* 'circle, spin'), and GoalClass (e.g., *prantsatama* 'fall with a crash'), and combine with manner expressions less frequently (15%, 14%, and 14% respectively). The Chi-square test reveals that the difference in proportions is significant with a weak effect size: $\chi^2(5, N = 9500) = 166.38$, $p < 0.001$, Cramér's V = 0.13.

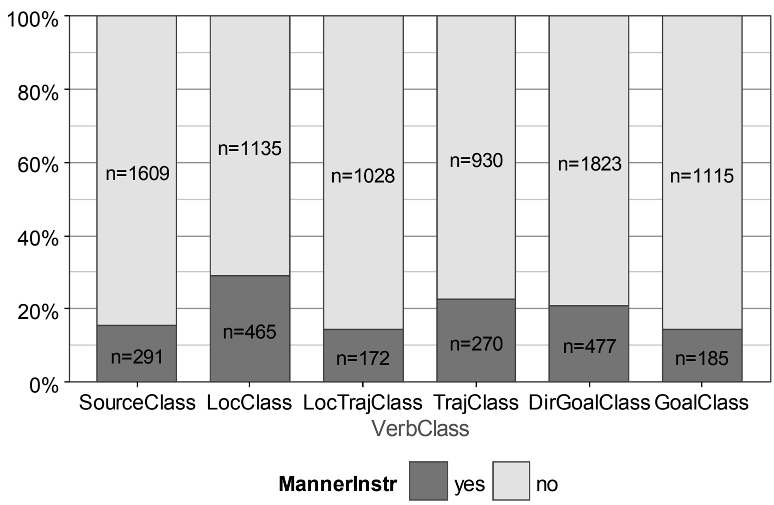

Figure 98. The presence (= yes) or absence (= no) of manner expressions across verb classes

Table 47. Pearson's residuals for MannerInstrument and Class

	Source-Class	Loc-Class	LocTraj-Class	Traj-Class	DirGoal-Class	Goal-Class
MannerInstrument expression absent (= no)	2.07	−4.23	2.03	−1.13	−0.62	2.15
MannerInstrument expression present (= yes)	**−4.20**	**8.57**	**−4.11**	**2.29**	1.26	**−4.36**

These proportions, along with Pearson's residuals (see Table 47), indicate that **LocClass** and **TrajClass** show an opposite trend to the other classes in that they are inclined towards expressing manner. LocClass and TrajClass are amongst the three classes which contain solely manner of motion verbs, and the neutral verb (see Figure 94 and Section 9.4.2 above). This is in agreement with the earlier finding (see Section 9.2.1) where manner of motion verbs are found to be slightly biased towards manner expressions.

However, **LocTrajClass**, which also only contains the manner of motion verbs and is strongly inclined towards medial windowing, is biased away from manner expressions. This is interesting because the semantic characteristics of the verbs in LocTrajClass are similar to LocClass in that these verbs express, in similar proportions, either translational of both motions, or horizontal and directionally ambiguous motion (see Figure 94, Figure 95, and Figure 96 in the above sections). The only semantic feature that differentiates these classes is VerbSpeed. The verbs in LocTrajClass have significantly lower speed ratings than the verbs in LocClass.

The verbs in **SourceClass** (e.g., *purskama* 'erupt, spurt') and **GoalClass** (e.g., *prantsatama* 'fall with a crash') have only a limited number of combinations with manner expressions, and **DirGoalClass** (e.g., *ruttama* 'hurry, rush') is comparatively insensitive to MannerInstrument (see Table 47). These are the three classes which are mainly biased to the expressions of the initial or final portion of the path. They are also the only three which contain verbs of directional motion (i.e., source and goal verbs). Such verbs, as shown in Section 9.2.1, do not tend to combine with manner expressions frequently. These findings, thus, provide converging evidence for the consistent windowing strategy in motion language.

Taken together, verb classes vary with regard to the amount of clauses where manner is expressed. Simultaneously, verb classes, themselves, are obtained on the basis of spatial variables. The variable for manner (i.e., MannerInstrument) is not taken into account in this classification (see Section 9.4.1). The association between Class and MannerInstrument is weak, but significant, and shows that, in particular, two verb classes (i.e., LocClass and TrajClass) are inclined towards clauses containing manner-related information. Not surprisingly in the light of consistent windowing, these two classes are composed of mainly manner of motion verbs. Furthermore, the verb classes that comprise directional verbs are biased away from manner expressions.

9.4.4. The final touch

To add a final touch, I present random forests for predicting the verb classes (i.e., **Class**). The aim of these models is to evaluate the importance of all the variables that are discussed in the study, by using these as the independent variables to predict the verb class. Due to the size and complexity of the data, and the fact that conditional random forests are restricted to only a limited amount of calculations, I have constructed several instead of one model.

Consequently, I present four models. All of the models predict the verb class (i.e., Class). The combination of the independent variables varies from model to model to account for the best representation of the data.

As for the first model, I include all the principal variables of the study. These are the six spatial variables (i.e., Source, FromDirection, Location, Trajectory, Direction, and Goal) and the four verb semantic variables (VerbType, MotionType, HorVert, and BinnedSpeed). Due to computational restrictions, the categorical variable BinnedSpeed is included instead of the continuous variable VerbSpeed. Variable importances for these ten variables are presented in Figure 99. From this figure, it appears that there are four variables of primary importance in predicting the verb classes. These four variables are the verb semantic variables: HorVert, BinnedSpeed, VerbType, and MotionType. The six spatial variables (i.e., Location, Goal, Direction, Trajectory, Source, and FromDirection) have less predictive power. This result is intriguing because the verb classes themselves are obtained via clustering on the basis of the six spatial variables, and not on the basis of the verb semantic variables. The conclusion to be drawn from the result of random forests is that the semantic features of motion verbs, and spatial expressions in motion clauses, do associate significantly, as suggested by the consistent windowing hypothesis.

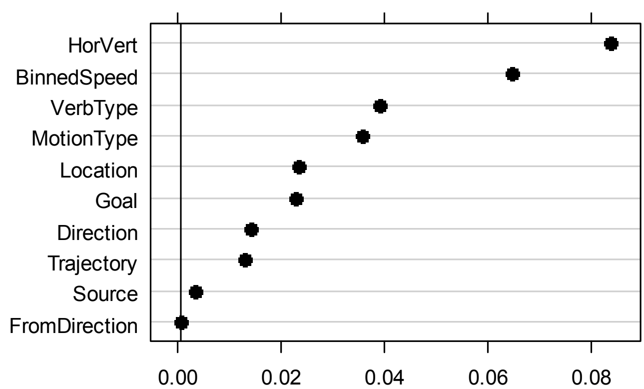

Figure 99. Conditional relative importance in predicting Class (predictors to the right of the vertical line are significant): Class ~ Source + FromDirection + Location + Trajectory + Direction + Goal + VerbType + MotionType + HorVert + BinnedSpeed

The other variables that have some influence on the results are Manner-Instrument, MoverAnimacy, VerbAnimacy, Genre, and Frequency (see Sections 9.2, 9.3.1, and 9.3.2). These variables are included in the model of predicting Class alongside the four main variables of the previous forest (i.e., HorVert, BinnedSpeed, VerbType, and MotionType). For computational reasons, Frequency is replaced with a three-level categorical variable, BinnedFrequency[59]. Conditional relative importances (see Figure 100) show that Genre, Binned-Speed, and HorVert are the main variables that distinguish between the six

[59] K-means clustering technique is used for the conversion.

classes of verbs, followed by VerbType, then by VerbAnimacy, and finally by MotionType. Interestingly, the three-level variable for verb frequency (i.e., BinnedFrequency) is relatively marginal, and the overlapping two-level variable Genre is the dominant one.

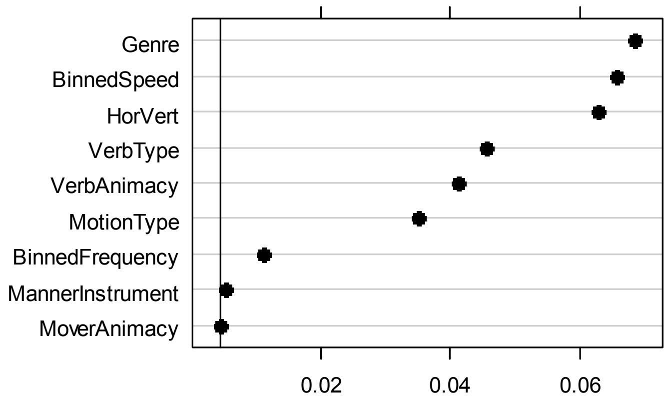

Figure 100. Conditional relative importance in predicting Class (predictors to the right of the vertical line are significant): Class ~ VerbType + MotionType + HorVert + BinnedSpeed + MannerInstrument + MoverAnimacy + VerbAnimacy + Genre + BinnedFrequency

The importance of text genre (Genre) and verb frequency (Frequency) needs further examination. Thus, a random forest is grown again with these variables together with the four main verb semantic variables. However, this time the numeric variable Frequency is used instead of the three-level categorical variable BinnedFrequency. In this model, the variable for speed is also included as a numeric one (i.e., VerbSpeed). The variable importances can be found in Figure 101. These relative importances show that VerbSpeed and Frequency are the dominant factors that differentiate between verb classes, Genre is insignificant, and the other verb semantic variables are somewhat significant.

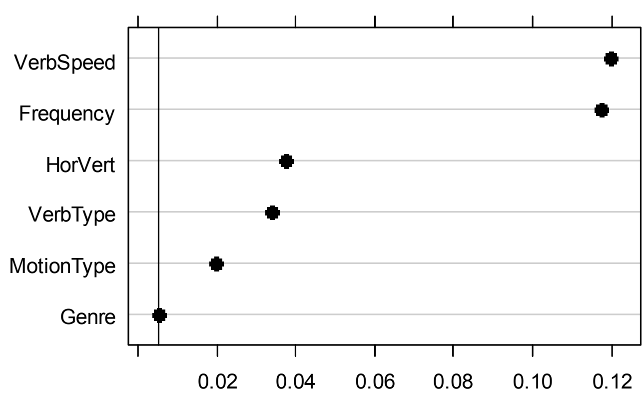

Figure 101. Conditional relative importance in predicting Class (predictors to the right of the vertical line are significant): Class ~ VerbType + MotionType + HorVert + VerbSpeed + Genre + Frequency

Finally, and for the sake of consistency, the six semantic variables of minor importance in motion clauses (Purpose, Result, Time, Cause, Co-mover, and Distance) are presented in Figure 102. Not surprisingly and in combination with the four main verb semantic variables, these six semantic variables have almost no influence over verb classes.

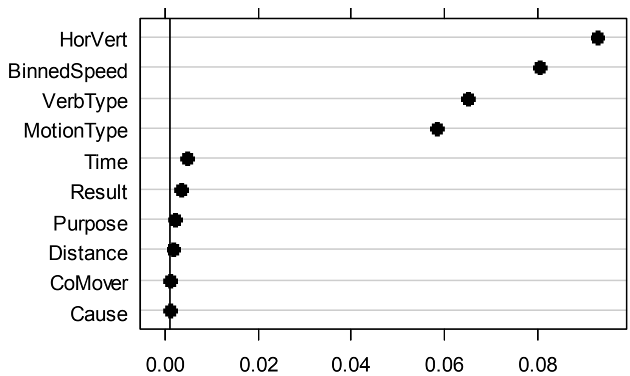

Figure 102. Conditional relative importance in predicting Class (predictors to the right of the vertical line are significant): Class ~ VerbType + MotionType + HorVert + BinnedSpeed + Purpose + Result + Time + Cause + Co-mover + Distance

To conclude, the evaluation of results through verb classification shows that if spatial expressions occur in motion clauses, verbs and spatial expressions do have a tendency to window the same portion of the path. This is because verbs and spatial expressions tend to express similar information. From all the other factors that the current study has explored, only two variables have important bearings on these main results: the verb semantic variable for animacy, and the frequency of the verb.

The strong association between verb semantics, and preferable clausal patterns of verbs, becomes, nevertheless, particularly evident in the prediction of the clustered groups of verbs in random forests. Whereas the clustering of verbs is based on the clausal patterns of spatial expressions, the resulting verb classes are mainly sensitive to verb semantic factors and not to the spatial factors that contribute to these clausal patterns. This provides further strong evidence for the hypothesis of consistent windowing.

10. GENERAL DISCUSSION

10.1. Introduction

There is no way one can talk more than allowed by the cognitive capacities of human beings. As such, the structure of a language should both reflect the nature of cognitive capacities and mechanisms, and allow effective processing of itself. Based on this general understanding, the current study aims to evaluate the structure of descriptions that refer to one fundamental domain that human cognition needs to account for. This domain is motion. In particular, the study examines whether the hypothesis of consistent windowing holds true for the clausal patterns of motion clauses. The term 'consistent windowing' has its roots in Talmy's (1996; 2000a: 255–309) approach to windowing of attention. Here, windowing as an expression of something is seen to have attention-driven properties. Developing from this, the hypothesis of this thesis is that not only windowing, but consistent windowing of attention occurs. As such, the prediction is that prominent information about motion is described in an enhanced manner via multiple expression. This structure of motion clauses would be in concordance with how attentional mechanisms of human beings work and, as such, would account for a cognitively plausible language description.

More specifically, and by this hypothesis of consistent windowing, I suggest that motion verbs, and other important expressions in a clause, express (i.e., window) the same or similar spatial and manner information. For instance, when information about the destination of motion is important, these meanings are specified both by means of a motion verb and by some other spatial expression in the clause. To test this hypothesis, I have collected corpus data of Estonian actual motion clauses for 95 frequent motion verbs and conducted statistical analyses on this data using both univariate and multivariate methods. The data has been assessed slice by slice by analysing important members of clausal patterns one by one with regard to verb semantic features and the other units of clauses. Finally, and to test whether the results from this approach are actually credible, I have classified all the verbs based on their clausal patterns of spatial information and validated the resulting classes from the viewpoint of the verb semantic and other factors.

10.2. The hypothesis of consistent windowing confirmed

The main outcome of these analyses is that the hypothesis of consistent windowing is confirmed. This is particularly true for spatial, and somewhat less evident for manner information. As for spatial information, the results indicate that the more directional a verb is, the more directional spatial expressions the verb tends to combine with. More specifically, verbs specifying the departure point of motion have a strong preference of combining with expressions referring to the initial portion of the path (i.e., source verbs with Source expressions, as in *lahkus toast* '(s)he left the room'), verbs referring to the medial portion of the path prefer combining with expressions of the medial portion of the path (i.e., a set of manner of motion verbs with Location, and Trajectory, as in *lonkis õues/ mööda teed* '(s)he was strolling outside/along the path'), and verbs entailing the destination information with expressions of the final portion of the path (i.e., goal verbs and a set of manner of motion verbs with Direction, and Goal, as in *suundus/jooksis tuppa* '(s)he headed/ran into the room'). The study also reveals that directional information may be captured not only by the type of verb in terms of specifying the source, goal, or manner of motion (a variable called VerbType in the current study), but also by the specification of whether a verb expresses translational or self-contained motion (i.e., MotionType), horizontal or vertical motion (i.e., HorVert), and motion of different speeds (i.e., VerbSpeed). All these spatial verb semantic factors reflect the basic experience of motion and are shown adhere to typical clausal patterns of motion.

These findings of the expression of spatial information are in line with the studies that have revealed a clausal structure whereby some non-verb expression 'repeats' or 'augments' the meaning of the verb (Rohde 2001; Rakhilina 2004; Stefanowitsch & Rohde 2004; Bohnemeyer & Stolz 2006; Kita 2006; Levinson 2006; Cristobal 2010; Kopecka 2010; Cardini 2012; Slobin et al. 2014). More generally, this strategy can be seen as a case of semantic agreement. However, this agreement is far from being absolute as there is much variation in typical and less typical patterns. This variation in patterns seems to refer to the so-called 'conceptual alternativity' that enables us "to perform the selective windowing process in different patterns for the same event frame" (Talmy 2000a: 306). However, consistent windowing as a semantic agreement is a clear and strong foundation for many typical clausal patterns of motion in Estonian.

As for manner, it was found that when treated as one general category, manner of motion verbs are only somewhat inclined towards combining with manner expressions. This finding was further evaluated by analysing verb types and the presence or absence of verbal particles (or satellites), which have been argued to play important role in the structure of motion clauses (Talmy 1985; 2000b). The current study found that neither manner of motion verbs, nor directional verbs are particularly biased towards directional verbal particles. Thus, for manner as one category, the consistent windowing was only partly confirmed. This finding of manner may suggest that manner information is not the defining feature of motion in that the lexicalisation patterns of motion expressions are insensitive to manner information as proposed by several authors (Talmy 2000b; Slobin 2004; Mani & Pustejovsky 2012). For instance, in Talmy's (1985; 2000b) approach to motion, the component that distinguishes between the two main lexicalisation patterns is the Path, while Manner is treated as a Co-event. According to this understanding, manner information is not prominent in motion clauses, as the spatial settings are the very core of motion.

However, this finding of manner may be given a different interpretation. The fact that consistent windowing is only modestly confirmed with regard to verb type and manner expressions, may be explained by the heterogeneous nature of the category ‘manner’ (see also Mani & Pustejovsky 2012). As there are a number of manner features (Cardini 2008; Kopecka 2010; Slobin et al. 2014), also attested in this study, the heterogeneous nature of manner is clear. According to the consistent windowing hypothesis, however, the same, or at least similar information should be expressed simultaneously by multiple linguistic means in a clause. It may be that the category ‘manner’ is too broad to account for such ‘sameness’. This idea has clear support from the current study through the examination of one semantic subset of manner verbs, and manner expressions, which are easy to distinguish from other verbs and expressions. These are manner verbs and other expressions specifying the instrument. From this analysis, it appears that instrument verbs are clearly biased towards Instrument expressions (e.g., *sõitis rattaga* ‘(s)he drove the bike’) and this provides strong evidence for the consistent windowing hypothesis. It is, therefore, likely that such connections exist between other semantic types of manner of motion verbs and manner expressions, as has been found also for English (Özçalışkan & Slobin 2003; Slobin et al. 2014) and Polish (Kopecka 2010). A further study with more focus on these possible associations between manner of motion verbs and manner expressions is, therefore, suggested.

The consistent windowing tendency manifests itself also in the expression of the mover type. That is, if a verb expresses animate motion, such as walking or running, the mover in the motion clause is typically also an animate one (e.g., *Tüdruk kõndis* ‘The girl was walking’). If the verb expresses inanimate motion, the mover tends to be also an inanimate one (e.g., *Pall veeres* ‘The ball was rolling’). This finding is anything but surprising and indicates the fact that in some domains, the consistent windowing (or semantic agreement) is abundantly clear. This shows that the consistent windowing is an inherent feature of human language, and such patterns should also be searched for in the domains where such agreement may be much more hidden. For example, it is plausible that aspectual patterns also follow the consistent windowing principle in that perfective aspect associates with more directional verbs and clausal patterns of initial and final windowing, whereas imperfective aspect associates with the expressions of the medial portion of the path and low-directional verbs.

10.3. Attention and the embodied nature of language

As such, these findings of how spatial information is structured in motion clauses may be explained by means of cognitive processes that underlie the production and comprehension of language. This is because people are generally not able to process too many locations simultaneously with equal thoroughness when observing a visual scene. Instead, they focus their attention to prominent areas consistently with their aims and the nature of the visual scene (Kahneman 1973; Yantis 1992; Yantis & Hillstrom 1994; Cowan et al. 2005). Furthermore, it is not surprising to encounter language patterns that reflect such selectional processing (see also Talmy 2000a: 257–258, 304–307). In other words, salient, attention given entities or locations obtain enhanced processing (James 1890; Egeth & Yantis 1997; Kastner & Ungerleider 2000; Buschman & Miller 2007) and are, if deemed necessary to depict, also expressed in an enhanced manner.

This is related to the embodied approach to language. According to the embodiment theories, differences in cognition or experience result in differences in linguistic expression (Johnson 1987; Johnson 1989; Gibbs Jr 2006; Johansson Falck & Gibbs Jr 2013). This embodied ground for language has been shown in a number of studies (Tyler & Evans 2003; Zwaan 2003; Bergen & Chang 2005; Pecher & Zwaan 2005; Fischer & Zwaan 2008). Furthermore, motion clauses have also a clear bodily basis (Loftus & Palmer 1974; Bargh et al. 1996; Madden & Zwaan 2003; Matlock 2004; Kaschak et al. 2005; Richardson & Matlock 2007; Anderson et al. 2008; Meteyard et al. 2008; Anderson et al. 2010; Dudschig et al. 2012b; Meteyard et al. 2012; Speed & Vigliocco 2013; Lindsay et al. 2013).

Whether typical clausal patterns of motion clauses actually follow patterns of attentional phenomena, cannot be proved on the basis of a corpus analysis only. This would require a different type of psychological or psycholinguistic study. It is worth noting, however, that the current findings do correspond to the findings of eye-tracking studies, where attentional patterns evoked by motion clauses are examined (Richardson & Matlock 2007; Lindsay et al. 2013; Speed & Vigliocco 2013).

Moreover, as the values of one of the semantic variables of verb semantic features (i.e., VerbSpeed) are obtained through the experiment, the following tentative conclusions are drawn. That is, the speed ratings of motion verbs (see Sections 6.1.1.5 and 8.1.4) are represented by the variable, VerbSpeed, in the study. These speed ratings clearly distinguish verbs from each other with regard to their speed, and are shown to represent also other semantic features of motion verbs. Furthermore, clausal patterns of verbs are also significantly associated with the speed the verbs entail. This indicates that everyday experience and knowledge about motions in different speeds results in different clausal patterns in that the faster the motion is, the more directional categories a verb combines with. This finding may be because people not only distinguish between different speeds easily, but also react differently to these. In other words, fast motion is typically processed faster than slow motion (Tynan & Sekuler 1982; Burr et al. 1998; Kreegipuu et al. 2006; Kreegipuu & Allik 2007; Hutchinson & Ledgeway 2010). It is not surprising, therefore, that clausal patterns also reflect such processing differences.

However, attention is not what human cognition is solely about. Thus, other cognitive domains, such as working memory, need to be taken into account too when discussing the structure of language. Here, the clauses are only small units of written discourse with the discourse itself is being of the primary importance during communication. In order to follow and understand larger text units, however, one needs to be able to remember what was said earlier. This is where the capacity of working memory becomes important because of its constraints on how many different units of information one is capable of storing while processing a text (Gathercole & Baddeley 1993). As the size of working memory is approximately 3−4 units (Baddeley & Hitch 1974; Cowan et al. 2005), the amount of information given in a clause has to be kept within these limits. This means that additional information can be conveyed by means of constructional clusters. As such, the enhanced structure of language is what could and does serve this task.

10.4. Differences in meaning correspond to differences in clausal patterns

By establishing preferable clausal patterns of motion verbs, the current study also contributes to the well-attested fact that "difference of meaning correlates with difference of distribution" (Harris 1954: 156). There is converging evidence for this phenomenon in linguistics (Harris 1954; 1970; Bolinger 1968; Cruse 1986; Clark 1987; Hanks 1996; Gries & Otani 2010; Kuznetsova 2015), and the current study adds to this body of knowledge. Verbs of different semantics possess different clausal patterns. In particular, this can be seen from the verb classification of the study. This classification is automatically conducted on the basis of clausal patterns of spatial information. As a strong proof for the consistent windowing tendency, the resulted verb classes all differ from each other with respect to verb semantic variables.

The consistent windowing tendency, thus, indicates that different verbs, in terms of their semantic features, have different clausal patterns. This can be seen as a kind of semantic agreement as discussed above, albeit somewhat hidden. Whether such agreement is driven by verb semantics or construction, in general, may be a matter of dispute. For example, one way to interpret this finding is to claim for the centrality of the verb in which its semantics determines the structure of a clause (Levin & Rappaport Hovav 1996). However, this result can also be seen from the perspective of construction grammar whereby clausal patterns are constructions. In this case, it would be meaningless to talk about uni-directional composition of a clause as the choice of the members of the construction may emerge more or less simultaneously (Goldberg 1995; Fried & Östman 2004a). Whether a verb or the motion construction comes first can be seen as a 'chicken and egg' dilemma, which cannot be studied by corpus linguistic methods. What matters most is that motion verbs differ from each other in terms of the clausal patterns they tend to occur in, and that there is a semantic agreement between the verb and the clausal pattern of motion.

10.5. Verbs, constructions, and the multivariate nature of language

Whereas the consistent windowing tendency is evident in motion clauses, the descriptions themselves fall into a great variety of clausal patterns. The semantics of motion verbs and semantics of spatial categories interact in a number of ways. This finding is, of course, not surprising. This is because human language is, after all, highly complex and multivariate.

The clausal patterns of motion verbs, as established in this study, can be seen as the instantiations of the intransitive motion construction. The intransitive motion construction is a construction of an argument structure in which "X MOVES (to) Y" (Goldberg 1995: 3, 160), and can be treated as a family of constructions (see, for example, also Goldberg & Jackendoff 2004). By means of the analysis of conditional inference trees, the current study has revealed a range of patterns that are likely to be suitable candidates for the intransitive motion construction. For example, one of the typical patterns for a motion verb in Estonian would have the form of 'X MOVES from Y along Z to W'. This pattern does not contain Location, but does contain Source (from Y), Trajectory (along Z), and Goal (to W), as in *jooksis metsast teed mööda koju* lit. '(s)he ran from the forest along the road home'. Estonian is comparatively flexible in combining expressions of different spatial categories even though combinations of more than three spatial expressions are infrequent.

As the clausal patterns of motion verbs vary greatly, a general question of 'constructionness' arises. In other words, when is a combination of clausal units strong enough to be considered a construction? According to the initial definition of a construction, the construction can be established if its meaning does not result from the meanings of its components or our knowledge of grammar (Goldberg 1995: 4). The later definition includes the somewhat vague criterion of frequency in that a combination can be treated as a construction if it is sufficiently frequent, regardless of whether its meaning is predictable or not (Goldberg 2006: 5). The current study establishes patterns that are significantly frequent from a statistical perspective. For this purpose, the conditional inference trees proves to be a highly effective statistical tool. The statistically frequent patterns are presumably also patterns to which a status of a construction can be attributed, but this is something that cannot be established in full by corpus linguistic methods. That is, what is statistically significant may not be cognitively significant and vice versa. A pattern that a speaker perceives as a somehow fixed combination may not occur as a statistically frequent combination.

The relationship between the verb and its clausal context is also everything but easy to comprehend. The construction grammar (see, for example, Goldberg 1995; Fried & Östman 2004a) holds that verbs exhibit some 'core' meaning (which is constant across contexts the verb is used). At the same time, argument structures (clausal patterns) also have their specific meaning. In a prototypical case, the meaning of the verb and argument construction overlaps (Goldberg 1997: 386). Much of the current data can be seen as representing such patterns of overlapping meaning in that both the verb and the clausal pattern express actual motion. Whereas all verbs in the data indeed express actual motion (as only such verbs are included in the study), the question of what the construction expresses is not that straightforward.

It is widely held that any linguistic mean that conveys dynamic information can be seen as an instantiation of motion (see, for example, Talmy 2000a, for an approach to fictive motion). Thus, all clausal patterns which entail some dynamic information can be treated as argument structures of motion (e.g., *majja* 'into the house', *üle tee majja* 'over the road into the house'). These structures have a variety of forms and can be seen as a family of motion constructions. Due to the structural properties of Estonian language (rich morphology and comparatively free word order), the list of intransitive motion constructions is presumably much more diverse in Estonian than in a language such as English which lacks rich morphology and has comparatively strict word order.

However, not all clausal patterns of motion verbs convey dynamic information. For example, the clause *Ta jooksis pargis* '(S)he ran in the park' clearly expresses actual motion. Following the notation of construction grammar, the construction itself can be written as 'X MOVES in Y'. The construction would be a true construction of an intransitive motion if the meaning of motion were present also in the case of non-motion verb. However, this does not happen as epitomised by the example: *Ta laulis pargis* '(S)he sang in the park'.

Furthermore, the separation of the verb from the construction is also difficult and may lack cognitive grounding. This is because linguistic units never occur in isolation as is the case with motion verbs that are always used in some linguistic context to describe some situation. This, in turn, means that for a language speaker, motion verbs (or linguistic units in general) automatically associate with the possible usage contexts, both with situational and linguistic ones. Moreover, a variety of factors influence the associations that are evoked by a linguistic unit. This simply means that language is a highly multivariate phenomenon and the exact relationship between a motion verb and its clausal patterns has an extremely intrinsic structure. No linguistic analysis can fully account for this intrinsic structure as we do not have such an access to our minds. Thus, when addressing the meaning of the verb and the meaning of the construction (or the verb and its clausal patterns), this discussion only highlights some of the main and core aspects of language structure.

Although the relationship between the verb and its clausal pattern may be difficult to capture in all its richness, the study, nevertheless, demonstrates that this relationship can be studied using corpus linguistic methods, and the principal mechanisms of consistent windowing can be established. The results of the study also indicate that the meaning of a motion clause is a result of a complex processing. The results also provide justification for the decisions made when annotating verb semantic features. Most importantly, verbs can be attributed some 'core' meanings, such as directionality, motion type, spatial details, manner of motion, speed of motion, and mover animacy.

Thus, the results of the study are in accordance with the tenets of construction grammar in that we can determine the 'core' meaning of a verb (see also Goldberg 1995; 1997; 2010; Fried & Östman 2004a). In the current study, this 'core' meaning was captured by verb semantic variables standing for the spatial type and motion type of the verb, the direction of motion in terms of horizontal and vertical motion, the speed of motion a verb associates with, and also the animacy of motion as expressed by a motion verb. In the study, only the speed of motion is assessed on empirical, whereas all other semantic features are tagged on intuitive grounds. Although all these semantic features should be assessed by means of experimental designs to obtain more reliable results, the results of the study already show strongly that such features of verbs exist and associate with clausal patterns of motion verbs.

Nevertheless, the full meaning of argument structures of motion verbs is not addressed in this thesis. Only the semantic components of these structures are analysed. Future studies are needed to understand how the meaning of an argument structure emerges and to what extent this meaning can, in fact, be separated from the meaning of verbs.

10.6. Complementarity versus consistent windowing

The previous discussion leads to the issue of compositionality and complementarity of language, and motion descriptions in particular. The results of the study clearly indicate the *non*-complementary structure of language. This is contrary to the hidden complementarity in Talmy's (1985; 2000b: 21–146) model of the motion event, and the proposals of the complementarity view (Rappaport Hovav & Levin 2010; Levin & Rappaport Hovav 2013). This approach claims that manner and directionality (i.e., path) cannot be lexicalised simultaneously by a linguistic unit (i.e., the verb). If a verb can express both meanings (e.g., *climb* in English), these are argued to realise exclusively to each other in that only one of them is expressed in a particular clausal context.

This study shows that this claim heavily underestimates language. Manner and direction are not exclusive to each other as have also been shown in a number of studies (Aske 1989; Rohde 2001; Cardini 2008; Cifuentes Férez 2010; Goldberg 2010; Kopecka 2010). Linguistic units can flexibly accommodate a variety of semantic features which allow them to use in a variety of, also flexible contexts. Moreover, redundancy and simultaneous expression of multiple semantic features contribute to the very essence of language. Needless to say, whether some semantic features of a motion verb are evoked or not evoked cannot be evaluated on the basis of corpus data, and would need a psycholinguistic investigation. However, it is highly unrealistic that a human mind is capable of evoking only a particular meaning of a verb in a certain context and it refrains from also evoking closely related meanings.

The issue of complementarity is also closely related with that of compositionality. This study has discussed a variety of variables, all of which can be interpreted as being components of language. It should be stressed, however, that although it is possible to separate language into components, this does not automatically mean that this possibility represents the intrinsic mechanism of language, or that language speakers operate with such components. The same applies to the categories one establishes in order to conduct a statistical analysis, for which discrete units are a prerequisite (see also Divjak & Arppe 2013: 234). Although these categories may be the means to access the structure of language, it should not be forgotten that much of our implicit knowledge simply cannot be accessed by explicitly thinking about language. More elaborate mechanisms than a simple composition are needed to create and understand a language.

The results of consistent windowing, and the highly complex patterns of motion clauses, are clear evidence for the 'no-proof-needed' fact that language is a multivariate phenomenon. This conclusion is, again, in line with constructional approaches (Fillmore 1982; Goldberg 1995). Nevertheless, language speakers are sensitive to different categories in language, and able to distinguish between different formal units of language. This seems to suggest, in line with Langacker's (2010: 438) statement, that language is *partially* compositional.

10.7. Manner and directionality features of motion verbs

The findings of the study suggest that verb meaning is not rigid and can entail both directional and manner features. Which aspects of a verb meaning activate in a particular context, in turn, may depend on the context itself. This, again, provides evidence for the constructional nature of language whereby verb and construction meanings interplay (Goldberg 1995). This finding is contrary to the complementarity view as embedded in Talmy's (1985; 2000b) typology, and as put forward by Levin and Rappaport Hovav (2010; 2013). According to this view, manner and direction cannot be expressed simultaneously by a motion verb. However, whether motion verbs follow this principle is debated in linguistics as motion verbs comprising both directional and manner features are often reported (Aske 1989; Cardini 2008; Cifuentes Férez 2010; Goldberg 2010; Kopecka 2010; Cardini 2012).

This study is in line with these latter proposals for directional manner of motion verbs in that there is the fusion of manner and directional information in motion verbs. It appears that many manner of motion verbs entail strong information about the direction of motion. At the same time, directional verbs (source and goal verbs) also entail manner information as they vary, at least to some degree, on their speed ratings. For example, source verbs tend to express slower motion than goal verbs. This indicates the presence of manner features in directional verbs. Consequently, all directional verbs exhibit some backgrounded knowledge of the manner of motion, and all manner of motion verbs convey simultaneously directional information.

The distinction between manner of motion verbs and directional verbs is, nevertheless, maintained in the current study in line with linguistic tradition.

Given that manner and directional information from a visual scene may be processed in a segregated manner (Wu et al. 2008) and with different attention allocation (Papafragou et al. 2008; Soroli 2012), it seems more than plausible that this distinction of motion verbs has also cognitive grounds. It may, thus, be summarised that all motion verbs entail information about space and manner, while in some, spatial meanings are foregrounded, and in others, manner meanings are foregrounded. From this prospective, all motion verbs express different degrees of manner and path saliency.

However, the current study is not primarily designed to provide the basis on how the saliency of manner and path in the meaning of a verb can be measured. At the same time, if we assume that all verbs entail both manner and directionality meanings, one would like to measure the 'mannerness' and 'directionality' of motion verbs. The study has shown that speed (as a manner feature of motion verbs) can at least to some degree measure the directionality, or to be more precise, 'mannerness' of motion verbs. However, speed information alone is not sufficient to establish the type of a verb in terms of manner and path features. This is because the meaning of motion verbs is very complex. For example, speed information fails to take into account whether the verb expresses primarily translational or self-contained motion, or something in between. Thus, a complex set of features need to be taken into account when determining the directionality and mannerness of motion verbs. However, the study has also shown that because differences in meaning are reflected in differences of clausal patterns, the typical clausal patterns can be used as an indirect tool to measure the salience of these semantic features. This means that the directionality of clausal patterns, itself, needs to be defined and measured at first. Thus, future research is needed to establish the criteria on how the salience of these two semantic features, direction and manner, in motion verbs and in clausal units can, in reality, be measured.

10.8. Motion verbs, spatial categories, and the cline of directionality

Thus, the concept of directionality plays a major role in this study. However, this concept may be understood very differently. Two related concepts may be discussed in relation to directionality: translocation and dynamicity. As for translocation, I follow an assumption that translational motion evokes directional meanings both in the visual world, as well as in the linguistic descriptions. As such, any motion verb that depicts translational motion simultaneously comprises some directional information. This understanding of translational motion is comparable to that of Path (i.e., Trajectory). Even though it stands for the static portion between the two points of motion, it nevertheless evokes directional reading (see also Johnson 1987).

Apart from motion verbs, I also suggest that the idea of directionality applies to other spatial expressions in a similar way. More specifically, I treat the categories representing the initial and final portion of the path (i.e., Source and FromDirection for the initial, and Direction and Goal for the final portion of the path) as directional categories, while those of the medial portion of the path (i.e., Location and Trajectory) as non-directional categories. This is a simplification, of course, as Trajectory, standing for expressions of the route of motion, also comprises dynamic information.

The clausal patterns of motion verbs, as attested in this study, also suggest that the spatial categories differ from each other on the degree of directionality they imply, and the following cline of directionality may be created: Location > Trajectory > Direction > Source > Goal. Location is positioned to the left extreme of this cline as the most static spatial category. The data show that Location is typically expressed alongside the verbs which possess limited information about the direction of motion. For instance, the expressions of Location are frequently used in motion clauses to specify whether the clause expresses translational motion (i.e. highly directional motion) or not. This is particularly true for motion verbs which are ambiguous with respect to translational and self-contained motion (e.g., *hüppama* 'jump'). In addition, the expressions of Location have a tendency to be combined with manner of motion verbs; particularly so if the manner of motion verbs are 'low-directional'.

In contrast, Goal is positioned to the right extreme of this cline. Goal is strongly inclined towards verbs that specify the destination of motion (i.e., goal verbs). Furthermore, the expression of Goal is extremely likely if the goal verb expresses translational and vertical motion. As such, Goal has a strong preference towards most directional motion verbs. Source may be placed between Direction and Goal in terms of directionality. This is because it mostly positions itself between Direction and Goal in its biases towards the verbs of translational and vertical motion, but it is also strongly inclined towards source verbs.

However, and according to the speed ratings of motion verbs, the cline would be as follows: Location > Trajectory > Source > Goal > Direction. That is, verbs of slowest motion tend to co-occur with Location expressions, and verbs of fastest motion tend to co-occur with Direction expressions. Thus, if the speed of motion is understood as a means to measure the degree of directionality, the cline would be slightly different.

Taken together, directionality affects the structure of motion clauses. However, further research on the directionality of motion verbs of different semantic features, and the directionality of spatial categories is needed in order to better understand the concept of directionality and its impact to language. Studies of other methods are also required to evaluate the findings of this study. Most importantly, psycholinguistic and psychological studies should be conducted to determine the directionality of linguistic units and spatial relations as experienced by a language user.

10.9. The heterogeneous category of manner

The study also reveals many aspects of the category, manner. Firstly, manner of motion is a highly heterogeneous category regardless of whether the verb or some non-verb expression depicts manner (see also Slobin 2006; Cardini 2008; Kopecka 2010; Mani & Pustejovsky 2012; Slobin et al. 2014). The semantic diversity of manner features is, thus, inevitable, and may be linked to the fact that the morphosyntactic inventory of manner phrases in Estonian is also rich and heterogeneous. This heterogeneity may be explained by the domain itself (motion can be performed in a variety of ways), and also by the typological type of Estonian. Estonian is a satellite-framed language, but also a language of rich morphology. As a satellite-framed language, a great "lexical diversity of Manner" (Slobin et al. 2014: 727; see also Slobin 1996; 2004; 2006) is what should and does occur. As a language of rich morphology, great morphosyntactic diversity of manner is possible.

Secondly, although there is a semantic diversity of manner, the study establishes, similarly to Slobin et al. (2014), that speed information is a core feature that describes manner of motion verbs. In other words, all other manner features can be reduced to speed information. For example, laborious motion requires slow motion, whereas effortless motion entails fast motion. This study also shows that the speed information of motion, as expressed by a motion verb, implies simultaneously the directionality of motion. That is, the faster the motion of a verb is, the more directional the verb is. For example, the manner of motion verb *tormama* 'rush, dash' is a fast motion verb, but it is a highly directional verb too. This can be seen from the clausal patterns of fast motion verbs. Moreover, all verbs are at least modestly sensitive to speed information.

Finally, it may be asked where the interpretation of manner originates. For example, Slobin et al. (2014: 728) suggest that often manner features "draw upon subjective evaluations", and that such features may actually not be perceivable when observing motion. Indeed, many manner of motion verbs and manner expressions convey information about the inner state of the mover, such as anger, haste, or tiredness. Whether such features could be seen also in motor patterns would call for a future examination. However, research into biological motion (Johansson 1973) does seem to suggest that such features are indeed reflected in motor pattern. For example, it has been shown that a variety of properties of the mover can be inferred exclusively from the motor pattern of a human mover (Troje 2002). Given that human beings are programmed to try to read the minds of other people as the studies of the theory of mind suggest (for review, see Goldman 2012), it is plausible that people at least attempt to recover the inner state of others from their physical appearance, and this also includes motor patterns.

10.10. The importance of Goal in language

The current findings have also important implications for the *goal-over-source* principle as proposed by Ikegami (1987) and Dirven and Verspoor (1998), and proved, for instance, by Lakusta and Landau (2005) and Pajusalu et al. (2013). The current study found that only goal verbs and highly directional manner of motion verbs are Goal-biased. This suggests that the *goal-over-source* principle may apply only to the verbs that have particular Goal specifying meanings. Similar findings have been found also in a large number of studies (Aske 1989; Slobin & Hoiting 1994; Jones 1996; Rohde 2001; Rakhilina 2004; Stefanowitsch & Rohde 2004; Kita 2006; Levinson 2006; Filipović 2007; Nikitina 2009; Cristobal 2010; Kopecka 2010; Cardini 2012; Taremaa 2013).

This is not to say, however, that the principle should be abandoned. On the contrary, when analysing the language as a whole, there seems to be clear evidence for the Goal-bias. As the process of data extraction of the current study and the analysis of verb frequency show, the more frequent a verb is, the more likely it expresses Goal-directed motion. Given that the consistent windowing tendency applies to motion clauses, this frequency finding shows that, in general, there are many more Goal expressions in a language than expressions of the other spatial categories.

This also explains why the Goal-bias has been found in a number of studies. In the vast majority of these studies, no distinctions are made between different types of verbs, while typically verbs of frequent use are included in the experiments or corpus analyses. To summarise, it is highly likely that human beings are predominantly Goal-biased in nature (Lakusta et al. 2007; Lakusta & Landau 2012; Lakusta & Carey 2015) and in language use (Ikegami 1987; Dirven & Verspoor 1998; Lakusta & Landau 2005; Lewandowski 2012; Pajusalu et al. 2013). However, caution must be applied when stating the prevalence of this principle over all usages of language units as different motion verbs clearly behave differently with regard to this bias.

10.11. Grammatical constraints in the expression of motion

Besides analysing Estonian data, the study has also made reference to other languages in which data seem to suggest at least some evidence for the consistent windowing tendency. These include, for example, English (Aske 1989; Slobin & Hoiting 1994; Rohde 2001; Stefanowitsch & Rohde 2004; Cardini 2008; Cristobal 2010), Russian (Rakhilina 2004), and Polish (Kopecka 2010) as satellite-framed languages; and Spanish (Aske 1989; Slobin & Hoiting 1994; Cristobal 2010), French (Jones 1996), Italian (Cardini 2008; 2012), Japanese (Kita 2006), Yélî Dnye (Levinson 2006), and Wan (Nikitina 2009) as verb-framed languages.

However, one question the study has not addressed is the relationship between cognitive factors that structure language and the grammatical inventory of a specific language. That is, there is much research conducted on the typological status of individual languages with regard to lexicalisation patterns (e.g., Slobin 2004; Huang & Tanangkingsing 2005; Chen & Guo 2009). It has also been shown that even languages that are similar in their typological status with respect to lexicalisation patterns, show significant differences in their expression of spatial or manner information (e.g., Berthele 2004; Koptjevskaja-Tamm et al. 2010; Majid et al. 2015). Nevertheless, the interplay between general typological features of languages (e.g., word order, morphological characteristics, intonation patterns), and cognitive capacities that enable language processing and production, has received comparatively little research. For example, it is known that aspectual characteristics of a language are related to the expression and understanding of the spatial information of motion (e.g., the expression of Goal) (Vendler 1957; Anderson et al. 2013; Athanasopoulos & Bylund 2013). Thus, the interaction between cognition and grammar in the expression of motion is an important issue for future research. In other words, it remains open to whether and to what extent such consistent windowing patterns occur in typologically different languages, and how such patterns are influenced by grammatical characteristics of a language.

10.12. Putting language into statistic frames

The inevitable structural complexity of language calls also for addressing another methodological issue. The current study applies empirical methods to analyse clause structure, and represents a feature analysis approach in which effective factors are chosen, and data are tagged with respect to these factors. As a result, there are variables which in statistical analyses can function as either dependent or independent variables. Given this methodology, there are two issues that need to be raised. One concerns the validity of the factors that are chosen, and the other the validity of the selected statistical techniques that are applied over these factors. As for the factors, the current study examines mainly the spatial and manner categories in motion clauses. For these reasons, the data is tagged for mainly spatial and manner variables.

These factors are carefully selected based on the previous findings attested in the literature. The coding schema seems to be valid as these factors allow the hypothesis of consistent windowing to be tested. However, whether language speakers themselves could operate with such factors in producing and processing language (see also Divjak & Arppe 2013: 234) remains to be studied by other and more appropriate methods. However, given that the results are convergent with the findings of cognitive psychology, it could be that not only the results, but also the factors behind the results are psychologically plausible.

Another issue concerns the manual coding of the data. Not only is manual coding prone to errors (although most automatic solutions are also), but in this study, the coding is also mainly based on a single person's intuitions. Such an intuitive annotation of the data is common in linguistics, and cannot be avoided in many cases. Ideally, a collection of intuitions should be used to reach more reliable and stable results than one person's intuition. This ideal state is, however, difficult to reach in many cases and particularly if a semantic analysis of large corpus data has to be conducted. Thus, most variables in this study are coded only by the author. Only the variable, which represents the speed of motion as implied by a motion verb (VerbSpeed), receives its values from an experiment. As the study yields results of significant associations between these intuitively coded variables, it may be concluded that the coding is reliable enough. However, a further investigation of the semantic categories of the study, and particularly of the motion verbs (VerbType, MotionType, HorVert, and VerbAnimacy) should be undertaken to evaluate the coding decisions of the current study, and to analyse the semantics of motion verbs in more detail.

Furthermore, it should be noted that model performances of random forests show good or even excellent results, but they do not reach perfect outcomes. In other words, the included factors explain much, but they cannot fully account for the whole variation of the predicted spatial categories. This means that some effective factors are not covered by the current analyses. This is not surprising because language has a complex nature, and cannot be explained only by a limited set of factors which represent a limited set of verb semantic features, and the main spatial categories.

For example, this study does not take into account author-related factors, such as age, idiolectal preferences, and the purpose of the text, which may influence the findings of this study. Unfortunately, and due to limitations of the used corpora, repeated measures design is used which means that several clauses originate from the same authors. The corpora of Estonian language are comparatively limited and do not allow the extraction of only one clause per author which would avoid repeated measures in the data. Although there are statistical means that can take into account such repeated measures (i.e., mixed effect regression), this technique is inappropriate for the current data due to the high degree of interactions in the data.

In addition to idiolectal variation, some other possibly important factors are not dealt with. For example, the temporal and aspectual properties of motion clauses could have contributed to the results as telicity has often been related to the expression of Goal (Vendler 1957). The conducted analysis of clauses also fails to take into account discourse factors, and it does not address the imaginary distance of the conceptualiser as an observer from the situation. A number of other such factors, which occur in language and would serve closer examination, are, thus, not covered in order to concentrate on the main objective of the study.

As for the statistical techniques which are appropriate for categorical data, several ones are utilised in this study. This 'multitechnical' analysis of the data allows the examination of the data from the different perspectives. It also diminishes the possible limitations of the particular techniques that could bias the results. The utilised techniques include univariate significance testing and analysis of Pearson's residuals, correspondence and cluster analysis, conditional random forests and conditional inference trees. Each technique serves its own narrower aim, with random forests and conditional inference trees proving to be particularly suitable for analysing constructional data.

10.13. The Estonian language and its typological status

Finally, this study contributes to the knowledge of the structural properties of the Estonian language in expressing motion, and to the knowledge of the importance of motion expressions in this language (e.g., Rätsep 1978; Vainik 1995; 2013; Pajusalu 2004; Pajusalu & Orav 2007; Pajusalu & Tragel 2007; Tragel & Veismann 2008; Vainik & Orav 2009; 2012; Veismann 2009; Õim et al. 2009a; 2009b; 2010; Vainik et al. 2010; Seinberg 2011; Pool & Pajusalu 2012; Tragel & Habicht 2012; Õim 2012; Pajusalu et al. 2013; Taremaa 2013; Habicht & Tragel 2014; Nelis & Miljan 2016). Moreover, this study has created a classification of Estonian motion verbs based on their clausal patterns.

As for the typological status of Estonian with respect to the lexicalisation patterns (Talmy 1985; 2000b), inferences about this issue can also be drawn from patterns in the data even though this was not the main topic of the study. Most importantly, the data elicitation and data analysis show that Estonian (as a Finno-Ugric language) is a satellite-framed language as suggested by earlier observations and research (Talmy 2000b: 27, 60; Tragel & Veismann 2008: 516; Seinberg 2011; Pool & Pajusalu 2012).

This is supported by the following findings of the current study. First, Estonian has a rich inventory of manner of motion verbs. Second, manner expressions in Estonian combine both with directional, and manner of motion verbs, and similarly to manner verbs, are semantically very diverse. In other words, Estonian distinguishes between fine-grain features of manner. Finally, the boundary crossing constraint does not occur as, in principle, any motion verb can combine with Source, and Goal expressions. This, however, does not necessarily mean that they do occur in such combinations. As such, Estonian behaves as a satellite-framed language (see also Talmy 1985; 2000b; Aske 1989; Slobin & Hoiting 1994; Slobin 2004; 2006; Slobin et al. 2014).

However, the fact that something is possible does not mean that it actually occurs. Although the inventory of Estonian manner of motion verbs is impressive, this does not mean that they are frequently used. On the contrary, when analysing verbs of different types and their usage frequencies, it appears that high frequency motion verbs are typically directional verbs. Moreover, many goal verbs are used extremely frequently, whereas manner of motion verbs tend not to reach such a high rate of frequency. This is in accord with the data from other languages, including verb-framed languages.

The same general statement of possibility and actuality applies to the boundary crossing constraint. Estonian does allow combinations of manner of motion verbs and telic expressions, which is a typical feature of satellite-framed languages (Aske 1989; Slobin & Hoiting 1994). However, manner of motion verbs tend to combine with boundary crossing expressions only if the manner of motion verbs entail somewhat foregrounded information about directionality. If the manner of motion verbs specify directionality to a lesser extent, then these verbs tend not to occur in such combinations. This finding is in concordance with language data from verb-framed languages (Aske 1989; Slobin & Hoiting 1994; Filipović 2007; Nikitina 2009). Thus, even though the type and the flexibility of Estonian language do allow boundary crossing, the language typically does not make use of such patterns. Instead, Estonian seems to prefer patterns which are comparatively similar to those attested for verb-framed languages.

Finally, due to the structural properties of Estonian language, it can be assumed that, in principle, any verb can co-occur with any expression. That is, no pattern can be excluded beforehand. The analysis presents typical patterns of motion verbs, but it also shows that Estonian can easily accommodate both lexicalisation patterns (i.e., Manner- and Path-conflating verbs; see also Talmy 1985, 2000b). Moreover, it would be difficult to state which of the lexicalisation patterns is more typical for Estonian. This is because the so-called Path-conflating verbs (i.e., directional verbs) are the most frequent verbs in Estonian, and the use of these verbs is substantially more frequent than the use of the vast majority of manner of motion verbs. Furthermore, the analysis shows that directional verbal particles (i.e., satellites) are found to be rather insensitive to verb types. Thus, the expression of Path (inside or outside the verb) cannot be used as a clear criterion to establish the preferable lexicalisation pattern in Estonian. These findings contribute to the knowledge of intralanguage variation with respect to the lexicalisation patterns as attested, for instance, by Filipović (2007).

Moreover, all this raises a question on the criteria that could be applied to establish the typological type of a language with regard to lexicalisation patterns. Based on the current study, the preferable conflation pattern (Path information in verb or in satellite) seems to be an insufficient criterion, because verbal particles (i.e., satellites) do not associate with the semantics (i.e., manner vs. directional features) of the verb clearly. However, the richness of manner expressions in Estonian could be seen as supporting the idea that satellite-framed languages distinguish between fine-grained manner features. However, the fact that directional verbs are more frequently used (i.e., the richness of manner does not reflect in actual language use), weakens the importance of this criterion. Related to this, although Estonian allows boundary crossing constructions, such constructions do not necessarily occur. These findings suggest that language-internal criteria should not be treated as absolute ones. For a more reliable and informative result of classification, a mixture of different criteria (including also psycholinguistic criteria) could be used.

10.14. Summary

Motion clauses in Estonian show clear evidence for the consistent windowing tendency which can be seen as a semantic agreement between motion verbs and other expressions in the clause. Such patterns reflect attentional patterns and indicate the embodied roots of language. They also reflect the well-known fact that semantic differences can be seen in structural ones, and that the meaning of a verb and a construction (including the meanings of other units in the construction) interact in a number of ways as language structure is highly multivariate. The results also suggest that the domain of manner of motion is very diverse and that motion verbs can flexibly accommodate different semantic features. Furthermore, manner and directionality are not exclusive to each other. These results show not only that the patterns of consistent windowing exist, but also that these patterns, otherwise often somewhat hidden, can be easily detected and presented by applying statistical techniques of multivariate data.

11. CONCLUSION

The expression of motion has received enormous attention in linguistics. Consequently, our understanding about how motion is expressed in languages is comparatively rich. This is essential because dynamic descriptions form an important part of any language. Knowing the structure of motion expressions, thus, contributes to the body of knowledge about the very nature of language. Furthermore, the expression of motion is an invaluable tool to investigate the nature of a language on the basis of its cognitive grounding. This is because language does not come into being without a human possessing also many other cognitive capacities besides language ability. The cognitive capacities of a human being, in turn, have evolved to effectively exist in the environment where moving objects, and social relationships, form an essential part of everyday life. Thus, the experience of motion, and the expression of motion must be inherently connected as they are both 'hosted' by a human being. As such, the characteristics of the cognitive processing of visual motion should also be reflected in the structure of the expressions which refer to visual motion. However, this link has received comparatively little attention despite the substantial amount of research into motion clauses in linguistics, and into the processing of motion in cognitive psychology.

In the current study, I set out to examine this link from a linguistic perspective. The objective is to examine the structure of motion clauses following the assumption that our everyday experience of physical motion ultimately has a bearing on the linguistic patterns of motion. More specifically, I hypothesised that patterns of motion clauses reflect typical attentional patterns which are evoked when observing a moving object. To capture the idea that attention and language go hand in hand, I developed and tested '**the consistent windowing hypothesis**'. According to this hypothesis, attention given information is expressed in a way that draws attention to the important aspects of a scene. In other words, important information is enhanced in language patterns. As spatial and manner information are the most important aspects for conceptualising motion, I, thus, expected them to have such a language form of enhancement. I suggested that this enhancement (i.e., consistent windowing) is reached by means of employing clausal patterns where important information is depicted simultaneously by multiple linguistic units of a clause. By means of multiple expression, which can also be treated as a mechanism of semantic agreement or redundancy, the prominent information reflects attentional patterns.

The term 'consistent windowing' is based on Talmy's concept of 'windowing of attention' (1996; 2000a: 255–309). In Talmy's approach to windowing, language is seen as a structure in which elements express (i.e., window) different parts of a scene. As for motion, the initial, medial, and final portion of the path may be windowed or expressed (Talmy 2000a: 265–267). For example, the clause *she ran into the house* windows the final portion of the path (i.e., Goal). The hypothesis of the consistent windowing asserted in this thesis takes this concept one step further, and suggests that not only windowing, but a consistent windowing occurs. In this way, it captures the idea that the same or similar part of the scene is windowed (i.e., expressed) simultaneously by different linguistic means.

In this study, I explicitly tested whether the verb and other expressions in the clause express the same spatial or manner feature of motion in Estonian. I predicted that source verbs have a tendency to combine with Source expressions (e.g., *lahkus majast* '(s)he left (from) the house'), goal verbs with Direction, and Goal expressions (e.g., *suundus majja* '(s)he headed into the house'), and manner of motion verbs with Trajectory, and Location expressions (e.g., *kõndis maja ees* '(s)he walked in front of the house'). To put it differently, the verb and another spatial expression would window the same portion of the path. I also predicted that manner information may show similar patterns of enhancement in that manner of motion verbs would co-occur frequently with manner expressions (e.g., *jooksis kiiresti* '(s)he ran fast'), whereas source and goal verbs would not.

To test this hypothesis of consistent windowing, I conducted an extensive analysis on a large set of manually tagged corpus data. The procedure of the elicitation and analysis of the material had several stages. First, I created a list of motion verbs in Estonian. For this, I extracted semi-automatically all verbs (approximately 7600 verbs in total) from the main monolingual dictionary of Estonian (ÕS 2006). Then, I separated manually motion verbs (N = 506) from all these 7600 verbs. Second, I chose 95 motion verbs that occur frequently in the Balanced Corpus of Estonian. These verbs are verbs that express actual motion. Third, I extracted 100 actual motion clauses with each of the verbs from the written corpora of Estonian. These corpora represent fiction and newspaper texts. As a result, the data consisted of 9500 actual motion clauses. Fourth, I tagged each motion clause for a number of variables. The primary variables are as follows: (i) the verb semantic variables VerbType, MotionType, HorVert, and VerbSpeed; and (ii) the semantic variables of other expressions Source, FromDirection, Location, Trajectory, Direction, Goal, and MannerInstrument.

The verb semantic variables specify the general meaning of a motion verb. **VerbType** refers to whether the verb is a source verb (e.g., *lahkuma* 'leave'), goal verb (e.g., *suunduma* 'head', *keerama* 'turn'), manner of motion verb (e.g., *kõndima* 'walk'), or the neutral verb (i.e., *liikuma* 'move'). **MotionType** specifies the type of motion a verb depicts; namely, whether it describes translational (e.g., *lahkuma* 'leave', *suunduma* 'head', and *kõndima* 'walk'), self-contained (e.g., *värisema* 'shake, tremble'), or both motions (e.g., *liikuma* 'move', *keerama* 'turn', and *hüppama* 'jump'). **HorVert** stands for whether a verb mainly expresses motion along the horizontal axis (e.g., *lahkuma* 'leave', *suunduma* 'head', *keerama* 'turn', and *kõndima* 'walk') or the vertical axis (e.g., *kukkuma* 'fall', *vajuma* 'sink', and *kerkima* 'rise'), or is directionally ambiguous (e.g., *liikuma* 'move', *hüppama* 'jump', and *värisema* 'shake, tremble'). These variables are categorical, and tagged on intuitive grounds. The fourth verb semantic variable, **VerbSpeed**, represents the speed of motion as expressed by a motion verb. It is numeric, and receives its values from an experiment conducted in collaboration with Kairi Kreegipuu. The aim was to collect speed ratings for motion verbs. The mean standardised speed ratings of this experiment were used as values for the variable VerbSpeed.

The semantic variables of other expressions (Source, FromDirection, Location, Trajectory, Direction, Goal, and MannerInstrument) are binary categorical ones. They stand for the other important expressions in motion clauses and specify whether a particular category is expressed ('yes') or not expressed ('no'). For instance, the 'yes' value of the variable Source was tagged if a clause contained a Source expression, and vice versa with the 'no' value, if it did not. I defined the spatial semantic variables as follows. **Source** refers to the starting point of motion (e.g., *majast* 'from the house'), **FromDirection** to the place from the direction of which motion proceeds (e.g., *maja poolt* 'from the direction of the house'), **Location** to the place where motion occurs (e.g., *linnas* 'in the town'), **Trajectory** to the path followed when moving from one place to another (e.g., *mööda teed* 'along the path'), **Direction** to the place towards which motion proceeds (e.g., *metsa poole* 'towards the forest'), and **Goal** to the destination place of motion (e.g., *metsa* 'into the forest'). Source and FromDirection stand for the initial portion of the path, Location and Trajectory for the medial portion of the path, and Direction and Goal for the final portion of the path. In addition, I tagged the data for manner expressions (i.e., the variable **MannerInstrument**) which depict how motion is carried out (e.g., *kiiresti* 'quickly', *longates* 'limping').

The data was also analysed with respect to the variables of minor importance. These are (i) the morphosyntactic variables that correspond to the semantic variables Source, FromDirection, Location, Trajectory, Direction, Goal, and MannerInstrument; (ii) the variables of the animacy of the mover (VerbAnimacy for verb meaning, and MoverAnimacy for the meaning of the syntactic subject); (iii) the variable for the genre of the text (Genre) and the frequency of the verb (Frequency); and (iv) the variables for the other semantic units in a motion clause (Purpose, Result, Time, Cause, Co-mover, and Distance).

I conducted a number of statistical analyses with these annotated data as an input. The analyses included univariate and multivariate techniques. The univariate technique used for categorical data was a Chi-square test, accomplished through the use of effect size calculations and the examination of Pearson's residuals. To assess the association between the numeric variable VerbSpeed and the categorical spatial variables, I used binary logistic regression analysis. The multivariate techniques consisted of correspondence analysis, conditional random forests (together with the index of concordance), conditional inference trees, and hierarchical agglomerative clustering. Thus, the data was extensively analysed from different angles and through a mixture of statistical techniques.

As a result of this thorough examination, the hypothesis of consistent windowing is confirmed. Particularly, the spatial settings of motion clauses show that verb meaning and the meaning of spatial expressions in a clause tend to window (i.e., express) the same portion of the path. That is, source verbs do have a strong tendency to combine with Source expressions (e.g., *lahkus majast* '(s)he left (from) the house') and goal verbs have a strong tendency to combine with Direction, and Goal expressions (e.g., *suundus maja poole* '(s)he headed towards the house', *sisenes majja* '(s)he entered the house'). Manner of motion verbs combine mainly with Location, and Trajectory expressions (e.g., *hulkus linnas* '(s)he wandered in the city'; *komberdas mööda teed* '(s)he stumbled along the path'), but manner of motion verbs also combine frequently with Direction, and Goal expressions (e.g., *kihutas linna poole* '(s)he raced towards the city'; *prantsatas põrandale* '(s)he fell with a crash to the floor').

These results were obtained by the pairwise analyses of the variable VerbType and the spatial variables. However, the other semantic features of motion verbs also contributed to the clausal patterns of motion clauses. This considered the variables of type (MotionType), direction (HorVert), and speed of motion (VerbSpeed). All these variables specify how directional a described motion is. That is, translational motion is more directional than self-contained motion, vertical motion exhibits a stronger sense of directionality than horizontal motion, and fast motion entails a stronger directionality than slow motion.

The directional properties of each of the verb variables are also reflected in the typical clausal patterns of motion verbs. Namely, the more directional a verb is, the more directional categories it tends to combine with. For instance, a verb of translational, vertical, and high-speed motion (e.g., *kukkuma* 'fall') is extremely likely to combine with directional spatial expressions, such as Source or Goal. A verb of translational, but horizontal and slow motion (e.g., *komberdama* 'stumble, hobble'), conversely, is less likely to combine with Location, and Trajectory expressions. This also explains the behaviour of manner of motion verbs which are not only inclined towards the expressions of the medial portion of the path, as the hypothesis suggested, but also towards the final one. That is, manner of motion verbs that are lowly directional (e.g., *lonkima* 'stroll, saunter') combine with Location, and Trajectory; manner of motion verbs that are highly directional (e.g., *kihutama* 'race, career') combine with Direction, and Goal. With that respect, the variables MotionType, HorVert, and, in particular, VerbSpeed measure the degree of directionality of manner of motion verbs. At the same time, and due to the consistent windowing tendency, the clausal patterns of motion verbs also indicate this degree of directionality of motion verbs.

As for manner information, the pattern of consistent windowing is less evident, but it is present. That is, manner of motion verbs are slightly inclined towards combinations with manner expressions (e.g., *kõndis jala* '(s)he walked on foot'). Directional verbs (i.e., source and goal verbs) combine with manner expressions less frequently than manner of motion verbs. Nevertheless, this association is not strong and may suggest that the windowing of manner is modestly consistent. However, the examination of one subcategory of manner features – instrument – indicates a strong consistent windowing tendency. That is, manner of motion verbs which depict the instrument (e.g., *väntama* 'pedal', *ratsutama* 'gallop') are strongly biased towards combinations with instrument expressions (e.g., *rattaga* 'by bike', *hobusega* 'by horse'). This may suggest that the consistent windowing applies mainly to manner subcategories, and not so clearly to the general and highly heterogeneous category of manner.

In addition to one-to-one correspondences, the analysis shows complex patterns of motion clauses. That is, although verb semantic factors can be used to predict whether a spatial category is expressed or not, the expression of the other spatial categories in the clause has also an influence on it. For example, whereas manner of motion verbs tend to combine with Location expressions, it is typical only if the other spatial categories are not expressed (e.g., *jooksis majas* '(s)he was running in the house'). If Goal is expressed, such combinations of manner of motion verbs and Location expressions are rare. Such patterns provide clear evidence for the multivariate and constructional nature of a language.

Finally, the analysis of other factors shows that only animacy and genre/frequency influence the results. As for animacy, this information can be entailed by verb semantics (hence, variable VerbAnimacy) and by the semantics of a syntactic subject (hence, variable MoverAnimacy). Not surprisingly, the two variables associate strongly. This means that if a verb expresses animate motion (e.g., *kõndima* 'walk'), it tends to be used in clauses that express also animate motion (e.g., *poiss kõndis* 'the boy walked'). If a verb expresses primarily inanimate motion (e.g., *veerema* 'roll'), it tends to be used in clauses that express inanimate, or at least non-agentive motion (e.g., *pall veeres* 'the ball rolled', *poiss veeres* 'the boy rolled'). This semantic agreement is an example of consistent windowing and, thus, provides additional support for the hypothesis. Animacy associates also with clausal patterns of motion in that animate motion tends to be biased towards the expressions of the final portion of the path (i.e., Direction, and Goal, but also Trajectory), and inanimate motion tends to be biased towards those of the medial (Location) or initial portion of the path (i.e., Source).

The genre of the text (i.e., Genre), and frequency of the verb (i.e., Frequency), also affect the expression of spatial categories. However, as the data with high-frequency verbs is taken from fiction corpus and with low-frequency verbs from newspaper corpora, it is difficult to pinpoint which of the factors affect the outcome. The results show that high-frequency verbs (or clauses of fiction) tend to be inclined towards the expressions of the final portion of the path (i.e., Direction and Goal). Low-frequency verbs (clauses of newspapers) tend to be inclined towards the medial portion of the path (i.e., Location and Trajectory). Nevertheless, the examination of Genre, Frequency, and the verb semantic variables with regard to verbs of different clausal patterns shows that Frequency clearly overrides the importance of Genre. That is, Frequency is highly important in predicting verbs of different clausal patterns, and Genre is insignificant.

These results of the consistent windowing tendency contribute to the growing body of knowledge about the structure of motion expressions, and of language in general. Most importantly, these linguistic patterns seem to reflect attentional patterns as attested in the literature of cognitive psychology, while they may also allow effective processing of linguistic patterns themselves.

There are several implications of the results of this study. The most important one is that although it is possible to describe the structure of a language by means of grammatical concepts only, to account for the understanding of specific structures in a language, a comprehension of the cognitive characteristics of a human being is needed. The results suggest that there is an embodied basis of language and that difference in meaning goes together with difference in form. That is, the patterns of consistent windowing do seem to reflect the experiential basis of motion clauses. As attention is limited, and only the most important information is processed in depth, this is reflected in linguistic patterns where also the most important information is expressed in an enhanced manner. Moreover, clear evidence for the embodied underpinnings of motion clauses, and to language, in general, is provided by the fact that speed ratings of motion verbs, as determined by the experiment, strongly associate with clausal patterns of motion verbs.

It should be noted that although the study advocates for a close relationship between attentional and clausal patterns, to provide empirical evidence for this relationship in terms of psychological or psycholinguistic examination is not the aim of the current study. Furthermore, this would not be possible on the basis of corpus data even though the data are supplemented by the results of the experiment of a speed rating task. The structural patterns of motion clauses and those of attention and other cognitive domains, thus, remain to be compared with more appropriate methods in future research.

As for other implications, the results of the study suggest that information about the destination of motion (i.e., Goal) tends to be most frequently expressed. However, this is only a general tendency and does not apply equally to all motion verbs. That is, only goal verbs and highly directional manner of motion verbs tend to be Goal-biased. As these verbs are the most frequent verbs in Estonian, this results in a high number of clausal patterns where the final portion of the path (Direction or Goal) is expressed. Consequently, a large proportion of language is Goal-biased. Nevertheless, many manner of motion verbs are not inclined towards Goal, and are biased towards the medial portion of the path. Moreover, source verbs are inclined towards the expressions of initial portion of the path.

The study also contributes to the knowledge of the constructional and multivariate nature of language. It shows the intrinsic relationship between motion verbs and clausal patterns, and demonstrate the well-known fact that language is a multivariate phenomenon. The statistical tools that are chosen to access this structural diversity allow the analysis of highly complex data. As for the constructional information, the technique of applying analysis through conditional inference trees has proved to be a robust tool for determining typical clausal patterns of motion verbs of different semantics. The clustering technique, on the other hand, allows the classification of verbs on the basis of their clausal patterns. These verb classes then strongly associate with verb semantic features not used to cluster the data. This offers additional proof for a consistent windowing tendency in language.

Finally, directionality and manner are not exclusive to each other. Manner of motion verbs vary greatly with respect to the salience of the directional information in their meaning. For example, a manner of motion verb that expresses vertical or fast motion is clearly very directional (e.g., *prantsatama* 'fall with a crash', *tormama* 'rush, dash'), whereas a manner of motion verb that expresses horizontal and slow motion is modestly directional (e.g., *lonkima* 'stroll, saunter'). These differences in the degree of directionality information in verb semantics are clearly seen in clausal patterns of motion verbs. Simultaneously, directional verbs (i.e., source and goal verbs) also possess manner features as motion is always carried out not only somewhere, but also somehow. It is plausible that such manner associations are also evoked in the case of directional verbs. The speed ratings of motion verbs support this suggestion. Speed is typically taken as a manner feature. The ratings of verbs show that goal verbs express typically faster motion than source verbs.

There are several issues that deserve future research in order to validate the findings of the current study and to expand our knowledge on the mechanisms of expressing motion. First and foremost, much more empirical research is needed to obtain a deeper understanding of the interplay between language and attention. In particular, more research is required to both outline the exact attentional patterns related to motion clauses as well as to establish the criteria of distinguishing between the verbs of different semantic features. Secondly, empirical research is needed to establish more precisely how the 'directionality' and 'mannerness' of motion verbs can be measured. In this study, these two semantic characteristics were mostly assessed intuitively. Based on the results of the study, verb semantic features (i.e., motion type, horizontality/verticality, and, in particular, the speed of motion) can be used to detect the salience of manner and directional features of motion verbs. Furthermore, the semantics of typical clausal patterns can serve this function of measurement. However, it is essential to validate these conclusions through psycholinguistic studies. It is also necessary to determine more fine-grained criteria on which to measure the degree of directionality and mannerness (or the salience of directional or manner information) in the meaning of motion verbs and spatial expressions. Finally, studies should focus on how the combination of constructions (e.g., motion verb and other constructions that contribute to the final output of a motion clause) is attained from a psychological or neurological viewpoint.

Many facets of the expression of motion could not be discussed in this thesis due to the scope of the study. Thus, and in addition to the areas listed above, future studies could usefully explore, for example, (i) the unexplained variation in the data (including counterexamples to the hypothesis) and the factors behind this variation (e.g., aspectuality, language-specific characteristics, discourse effects); (ii) the patterns of motion clauses across manner subcategories (e.g., difficult motion, aimless motion, nonlinear motion); (iii) the morphosyntactic features of clausal patterns with regard to verbs and verb semantic features in motion descriptions (e.g., the use of verbal particles, free adverbs, adpositions, and case-inflected noun phrases alongside verbs of different semantics); (iv) the 'richness' of spatial descriptions in motion clauses; the factors that influence this richness, and the influence of this richness to a conceptualiser; (v) the use of motion verbs in other contexts, and the use of other, low-frequency motion verbs which were not included in the study; (vi) clausal patterns of motion descriptions in other languages; (vii) the impact of language-internal factors (typological characteristics of a language in general; e.g., word order, morphological richness, and intonational patterns) on the possible structure of motion clauses; and (viii) the fine-grained criteria to determine the 'satellite-framedness' and 'verb-framedness' of different languages.

The structure of motion clauses reflects attentional patterns. Motion clauses in Estonian tend to enhance, through linguistic means, such information that would receive extra attention when observing visual motion. Consequently, the typical patterns of motion clauses show consistent windowing in that they routinely map similar information into the meaning of the motion verb and other expressions. Such structures are, presumably, also easy to process within the cognitive capacities of a human being. The findings of the study, thus, contribute to the plausible explanation of language and anchor language into cognition.

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SUMMARY IN ESTONIAN

Tähelepanu ja keel. Korpusuurimus liikumise väljendamisest eesti keeles

Liikumine ning liikumisest arusaamine on vältimatu osa meie igapäevaelust. Seetõttu on meil liikumisest kui sellisest väga põhjalikud teadmised, millest paljud võivad olla teadvustamata. Kuna liikumine moodustab meie elust ja nähtavast maailmast suure osa, on meil sageli vaja ka liikumisest rääkida. On igati ootuspärane, et see, kuidas me liikumist näeme ja mida liikumisest teame, kajastub ka liikumist kirjeldavates keelelistes väljendustes. Inimene on üks tervik ja keelevõime ei ole lahutatav inimese muudest kognitiivsetest võimetest, nagu näiteks tähelepanust, mälust ja tajust. Kuigi keeleteaduses on liikumisväljendeid väga palju uuritud, on uurimustes võrdlemisi vähe vaadeldud keele seost teiste kognitiivsete protsessidega.

Väitekirjas uuringi seda seost keele vaatenurgast. Töö eesmärk on kirjeldada keele struktuuri, lähtudes eeldusest, et inimese igapäevane kogemus ja teadmised liikumise kohta mõjutavad seda, kuidas liikumisest tavaliselt räägitakse. Töö keskmes on tähelepanu mõiste ning arusaam, et tähelepanu on piiratud ning visuaalsest väljast on võimalik korraga põhjalikumalt töödelda ainult valitud informatsiooni. Ka ei ole võimalik mitte kõike nähtavat keeleliselt väljendada, saati siis seda, mis jääb tähelepanu keskmest välja. Niisiis tõukun uurimuses oletusest, et tähelepanumustrid kajastuvad keelemustrites ning tõenäoliselt väljendatakse liikumislausetes pigem just sellist informatsiooni, mida ka füüsilise liikumise jälgimisel töödeldaks eelisjärjekorras.

Selle mõtte esitan **ühtse akendamise hüpoteesina**. Hüpoteesiga pakun, et see, millele tähelepanu mingi liikumise jälgimisel tavaliselt koonduks, on tavaliselt ka väljendatud nii, et liikumiskirjeldus tõmbab tähelepanu samadele olulistele aspektidele. Teisisõnu, tähelepanumustrid kanduvad keelemustritesse ning oluline informatsioon on ka keeleliselt olulisena väljendatud. Ühtlasi aitab see liikumiskirjeldusi mõistestada, luues kujutluse, milline võiks kirjeldatud sündmus välja näha. Liikumise mõistestamiseks on kõige olulisem informatsioon ruumi ning liikumisviisi kohta. Ilma selleta, eriti veel ilma ruumilise informatsioonita, poleks üldse võimalik liikumisest rääkida. Seetõttu eeldan, et kui liikumisest räägitakse, väljendatakse keeles suurema rõhuasetusega just ruumi ja viisi. Olulise informatsiooni rõhutamise mehhanismina pakun välja ühtse akendamise suundumuse, mis tähendab seda, et liikumisväljendi (st klausi) sees väljendab sarnast informatsiooni mitu keeleühikut. Kuigi olulise informatsiooni rõhutamiseks kasutatakse ka muid keelelisi vahendeid (näiteks intonatsiooni), on mitmene väljendamine üks keeleomaseid viise mingile olulisele informatsioonile suurema kaalu andmiseks. Sellist mitmest väljendamist võib käsitleda semantilise ühildumisena.

Töös esitatud ühtse akendamise mõiste juured asuvad Leonard Talmy (1996; 2000a: 255–309) tähelepanu akendamise käsitluses. Talmy käsitluses on keel midagi sellist, mille abil n-ö akendatakse situatsiooni teatud osi. See tähendab, et keeleüksused on justkui aknad, mille kaudu kirjeldatavat situatsiooni nähakse.

Liikumise väljendamisel on Talmy (2000a: 265–267) järgi kolm akent, mis annavad põhilise arusaama liikumisruumist. Nii võib aset leida kas liikumistee algus-, kesk- või lõpuosa akendamine ehk väljendamine. Näiteks lausega *Ta jooksis majja* on väljendatud liikumistee lõpuosa, ent jäetud kirjeldamata liikumistee algus- või keskmine osa. Siinse töö ühtse akendamise hüpotees on samm edasi Talmy käsitlusest. Hüpoteesi järgi ei avaldu keeles mitte üksnes akendamine, vaid ühtne akendamine – liikumissündmuse akendamine toimub nii, et üheaegselt akendatakse mingit osa sündmusest mitme keeleüksuse varal.

Väitekirjas otsin hüpoteesile kinnitust lausemallide kaudu, keskendudes peamiselt verbisemantikale ning ruumi- ja viisiväljendite semantikale. Oletan, et lähtekohta märkivad verbid (ehk lähtekohaverbid, nt *lahkuma*) esinevad eelistatult koos Lähtekoha väljenditega (nt *majast*), sihtkohta märkivad verbid (ehk sihtkohaverbid, nt *suunduma*) koos Suuna (nt *maja poole*) või Sihtkoha väljenditega (nt *majja*), ning liikumisviisi märkivad verbid (ehk viisiverbid, nt *kõndima*) koos Asukoha (nt *majas*) või Trajektoori väljenditega (nt *mööda teed*). Sel moel akendavad nii verb kui ka ruumiväljend liikumistee sama osa, vastavalt kas algus-, lõpu- või keskosa. Liikumisviisi kohta eeldan, et kui liikumisviis on oluline, võidakse ka seda väljendada sarnase mitmese väljendamise malli abil. See tähendab, et viisiverbid (nt *kõndima*) esinevad Liikumisviisi väljenditega (nt *rahulikult*) koos sagedamini kui lähtekoha- ja sihtkohaverbid (st suunaverbid).

Hüpoteesi kinnitamiseks olen viinud läbi laiaulatusliku korpusanalüüsi. Korpusmaterjal pärineb eesti kirjakeele korpustest ning materjali kogumisele eelnes mitu sammu. Kõigepealt moodustasin õigekeelsussõnaraamatu (ÕS 2006) verbide hulgast (verbe on ÕSis ligikaudu 7600) semantiliste valikukriteeriumide põhjal liikumisverbide nimekirja (kokku 506 liikumisverbi). Seejärel analüüsisin verbe Tasakaalus korpuse sagedusloendi alusel ning valisin töösse 95 kõige sagedasemat verbi, millega oli kirjakeele korpustest võimalik leida ka piisaval hulgal füüsilist liikumist kirjeldavaid lauseid. Lõpuks võtsin korpustest (47 sagedasema verbiga Tasakaalus korpuse ilukirjanduse allkorpusest ning 48 vähemsagedase verbiga Koondkorpuse ajakirjanduse allkorpustest) iga verbiga 100 füüsilist liikumist väljendavat lauset. Analüüsis kasutasin liikumisverbi finiitvormi sisaldavaid klause. Niisiis koosneb töö keelematerjal ühtekokku 9500 klausist, millega kirjeldatakse füüsilist liikumist. Andmeanalüüsi jaoks märgendasin iga liikumisklausi käsitsi mitmete tunnuste suhtes. Peamised tunnused jagunevad kaheks: ühed on verbisemantilised tunnused Verbitüüp (*VerbType*), Liikumistüüp (*MotionType*), HorVert (*HorVert*) ja VerbiKiirus (*VerbSpeed*), ning teised on muude keeleüksuste kohta käivad tunnused Lähtekoht (*Source*), Lähtesuund (*FromDirection*), Asukoht (*Location*), Trajektoor (*Trajectory*), Suund (*Direction*), Sihtkoht (*Goal*) ja Liikumisviis (*Manner-Instrument*).

Verbisemantilised tunnused määratlevad liikumisverbide üldist tähendust. Tunnus **Verbitüüp** (*VerbType*) näitab, kas liikumisverb väljendab lähtekohta (nt *lahkuma*), sihtkohta (nt *suunduma*), viisi (nt *kõndima*) või on oma tähenduselt võrdlemisi neutraalne (st *liikuma*). Tunnus **Liikumistüüp** (*MotionType*) näitab, kas verb väljendab asukohavahetusega liikumist (nt *lahkuma, suunduma* ja *kõndima*), liikumist ühe koha peal (nt *värisema*) või võib väljendada mõlemat liiki liikumist (nt *liikuma*, *keerama* ja *hüppama*). Tunnus **HorVert** (*HorVert*) viitab sellele, kas verb väljendab horisontaalset liikumist (nt *lahkuma*, *suunduma*, *keerama* ja *kõndima*), vertikaalset liikumist (nt *kukkuma*, *vajuma* ja *kerkima*) või on kindlat suunda raske välja tuua (nt *liikuma*, *hüppama* ja *värisema*). Tunnus **Verbikiirus** (*VerbSpeed*) näitab, kui kiire või aeglane verbiga väljendatud liikumine hinnanguliselt on (näiteks *lonkima* väljendab aeglast, aga *kihutama* kiiret liikumist). Kolm esimest tunnust – Verbitüüp, Liikumistüüp ja HorVert – on kategoriaalsed (st tunnuste väärtused on sildid ja mitte arvud), ning märgendatud käsitsi. Neljas verbisemantiline tunnus – Verbikiirus – on seevastu arvtunnus ning selle väärtused pärinevad katse tulemustest. Katse viisime läbi koos Kairi Kreegipuuga ning selle eesmärk oli liikumisverbide kiirushinnangute kogumine.

Teised semantilised tunnused määratlevad liikumisväljendite mitteverbiliste üksuste tähendust. Need semantilised tunnused piiritlen järgnevalt: **Lähtekoht** (*Source*) on koht, kus liikumine algab (nt *majast*); **Lähtesuund** (*FromDirection*) on koht, mille suunast liigutakse (nt *maja poolt*); **Asukoht** (*Location*) on koht, kus liikumine toimub (nt *majas*); **Trajektoor** (*Trajectory*) on tee, mida mööda liigutakse (nt *läbi maja*); **Suund** (*Direction*) on koht, mille poole liigutakse (nt *maja poole*); **Sihtkoht** (*Goal*) on koht, kus liikumine lõpeb (nt *majja*). Lähtekoht ja Lähtesuund on ühtlasi kategooriad, mis viitavad liikumistee algusosale, Asukoht ja Trajektoor viitavad liikumistee keskmisele osale ning Suund ja Sihtkoht liikumistee lõpuosale. Lisaks nendele ruumilistele tunnustele märgendasin klausides põhitunnusena ka tunnust **Liikumisviis** (*Manner-Instrument*), mis näitab, kas liikumisklausis esineb mõni liikumisviisi (sh liikumisvahendit) täpsustav väljend (nt *kiiresti*, *hüpeldes*, *rattaga*). Need on binaarsed kategoriaalsed tunnused ja viitavad sellele, kas liikumisklausis vastavat semantilist kategooriat väljendatakse (tunnuse väärtus „jah“) või mitte (tunnuse väärtus „ei“). Kui klausis kirjeldati näiteks liikumise alguspunkti, nagu lauses *Ta väljus majast*, märgendasin tunnuse Lähtekoht väärtuseks „jah“. Kui aga Lähtekoha väljend puudus, nagu lauses *Ta väljus tänavale*, märgendasin väärtuseks „ei“.

Peale põhitunnuste määrasin liikumisklausides ka teisi tunnuseid. Selliseid tunnuseid on nelja liiki: (1) semantiliste tunnuste paralleeltunnused, mis täpsustavad semantiliste üksuste Lähtekoht, Lähtesuund, Asukoht, Trajektoor, Suund, Sihtkoht ja Liikumisviis morfosüntaktilist vormi; (2) elususe tunnused, millest üks näitab verbiga väljendatud liikumise tüüpilist läbiviijat (*VerbAnimacy*; nt *kõndima* väljendab elusolendi liikumist) ja teine klausis väljendatud liikuja elusust (*MoverAnimacy*; nt *poiss* lauses *Poiss kukkus* väljendab samuti elusolendi liikumist); (3) teksti täpsustav tunnus Tekstiliik (*Genre*; ilukirjandus või ajakirjandus) ning verbi üldsageduse tunnus Sagedus (*Frequency*; Tasakaalus korpuse sagedusloendi järgi); ning (4) liikumisklausides esinevate vähemtähtsate semantiliste ühikute tunnused Eesmärk (*Purpose*), Tulemus (*Result*), Aeg (*Time*), Põhjus (*Cause*), Kaasliikuja (*Co-mover*), Vahemaa (*Distance*).

Märgendatud andmestikku analüüsin mitmete erinevate statistiliste meetoditega. Monofaktoriaalsetest meetoditest (st meetoditest, millega saab uurida kahe tunnuse omavahelist seotust) kasutan hii-ruut testi koos Craméri seosekordajaga ning Pearsoni jääkide analüüsiga. Numbrilise tunnuse Verbikiirus (*VerbSpeed*) seotust kategoriaalsete tunnustega mõõdan binaarse logistilise regressiooniga. Multifaktoriaalsetest meetoditest (st meetoditest, millega saab uurida rohkem kui kahe tunnuse omavahelist seotust) kasutan korrespondentsanalüüsi, tingimuslikke juhumetsasid (*conditional random forests*) koos seosekordajaga C (*index of concordance*), tingimuslikke rekursiivseid otsustuspuid (*conditional inference trees*) ning hierarhilist aglomeratiivset klasterdamist.

Analüüs viitab selgelt ühtse akendamise hüpoteesi kehtivusele. Iseäranis selgesti ilmneb ühtse akendamise suundumus ruumilise informatsiooni esitamise mallides. Kui ruumiväljendid klausis esinevad, siis liikumisverb ja klausis esinev ruumiväljend viitavad väga sageli samale liikumistee osale, akendades sarnast osa liikumisruumist. Lähtekohta märkivaid verbe kasutatakse tavaliselt ühes klausis koos Lähtekoha väljenditega (nt *väljus majast*), sihtkohta märkivaid verbe aga koos Suuna või Sihtkoha väljenditega (nt *suundus maja poole*, *sisenes majja*). Viisiverbid esinevad sageli koos Asukoha või Trajektoori väljenditega (nt *hulkus linnas* ja *komberdas mööda teed*), aga ka koos Suuna või Sihtkoha väljenditega (nt *kihutas kodu poole* ja *prantsatas põrandale*).

Ruumi väljendamise kõrval on liikumisklausides väga olulisel kohal ka liikumisviisi väljendamine ning seegi näitab ühtse akendamise suundumust, ehkki esmapilgul mitte nii tugevat kui ruumimallides. Siiski esinevad viisiverbid koos viisiväljenditega (nt *kõndis jala*) sagedamini kui suunaverbid (st lähte- ja sihtkohaverbid). Kuna see seos ei ole siiski tugev, võiks järeldada, et viisi väljendamisel on tegu ühtse akendamisega tagasihoidlikul määral. Samas näitab liikumisviisi ühe alamkategooria uurimine, et ka liikumisviisi väljendamisel avaldub selge ühtse akendamise suundumus. Selleks alamkategooriaks on Liikumisvahend (*Instrument*). Viisiverbid, mis väljendavad liikumisvahendit, esinevad väga sageli koos Liikumisvahendi väljenditega (nt *väntas rattaga*, *ratsutas hobusega* ja *lendas lennukiga*). Materjali lähem vaatlus osutab sellele, et sarnane alamkategooriate ühildumine võiks toimuda ka teiste viisitunnuste puhul (nt kiire liikumise verb võiks seonduda kiire liikumise väljendiga, nagu lauses *Kihutas kiiresti*). Niisiis võiks väita, et ühtse akendamise suundumus rakendub viisikategooriale tervikuna ainult üldjoontes, ning pigem avaldub see viisi alamkategooriates.

Kuigi analüüs toob välja põhilised suundumused liikumisverbide lausemallides, tuleb välja ka keelematerjali suur variatiivsus ning komplekssus. Ruumiväljendite esinemist mõjutavad lisaks tunnusele Verbitüüp ka ülejäänud kolm verbisemantilist tunnust. Nende kolme tunnuse ühisjoonena võib välja tuua, et kõik nad täpsustavad verbi suunalisust. Näiteks asukohavahetusega liikumine on suunalisem kui ühe koha peal liikumine (tunnus Liikumistüüp; vrd *jooksma* ja *värisema*), vertikaalne liikumine suunalisem kui horisontaalne (tunnus HorVert; vrd *prantsatama* ja *jalutama*) ja kiire liikumine suunalisem kui aeglane (tunnus Verbikiirus; vrd *kihutama* ja *lonkima*).

Keelematerjalist paistab selgesti, et mida suunalisem on liikumisverb, seda suunalisemate kategooriatega see tavaliselt koos esineb. Näiteks on väga tavaline, et verb, mis väljendab asukohavahetusega vertikaalset ja kiiret liikumist (nt *kukkuma*), kombineerub kergesti Lähtekoha või Sihtkoha väljendiga (nt *kukkus põrandale*). Samas verb, mis väljendab küll asukohavahetust, ent horisontaalset ja aeglast liikumist (nt *komberdama*), kombineerub pigem Asukoha või Trajektoori väljendiga (nt *komberdas mööda teed*).

Selline suundumus selgitab ka viisiverbide tüüpilisi lausemalle ja seda, et nii liikumistee keskmise kui ka lõpuosa kirjeldamine on viisiverbidega klausides tavaline. Vähesel määral suunalised viisiverbid (nt *komberdama* ja *lonkima*) esinevad pigem koos väljenditega, mis viitavad liikumistee keskmisele osale ehk Asukohale või Trajektoorile. Tugevasti suunalised viisiverbid (nt *prantsatama* ja *kihutama*) esinevad aga pigem koos väljenditega, mis viitavad liikumistee lõpuosale ehk Suunale või Sihtkohale. See omakorda tähendab, et verbisemantilised tunnused Liikumistüüp, HorVert, eriti aga Verbikiirus on tunnused, mille abil saab määrata viisiverbide suunalisust.

Lisaks ühtse akendamise suundumustele toob analüüs välja ka lausemallide komplekssuse. Selles ei ole muidugi midagi üllatuslikku, nagu nähtub ka Eesti keeleteaduses teedrajavast Huno Rätsepa (1978) eesti keele lihtlausete analüüsist. Statistiliste meetoditega keele uurimine lubab aga keele komplekssust uurida ja esitada veelgi põhjalikumalt ning täpsemalt. Näiteks võib tuua, et kuigi viisiverbid esinevad sageli koos Asukoha väljenditega, on see tõenäoline pigem siis, kui teised viis ruumilist kategooriat samas klausis ei esine, nagu lauses *Ta jooksis majas*. Kui aga Sihtkoht oleks samuti märgitud, siis oleks Asukoha väljendamine väga vähetõenäoline, kuigi eesti keeles võimalik (nt *Ta jooksis majas kööki*). Sellised mallid illustreerivad ilmekalt keele komplekssust ja konstruktsioonilisust.

Kuna lausemallid on väga komplekssed, analüüsin ka mõningate teiste, vähemtähtsate tunnuste mõju tulemustele. Analüüs näitab, et seda, kas ruumikategooria avaldub või mitte, mõjutavad ainult kirjeldatud liikuja elusus ja klausi tekstiliik ning verbi üldine esinemissagedus. Elusust esindavad kaks tunnust: verbisemantiline VerbElusus (*VerbAnimacy*) ning klausisemantiline LiikujaElusus (*MoverAnimacy*), mis on omavahel väga tugevasti seotud. Kui verb väljendab pigem elusolendi liikumist (nt *kõndima*), väljendatakse ka liikumisklausis liikujana enamasti elusolendit (nt *poiss kõndis*). Kui aga verb väljendab pigem asja liikumist (nt *veerema*), väljendatakse ka klausis pigem elutut liikujat (nt *pall veeres*). Selline semantiline ühildumine on eesti keeles väga loomulik, ent tõestab ka ühtset akendamist. Elusus mõjutab mõningal määral ka liikumisverbide lausemalle. Elusa liikuja korral on palju tavalisem liikumistee lõpuosa (st Suuna ja Sihtkoha, aga ka Trajektoori) väljendamine, samas kui elutu liikuja korral on tavaline kas Asukoha või Lähtekoha kirjeldamine.

Ka selgub, et tekstiliik ja sagedus mõjutavad ruumikategooriate väljendamist. Need kaks tunnust siinses töös kattuvad, kuna sagedaste verbidega klausid pärinevad ilukirjanduskorpusest, vähemsagedaste verbidega klausid aga ajakirjanduskorpustest. Seetõttu on raske hinnata, kumb tunnustest lausemallides olulisem on ja tulemusi mõjutab. Üldiste suundumustena võib välja tuua, et sagedased verbid (või siis ilukirjandustekstid) on kaldu pigem liikumistee lõpuosa kirjelduste ehk Suuna ja Sihtkoha poole, vähemsagedased verbid (või siis ajakirjandustekstid) aga pigem liikumistee keskmise osa ehk Asukoha ja Trajektoori poole. Verbisemantiliste tunnuste, tekstiliigi tunnuse ja sageduse tunnuse ühisanalüüs näitab siiski, et eri lausemustritega verbide ennustamisel on sagedus väga oluline, tekstiliik aga tähtsusetu.

Ühtset akendamist ning liikumisklauside ülesehituslikke eripärasid näitavad tulemused on oluline lisandus senistele teadmistele liikumise väljendamise kohta nii üleüldiselt kui ka eesti keeles kitsamalt. Need tulemused toovad esile mõningaid olulisi keele toimimise aspekte. Siinse töö mõttes on kõige olulisem, et keelemustrid näivad tõepoolest peegeldavat tähelepanumustreid, nagu on leitud kognitiivse psühholoogia uurimustes. Seda, millele tähelepanu koonduks liikumise jälgimisel, ka väljendatakse ulatuslikumalt. Samas lubavad lausemallid, milles sama informatsiooni on mitmekordselt väljendatud, ka tõenäoliselt keele enda efektiivset kognitiivset töötlemist.

Tööl on ka mitmeid teisi järelmeid. Kuigi keelt võib kirjeldada üksnes vormist lähtudes (näiteks morfoloogiliste kategooriate kaudu), on keelestruktuuri mõistmiseks siiski vajalik arvesse võtta inimest kui kognitiivset tervikut. See, kuidas liikumist tajutakse ja kognitiivselt töödeldakse, on aluseks sellele, kuidas liikumist keeleliselt saab väljendada. Kuna tähelepanu on piiratud ning ainult kõige olulisemat töödeldakse põhjalikult, ei ole üllatus, et ka liikumist väljendavad klausid esitavad informatsiooni piiratult. See-eest väljendatakse olulist ja efektiivset mõistestamist võimaldavat informatsiooni eriliselt rõhutatult. See näitab, et keelel on kehastumuslik (*embodied*) taust, millele lisab kinnitust ka töös ilmnenud tõsiasi, et katseliselt kogutud liikumisverbide kiirushinnangud on oluliselt ja tugevasti seotud ruumikategooriate väljendamisega klausides. Tähelepanu ja lausemallide seose rõhutamise kõrval tuleks siiski märkida, et sellise seose lõplik tõestamine ei olnud ega saanudki olla siinse töö eesmärk. Erinevate kognitiivsete võimete seotuse ja täpse seotusviisi näitamiseks ning tõestamiseks ei piisa üksnes korpusuurimusest, kuigi põhjalik statistiline analüüs lubab selliste seoste kohta nii mõndagi oletada. Niisiis võiks siinse töö tulemused olla aluseks edaspidistele eksperimentaalse psühholoogia ja psühholingvistilistika meetoditega läbiviidud uurimustele.

Töö tulemuste keeleteaduslikest järelmitest võiks välja tuua – sarnaselt mitmete eelnevate uurimustega –, et kõige sagedamini väljendatakse keeles Sihtkohta, teisi ruumikategooriaid väljendatakse aga harvem. Samas ei näita üldine sagedus kindlasti seda, et Sihtkohta väljendataks kõige sagedamini kõikide verbide korral. Sihtkoha väljendamine on tavaline ainult teatud tingimustel, peamiselt siis, kui verb väljendab sihtkohta, või kui viisiverb kätkeb tugevat suunalisuse tähendust. Sellised verbid on eesti keeles kõige sagedasemad liikumisverbid, mis toob kaasa ka üldise suure sageduse Sihtkoha mainimistes. See omakorda osutab sellele, et keel tervikuna on oluliselt kaldu Sihtkoha väljendamise poole ehk teisisõnu – kuhugi liikumisest räägitakse oluliselt sagedamini kui kuskilt või kuskil liikumisest. Ei tohi aga jätta tähelepanuta tõsiasja, et suur osa viisiverbidest, rääkimata lähtekohta märkivatest verbidest, ei esine tavaliselt koos Sihtkoha väljenditega.

Keelematerjali analüüsist selgub, et keeleüksused on semantilises mõttes väga paindlikud ning et iseäranis Liikumisviis on ülimalt heterogeenne kategooria. Töö oluline järeldus on, et vastupidiselt sageli väidetule ei ole liikumisviis ja suunalisus verbitähenduses teineteist välistavad tunnused, sest füüsiline liikumine toimub alati ruumis ja mingil moel. Viisiverbe on väga erinevaid ja nad väljendavad ka suunalisust erineval määral. Näiteks vertikaalset ja kiiret liikumist väljendav viisiverb on oma tähenduselt selgesti suunaline (nt *prantsatama*), samas kui horisontaalset ja aeglast liikumist väljendav viisiverb on vähesel, kuid asukohavahetust kirjeldades siiski mõningal määral suunaline (nt *lonkima*). Sellised erinevused suunalisuse määras kajastuvad selgesti ka viisiverbide lausemallides. Samas väljendavad ka suunaverbid (lähte- ja sihtkohaverbid) vähemalt mingil määral liikumisviisi, kuna tõenäoliselt tekitavad need verbid mingi aimduse, kuidas nende verbidega väljendatud liikumine aset võiks leida. Seda näib kinnitavat verbide katseliselt kogutud kiirushinnangud (kiirust peetakse tavaliselt liikumisviisi täpsustavaks tunnuseks), mis ka suunaverbide, eriti lähtekohaverbide korral mõneti varieerub. Samuti on sihtkohaverbide kiirushinnangud suuremad kui lähtekohaverbidel, mis näitab seda, et kuhugi poole liikumist peetakse kiiremaks kui kusagilt ära liikumist.

Töö näitab ka hästi keele komplekssust ja konstruktsioonilisust. Ühe tunnuse seletamiseks on vaja arvesse võtta väga palju teisi tunnuseid, mis omakorda võivad omavahel väga keerukal ja mitmel moel seotud olla. Et sellele ligi pääseda, on statistilised meetodid pea möödapääsmatud ning meetodite kombineerimine annab olulist informatsiooni keele struktuuri kohta. Siinses töös kasutusel olnud meetodid on igaüks lubanud seda komplekssust analüüsida mõneti isemoodi, andes andmestiku struktuurist hea üleavaate. Konstruktsiooniliste mallide uurimiseks osutusid eriti headeks vahenditeks tingimuslike juhumetsade (*conditional random forests*) ja tingimuslike otsustuspuude (*conditional inference trees*) meetodid. Verbide lausemallipõhiseks klassifitseerimiseks oli hea vahend hierarhiline aglomeratiivne klasterdamistehnika. Tasub mainida, et klasterdamise teel saadud verbiklasside aluseks olid üksnes ruumikategooriad, saadud klassid aga eristusid oluliselt verbisemantiliste tunnuste poolest. See näitab hüpoteesi kehtivust, ent teise nurga alt.

Kokkuvõtvalt näitab väitekiri, et liikumist väljendavate klauside ülesehitus peegeldab tähelepanumalle. Kasutades mitme sarnase sisuga väljendusvahendit, rõhutatakse eesti keele liikumisklausides informatsiooni, millele koonduks tähelepanu füüsilise liikumise vaatlemisel. Väljendades klausi sees üheaegselt sarnast informatsiooni nii verbi kui ka teiste keeleüksustega, avaldub selge ühtse akendamise suundumus. Selliseid keelemalle on ilmselt lihtne nii tähelepanu kui ka töömälu ja muude kogniivsete võimete piiratuse juures töödelda. Töö tulemused rõhutavad keele kognitiivset alust ning panustavad kognitiivselt realistlikku keelekirjeldusse.

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