JYU DISSERTATIONS 78

Anna Puupponen

Understanding Nonmanuality

A Study on the Actions of the Head and Body in Finnish Sign Language

UNIVERSITY OF JYVÄSKYLÄ
FACULTY OF HUMANITIES AND SOCIAL SCIENCES

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Upon this first, and in one sense this sole, rule of reason, that in order to learn you must desire to learn, and in so desiring not be satisfied with what you already incline to think, there follows one corollary which itself deserves to be inscribed upon every wall of the city of philosophy: Do not block the way of inquiry.

— Charles S. Peirce

The body is not a thing, it is a situation: it is our grasp on the world and a sketch of our projects.

— Simone de Beauvoir

When a body moves, it's the most revealing thing. Dance for me a minute, and I'll tell you who you are.

— Mikhail Baryshnikov

ABSTRACT

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Understanding nonmanuality – A study on the actions of the head and body in Finnish Sign Language
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This dissertation, consisting of four articles and this Overview, reports a study on nonmanuality, that is, the actions of the face, head and body, in Finnish Sign Language (FinSL). More specifically, the study focuses on a relatively understudied area of nonmanuality: the actions of the signer's head and body. The study is theoretically rooted in usage-based linguistics, sign language linguistics, gesture studies and semiotics, and the analysis is made and the conclusions are drawn on the basis of corpus narratives and dialogues as well as synchronized Motion Capture and digital video recordings of FinSL. The study investigates the forms and functions of the actions of the head and body, the relationship between the actions of these two body parts, and the connection between a particular type of head movement, a head nod, and the actions of the signer's hands in FinSL. The study also presents a theoretical view of the signals from the signer's head and body according to Peircean and post-Peircean semiotics, and discusses the role of nonmanuality in sign languages.

The results of the study show that (i) forms and functions of the actions of the head and body form prototypes rather than discrete classes, and that these actions rarely show conventional pairing of one form to one function; (ii) the head and the torso cannot be seen as one articulator, and the co-occurring signals from these two body parts come together into combinations that differ in their degree of complexity both formally and functionally; (iii) systematicity can be found in the co-occurrence of head nods and manual syntactic units in FinSL; (iv) head and body movements involve different proportions of iconicity, indexicality and symbolicity, of which indexicality is generally the most prominent feature; (v) in signed utterances, nonmanual signals are one part of a semiotically complex but communicationally holistic whole; (vi) nevertheless, there are differences in how complementary co-occurring signals are, and in what the central semiotic features of signals from different parts of the signer's body are; and finally, (vii) that these semiotic centralities can be partly traced back to the physical and anatomical characteristics of different parts of the signer's body, and that nonmanual signals demonstrate how signification, language and cognition are intrinsically connected to how humans navigate in their physical and social surroundings with their bodies.

Keywords: sign language, nonmanuality, head movement, body movement, semiotics, iconicity, indexicality, symbolicity

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TIIVISTELMÄ

Puupponen, Anna
Ei-manuaalisuutta ymmärtämässä – tutkimus päällä ja keholla tuotetuista elementeistä suomalaisessa viittomakielessä
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Tämä väitöskirja koostuu neljästä artikkelista ja tästä yhteenveto-osasta, ja se esittelee tutkimuksen ei-manuaalisuudesta eli kasvoilla, päällä ja keholla tuotetuista elementeistä suomalaisessa viittomakielessä. Tarkalleen ottaen tutkimus keskittyy verrattaen vähän tutkittuun osaan ei-manuaalisuudesta: viittojien päällään ja kehollaan tuottamiin signaaleihin. Tutkimuksen teoreettinen viitekehys yhdistelee käyttöpohjaista teoriaa, viittomakielilingvistiikkaa, eletutkimusta ja semiotiikkaa, ja tutkimuksen analyysi ja johtopäätökset on tehty viittomakielisten korpusmateriaalien sekä liikekaappausaineiston pohjalta. Tutkimuksessa tarkastellaan päällä ja keholla tuotettujen elementtien muotoja ja funktioita, päällä ja keholla tuotettujen elementtien välistä suhdetta, sekä päällä tuotettujen signaalien suhdetta käsien toimintaan suomalaisessa viittomakielessä. Lisäksi tutkimus esittelee teoreettisen näkemyksen päällä ja keholla tuotettujen signaalien semioottisista piirteistä sekä ei-manuaalisuuden roolista viittomakielissä.

Tutkimuksen tulokset osoittavat, että (i) päällä ja keholla tuotettujen elementtien muodot ja funktiot muodostavat prototyyppejä pikemminkin kuin tarkkarajaisia kategorioita, ja että tietty muoto harvoin yhdistyy vain tiettyyn funktioon konventionaalisesti; (ii) päätä ja ylävartaloa ei voida tarkastella yhtenä artikulaattorina, vaan samanaikaisesti päällä ja keholla tuotetut signaalit muodostavat eriasteisesti kompleksisia yhdistelmiä sekä muotojensa että funktioidensa puolesta; (iii) pään nyökkäysliikkeet sijoittuvat ajallisesti käsillä tuotettuihin syntaktisiin jaksoihin nähden verrattaen systemaattisesti; (iv) pään ja kehon liikkeisiin liittyy erilaisissa mittasuhteissa ikonisuutta, indeksisyyttä ja symbolisuutta, joista indeksisyys on yleisesti ottaen näkyvin semioottinen strategia; (v) viitotuissa ilmauksissa eri kehon osilla tuotetut signaalit muodostavat semioottisesti kompleksisia, mutta viestinnällisesti yhtenäisiä kokonaisuuksia; (vi) huolimatta kyseisestä yhtenäisyydestä eri signaalityyppien välillä on eroja siinä miten riippuvaisia ne ovat muista signaaleista, minkä lisäksi eroja on löydettävissä myös eri kehonosien semioottisista painopisteistä; sekä (vii) nämä semioottiset painopisteet ovat osittain palautettavissa ihmiskehon eri osien fyysisiin ja anatomisiin piirteisiin, ja ei-manuaaliset signaalit osoittavat miten kaikenlainen merkkitoiminta, kieli ja kognitio ovat sidoksissa siihen, miten ihmiset navigoivat fyysisssä ja sosiaalisissa ympäristöissään kehoillaan.

Asiasanat: viittomakieli, ei-manuaalisuus, pään liike, kehon liike, semiotiikka, ikonisuus, indeksisyys, symbolisuus

PREFACE

This dissertation has not come about in isolation, and many parties have been involved in the process. First of all, none of this work would have been possible without the signers whose language use forms the data used in this study. A warm thank you to all of you! Thank you also to the people who introduced me to the world of sign languages during my very first years of study, for example, at the Finnish Folk High School for the Deaf in Helsinki, and at the University of Jyväskylä. I also want to thank the students and friends that I have had the pleasure of getting to know during my undergraduate studies, with special thanks to the Viito! student association.

There are several people to whom I want to give special thanks for their participation in the PhD process. First and foremost, I wish to thank my supervisors. Professor Tommi Jantunen, you have been a guide, a paragon, and a mentor. Thank you for increasing the fledgling interest of an undergraduate student in sign language linguistics through your teaching, as well as for including my Master's thesis in your then ongoing work with sign language data. Thank you for encouraging me to continue this process towards a PhD project, and for all the help, support and dedicated guidance you have given me through the years. Your visionary thinking and genuine excitement at doing research are inspiring, and your contribution to my work has been indispensable. Without you, this dissertation would never have been written. I also want to express my very warm thanks to professor emerita Ritva Takkinen, the second supervisor of my work. Thank you for all the discussions we had about the field that I was that I was just familiarizing myself with, and for the generosity and warmth with which you made me feel at home and a member of the community at the Sign Language Centre at the University of Jyväskylä.

Regarding this community, I would like to say how genuinely privileged I feel to be a member of this group of talented people. Thank you Ritva and Tommi, as well as Tuija Wainio, Danny De Weerdt, Juhana Salonen, Antti Kronqvist, Laura Kanto, Ulla-Maija Haapanen, Minttu Laine, Virpi Sipilä and Hannele Kuusela-Häkkinen for all your encouraging words and smiles, and thank you also to my former colleagues Elina Tapio and Outi Pippuri for your friendship and support. I've been able to see the work you all do every day – teaching, studying, interpreting, coordinating and developing – to provide a programme devoted to sign languages here in Finland at the highest university levels. I hope that, every now and then, you have time to stand back and acknowledge to yourselves just how important your work is. Just in case you don't, I am using this opportunity to do it.

I would like to thank especially Tuija Wainio and Danny De Weerdt for their support. Tuija, thank you for the countless discussions about language, love and life. Thank you also for the interest you have shown in my work, and for all the advice, wisdom and feedback – both professional and personal – you have given me over the years. Thank you, Danny, especially for the peer support in the ups and downs of learning how to do research, and for the

positive energy, honesty and joy you bring with you wherever you go. Your open mind and your curiosity about the world are infectious, and the many discussions we have had are very important to me. Thank you also to the doctoral researchers working with Finnish Sign Language here in Jyväskylä: in addition to Danny and Minttu, thank you Sanna Nordlund, Nina Sivunen, Outi Ahonen and Jarkko Keränen. It is a delight to see how our group has expanded during the last few years, and I can't wait to see the interesting new viewpoints and insights your future work will give us with regard to Finnish Sign Language and the sign language communities in Finland.

Special thanks are also due to the co-writers of the first and second original papers included in this dissertation, Tuija, Tommi, Birgitta Burger, and Johanna Mesch, as well as to Eleanor Underwood for checking the entire contents of this dissertation and its articles for their English. I have learned a lot during the process, and it has truly been a pleasure working with all of you. Thank you also to Maija Lepola for checking the Finnish abstract and summary of this dissertation for their language. In addition, my thanks to Leena Savolainen from the Finnish Association of the Deaf for our collaboration over the past years, professor Mika Lähteenmäki for his comments on the fourth and final original paper of the dissertation, as well as professor Trevor Johnston for the preliminary evaluation of this dissertation. A big thank you also to reader in linguistics Adam Schembri, Laura Kanto, PhD, and professor Jarmo Jantunen for their work as members of the assessment board evaluating the dissertation. I want to say a special thank you to Adam Schembri for agreeing to serve both as the preliminary examiner of the dissertation and as the opponent in the public examination of the dissertation.

I would like to use this opportunity to thank also the junior researchers in the Department of Language and Communication Studies with whom I have shared a work space as well as many thoughts and feelings regarding the process of doing a PhD. I would like to thank especially Sirkku Lesonen, Maiju Strömmer, Aija Virtanen, Katharina Ruuska, Hilkka Paldanius, Zahra Edalati Kian, Saeed Karimi-Aghdam, and Jari Parkkinen for all your peer support. Sirkku and Maiju, thank you for listening during those moments when work and life have seemed a bit bleaker than they actually are. Special thanks also to the *Langnet* network for doctoral programmes in language studies, which has offered me many learning experiences in its seminars, workshops, and summer schools, as well as important contacts with junior researchers working in language studies in other Finnish universities.

The study and its publication in national and international events have been partly conducted with the support of research grants, for which I wish to thank the Emil Aaltonen foundation and the Faculty of Humanities (currently the Faculty of Humanities and Social Sciences) at the University of Jyväskylä. In addition, I gratefully acknowledge the financial support given by the Academy of Finland and the University of Jyväskylä for projects *3BatS*, *ProGram* and the *Corpus project of Finland's sign languages*, as the study has used data collected and/or processed in these projects. A warm thank you also to the *Local Culture*

Hostel & Cafe in the old rectory building of the University of Jyväskylä: this lovely venue with its warm and friendly staff has been a perfect environment in which to write, read and think during the final stages of producing my PhD.

My most affectionate thanks also to my dear friends and family for all their encouragement and support during the past years. My parents Pasi and Marjaliisa, as well as Maiju, Aimo, Julle and Jarkko, thank you for being there, I love you all. And Tapio, it's not easy to find words. Thank you for making my life beautiful. Your patience, companionship, help and encouragement have been crucial for getting this process to where it is now. Thank you for everything.

Jyväskylä, on the Day of Mikael Agricola and Finnish Language, April 9th 2019
Anna Puupponen

LIST OF ORIGINAL PUBLICATIONS

The dissertation consists of this Overview and the following publications referred to as Articles I–V in the text:

I Puupponen, A., Wainio, T., Burger, B. & Jantunen, T. 2015. Head Movements in Finnish Sign Language on the Basis of Motion Capture Data: A Study of the Form and Function of Nods, Nodding, Head Thrusts, and Head Pulls. Sign Language & Linguistics 18(1), 41–89.

II Puupponen, A., Jantunen, T. & Mesch, J. 2016. The Alignment of Head Nods with Syntactic Units in Finnish Sign Language and Swedish Sign Language. In J. Barnes, A. Brugos, S. Shattuck-Hufnagel & N. Veilleux (eds.), Proceedings of Speech Prosody 2016, 168–72. Baixas, France: International Speech Communication Association.

III Puupponen, A. 2018. The relationship between the movements and positions of the head and the torso in Finnish Sign Language. Sign Language Studies 18(2), 175–214.

IV Puupponen, Anna. 2019. Towards understanding nonmanuality: a semiotic treatment of signers' head movements. Glossa: a journal of general linguistics 4(1): 39, 1–39

FIGURES

TABLES

CONTENTS

1 INTRODUCTION

1.1 Starting points of the study

When one begins to get to know sign languages, the varying cultural, social and embodied traditions of deaf people, sign language literature and arts, and so on, it very quickly becomes evident that signing is not something that is done only with the hands. The signer's whole body – hands, face, head, torso etc. – are involved in expressing and negotiating meaning. Being human, and engaging in different types of discourse in everyday life, one could be expected to find this rather obvious. People – regardless of whether they are deaf or hearing – converse with their whole bodies. Speakers' "body language" and "nonverbal communication" are subjects that come up in many social contexts, whether in guidelines on how to talk convincingly, a crime story about a detective reading people's unintended body signals while solving cases, or a behind-the-scenes extra about the production of an animation in which the animators work hard trying to bring their animated characters to life through, for example, thorough investigation of how we humans move and act with our bodies in our physical and social surroundings. Regardless of the ordinariness of these types of signals, I myself found that, as a hearing adult sign language learner, it was only when I was introduced to the Finnish Sign Language (FinSL) community that I began to pay serious attention to these aspects of communication.

This PhD research project is focused on the field of phenomena traditionally referred to in sign language (SL) linguistics as *nonmanuality:* those elements in sign languages which are produced with other parts of the body than the hands. More precisely, this study focuses on the actions of the signer's head and body in FinSL, and investigates the forms and functions of signals produced with the signer's head and body. The topic has arisen from a sincere interest in the nonmanual dimensions of signed communication. This interest is itself partly the result of the fact that, while as a learner of FinSL many of these embodied signals felt familiar and natural, in many respects the use of one's face, head and body emerged in a completely new way in signed interaction.

This novelty was evident both when watching other people sign and when I was myself learning how to converse, act and express my thoughts in FinSL. During this process I would have benefited from more knowledge of the nonmanual aspects of FinSL and how these affect the contents of signed discourse, the negotiation of meaning, the structure of a sign language and the progress of interaction. These issues are, I believe, important also for deaf and hearing children learning how to sign.

Despite the issues discussed in the following sections, the current study refers generally to all the different actions of the face, head and body in signed discourse as *nonmanuality*, and to a particular action of one of these body parts as a *nonmanual signal*. This is done largely on account of the lack of better terms. In addition, with these choices the study wishes to maintain a terminological connection to previous studies discussing the actions of the signer's face, head and body.

1.1.1 The concept of nonmanuality in sign language linguistics

In the modern history of SL linguistics, nonmanuality was a subject of interest already in early studies on the structure of American Sign Language (ASL), published in the 1970s and 1980s (Baker 1976; Baker & Padden 1978; Liddell 1978; 1980). As Baker and Padden (1978, 34) state, "research on sign language structure that only looks at what the signer's hands are doing is severely limiting itself". Despite this early interest in nonmanual aspects of signed languages, our knowledge of, for example, the signals produced with the signer's face, head and body, their functions, and the connections between co-occurring nonmanual signals in a sign language, is still rather limited. This is already evident in the way we refer to the actions of the signer's face, head and body: *non*manuality refers to 'everything else than what signers do with their hands'.

I believe that one could even say that the field of SL linguistics has been dominated by a so-called *manual bias* (Puupponen 2018; Article IV). This bias can be seen in two ways: affecting *what* is studied and affecting *how* something is studied. Regarding the former, the focus on manuality can be seen in the number of linguistic studies of sign languages that concentrate on the manual compared to the number of those that concentrate on the nonmanual. This issue – the still ongoing lack of knowledge about nonmanuals in sign languages – is one of the primary motivators for the current study. Concentrating on the manual may be the result of several factors, such as the chaotic nature of nonmanuality as a research subject, and the importance of signers' hands in conveying meanings and establishing common ground in signed discourse. On the other hand, the emphasis on the manual in SL linguistics may be the result of several preconceptual biases that can be traced back to structuralist semiotics and the presupposition of the arbitrariness and symbolicity of a natural language (see Saussure 1916). Nonmanuality, together with other gradient, multifunctional and contextually motivated dimensions of sign languages, are phenomena that could easily have been marginalized in the development of

modern SL linguistics (at a time referred to as the 'first wave' of SL research in the context of deaf studies, Kusters et al. 2017) due to the mainstream linguistic tradition of the 20th century towards which the validation of SLs as natural languages tended to look at the time (see e.g. Liddell 2003). A similar fate befell elements such as ideophones, interjections and other iconic and indexical elements in research on spoken languages (e.g. Dingemanse 2017).

Regarding the latter – the *how* something is studied – one might argue that the way nonmanuals have been treated in studies of SLs has also been affected by the manual, and by the so-called preconceptual biases proposed above. There is a lack of usable categories in the study of nonmanuality. A categorical distinction between, for example, the grammatical, the prosodic, and the gestural is known to be difficult in relation to nonmanual signals (e.g. Pfau & Quer 2010; Herrmann & Steinbach 2011) and, as I will argue in the current work, possibly even unnecessary. Still, much of the research on nonmanuality has presupposed a categorical distinction between so-called *linguistically relevant* nonmanual signals (referred to as, for example, non-manual adverbs or adjectives or as systematic markers of grammatical negation or interrogatives) and *non-linguistic* nonmanual signals of, for example, emotions and attitudes (see Section 2.2). This dualistic approach is considered in this work to be an oversimplification of the subject matter. Associating actions of the signer's face, head and body with linguistic units such as words, manual signs or morphemes is an example of how preconceptual biases – originating in the assumptions of the mainstream linguistic tradition of the past century – result in an overemphasis on the symbolicity of nonmanuality (see Article IV). This may be a result of the fact that by making this association, nonmanual elements are easier to validate as relevant subject matter for studies which have their theoretical starting points in the formalist tradition (e.g. Generative Grammar; Chomsky 1959; 1965). The problems arising from theoretical assumptions of nonmanual signals are discussed further in Sections 2.2 and 5.2 of this Overview.

In the early investigation of the structure of sign languages, co-occurring actions of the signer's face, head and body were often treated as one nonmanual element, a cluster of nonmanual features (e.g. Liddell 1980). As Baker and Padden (1978, 35) point out, nonmanuality includes a lot of synchrony, and "configurations of behaviors rather than any specific behavior is important as the carrier of meaning". As studies of nonmanuality have increased, discussion of the layering of several different nonmanual signals has moved towards differentiation between the mediums or channels through which they come about (e.g. Wilbur 2000; Sandler 2011; 2012). Some studies have focused on particular signals of the face, head or body in relation to specific linguistic structures and grammatical phenomena (for an overview, see e.g. Wilbur 2000; Pfau & Quer 2010; Herrmann & Pendzich 2014). Overall, linguistic studies focusing on signals produced with the head and torso are significantly less frequent than studies on different actions of the signer's face. The current study aims to contribute to changing this state of affairs by describing and analyzing a

less investigated area of nonmanuality, that is, the actions of the signer's head and body.

It can be argued that in the study of nonmanuals there is a so-called *facial bias*, which means that a substantial amount of research on nonmanuality has focused on the signals produced with the upper and lower parts of the signer's face, and that theoretical generalizations concerning nonmanuals have been made on the basis of this work (see Article IV). For example, associating all nonmanual gesturality with the signaling of affect and making a categorical distinction between *affective* and linguistically relevant nonmanuality are largely due to the studies done on signers' facial signals (see Article IV & Section 2.2 of this Overview). Many of these studies on facial expressions are neurolinguistic, and test the assumed difference between affective and linguistic nonmanuality through discrimination tasks based on visual stimuli (see e.g. Corina 1989; Corina et al. 1999; McCullough et al. 2005). However, testing theoretical notions that have not been established from a representative dataset of actual language use has its dangers, as will be discussed in the following section.

1.1.2 Motivation for the theoretical and methodological approach of the current study

As pointed out above, some theoretical generalizations about nonmanuality have been made on the basis of findings concerning facial signals, and many of these studies are based on neurolinguistic testing. However, as Johnston (2012, 163) points out, despite the fact that the "vast bulk of experiments in the language sciences are conducted using well-described, well-documented languages", in the study of sign languages generally "experimental studies of SL users have been conducted just as much to establish the facts of SLs as to test claims about language structure and use" (ibid.). In other words, experimental studies in psychology or the neurosciences may have been used at too early a stage in SL research. Instead of "enter[ing] the scene ''late'' in the process of language identification and description" (ibid.) so that they could draw on facts "arrived at through linguistic analysis of normal language output or through intuitions and introspection" (ibid.), they have been used to describe hitherto uninvestigated issues in a language. This important idea applies to the study of nonmanuals as well, and gives reason for re-examining the assumed theoretical categorizations regarding nonmanuality using comprehensive data on natural language use.

So, in addition to neurolinguistic studies, what types of data are the current theoretical generalizations concerning nonmanuality – or any other phenomena for that matter – based on? Johnston (2012) summarizes the methodological trends in the tradition of sign language linguistics as follows:

> With respect to elicitations, intuitions, and introspection, the vast majority of SL grammatical descriptions have been based on the judgments of extremely small sets of native users, rather than the analysis of representative samples of natural language output. (It goes without saying that relatively few SL linguists have themselves been native signers.) Most grammars and teaching materials are written from this perspective and informed by this type of language research. With respect to the description and analysis of natural language output (recordings of signing or transcriptions thereof), the examples of this within the SL research literature are few and far between. Datasets have been miniscule; corpora, in the strictest sense of the word, have been virtually nonexistent. (Johnston 2012, 163–164.)

Although intuition-based evaluations, tests and elicitation are important methodologies in linguistic research, sign language corpora are "important for the testing of language hypotheses in all language research at all levels" (Johnston 2010, 108). This testing is of particular significance because sign languages are young minority languages that "lack written forms and the well-developed community-based standards of correctness that often accompany literacy" (ibid.), and that "have interrupted generational transmission" (ibid.). As nonmanuals are known to be multifunctional signals that often do not involve the straightforward mapping of specific meanings to particular forms (e.g. Herrmann & Steinbach 2011), and which have been noted to include a lot of individual variation (e.g. Johnston et al. 2015; Jantunen 2017a; see also Articles II & III), it is evident that data consisting only of intuitive evaluations, or the language use of only a few signers, is open to misinterpretation and false conclusions. It is argued here that generalizations regarding, for example, the degree of conventionalization of different nonmanual signals in a given sign language need support from data that includes evidence of the frequency of their occurrence, co-occurrence and variation. That is, the current work builds on the view that *in understanding nonmanuality we can only establish types by looking at variety.* The current study aims to contribute in this respect to the discussion on nonmanuals since it uses a range of different types of data, including corpus narratives and dialogues from several different signers (see Section 3). It should be noted, however, that although the study uses data collected as a part of the Corpus project of Finland's sign languages, the study does not use statistical methods of corpus linguistics. Instead, the study aims at building methodological foundations for future studies, both quantitative and qualitative, on signers' head and body movements.

Furthermore, cross-linguistic comparison of nonmanual features in different sign languages is rare (see e.g. Crasborn et al. 2008), although some recent studies do compare the results of corpus-based investigation of nonmanual signals with previous studies in other sign languages (Johnston et al. 2015; Oomen & Pfau 2017; Johnston 2018). The need for further studies in this area forms the motivation for the comparative approach included in one of the substudies in the current work (see Section 4.3 & Article II). Generally speaking, the increasing collection and processing of corpora of different sign languages during the 2010s will offer new possibilities for cross-linguistic studies on nonmanual phenomena in sign languages.

So far, studies in the tradition of Generative Grammar (Chomsky 1959; 1965), have formed the mainstream of research on nonmanuality in sign language linguistics. Studies on nonmanuality in which language is approached from a usage-based, cognitive-functional view have been infrequent (see e.g. de Vos et al. 2009; Lackner 2013; Johnston et al. 2015; Johnston 2018). The current study wishes to contribute to overcoming this state of affairs through its theoretical and methodological approach. In the approach used here, nonmanuals are seen as one part of signers' communicative actions and they are studied from naturalistic data consisting of genuine signed interaction. The theoretical arguments and conclusions are built upon work on this data, in which observation, identification, description, analysis and typologies are not done on the basis of a predetermined formalism. The theoretical and methodological starting points of this study are discussed further in Sections 2 and 3, respectively.

Another natural result of the usage-based approach of the current study is that the connection between theory and the physical reality in which languages emerge is seen here as significant. The relative absence of usage-based approaches in the study of nonmanuals may, indeed, be one reason why theoretical assumptions about nonmanuals lack a strong phonetic basis. This issue does not concern only nonmanual aspects of sign languages, however. In general, it has been noted that while there have been few studies focusing on the phonetics of sign languages, there has been a substantial amount of model-based phonological research on such languages (Crasborn 2012). It has been suggested that this may be due to the fact that in sign languages the articulators are continuously visible (ibid.). However, thanks to the immense progress made in different video and motion capture technologies during the 21st century, we now have unprecedented possibilities for detailed, kinematic investigation into the signaling of sign languages. In order to understand the nature of nonmanuality in sign languages and to build empirically reliable theories of their nonmanual aspects, research on this topic must be able to describe how nonmanuals such as movements of the head and body *actually appear* in signed discourse. In doing this, the field of study can evaluate the empirical ground of assumed formal categories of nonmanuals (see Section 2.2) and, through this, also the conclusions reached about the functional characteristics of these signals. This objective accounts for the phonetic dimension, that is, the kinematic analysis of signers' head movements, included at the beginning of the current study (see Section 3 & Article I).

In short, the current study aims to increase our knowledge in certain problem areas. First of all, our understanding of the role of nonmanuality in sign languages is still rather limited, and in particular we have little information on the activity of the head and the torso, on the functions of these signals in sign languages, as well as on the relations between co-occurring nonmanual signals in sign languages. Secondly, we do not know much about the relationship between signers' nonmanual and manual actions. Thirdly, in the study of nonmanuals in sign languages there is a shortage of research taking a usage-

based, cognitive-functional approach to language. Finally, there is not enough phonetic basis for the notions and conceptualizations of nonmanual signals.

1.2 Objectives, research questions and an outline of the study

The current study consists of altogether four different substudies reported in four research articles (Articles I-IV), and this Overview. Articles I and II have multiple authors of which the corresponding author is Anna Puupponen. The corresponding author has carried out the most significant part of the research, including the conception and design of the research plan, the analysis and interpretation of data, and the writing of the manuscript. The co-authors have been involved in the study especially in the process of collecting and processing the data. All co-authors have also contributed to scientific discussions concerning the content of the papers, and have accepted the final versions of the manuscripts before publication. The study follows the principles of good scientific practice defined by the Finnish Advisory Board of Research Integrity and the ALLEA's (All European Academics) European Code of Conduct for Research Integrity. The necessary research permits have been acquired, and include permissions for the use of the materials according to several different levels (see Salonen et al. 2016). Still images of video materials have been used only of research subjects who have permitted using images of their materials in research publications.

The study seeks to answer the total of five central research questions listed below. In addition to these, each of the four substudies is built on more detailed, study-specific questions, which are presented in Section 4 of this Overview, together with a summary of the results of the studies.

Q1. What kind of movements and positions do signers produce with their head and body?

Q2. What kind of functions do the above-mentioned movements and positions have?

Q3. What kind of relationship do the actions of the head and the body have, and what is their relationship to other nonmanual actions?

Q4. What is the relationship between nonmanual and manual actions?

Q5. What is the role of nonmanuality in language in general?

Each substudy approaches the research subject from a different angle. While connected to all of the research questions, each substudy puts more emphasis on some of the questions than on others. The topic of each substudy and its connections to questions 1–5 are summarized in Table 1, followed by a short overview of each substudy.

TABLE 1 Connections between the central research questions and Substudies 1–4.

Sub-study	Research question	Topic
1	Q1, Q2	Forms and functions of four head movement types
2	Q4	Case study on the discourse-organizing function of nods
3	Q1, Q3	The relationship between torso and head movements
4	Q2-Q5	Semiotic features of head movements and nonmanuality

Substudy 1 concentrates on research questions 1 and 2 and investigates the forms and functions of four different head movement types in continuous dialogues of FinSL. The study describes and analyzes the kinematic characteristics and prototypicalities of these different head movements on the basis of Motion Capture data, and discusses the patterning in the combinations of the four types of forms and altogether seven different types of communicative, discourse-organizing, phonetic and syntactic functions.

Substudy 2 is a case study focusing on one of the form-function combinations found in Substudy 1, the discourse-organizing function of signers' head nods. The study concentrates on research question 4, the relationship between manual and nonmanual actions, and investigates the alignment of head nods with manual syntactic units. It is a comparative study of two historically related sign languages, FinSL and Swedish Sign Language (SSL), and the analysis is done on the basis of corpus narratives of both languages. The study describes the temporal alignment of nods with transitions between syntactic units such as clauses and sentences, and analyzes the functions of differently aligned nods in the narratives.

While Substudy 2 concentrates on the relations between particular nonmanual signals and manual syntactic sequences, Substudy 3, on the other hand, focuses on research question 3 and investigates the relationship between two types of nonmanuality: actions of the signers' head and the torso. The study is conducted using FinSL corpus data, and it investigates the overall activity of the head and the torso, the frequency of occurrence of different types of head and torso movements, and the degrees of formal and functional complexity in the combinations of co-occurring head and torso movements.

The complexity of functions in the combinations of co-occurring head and torso movements investigated in Substudy 3 is the motivation for the semiotic treatment of head movements and nonmanuality in Substudy 4. While connecting to all of the aforementioned research questions, it digs more deeply into Q2–Q4, and expands the discussion of the theoretical Q5 about the role of nonmanuality in sign languages. The study presents a semiotic typology of signers' head movements, a theoretical view of the proportions of semiotic strategies of iconicity, indexicality and symbolicity in the actions of the head, and a discussion of the semiotic complexity and communicative unity in head movements and actions of the signer's body in general. The outline of the research process and connections between the substudies are illustrated in Figure 1.

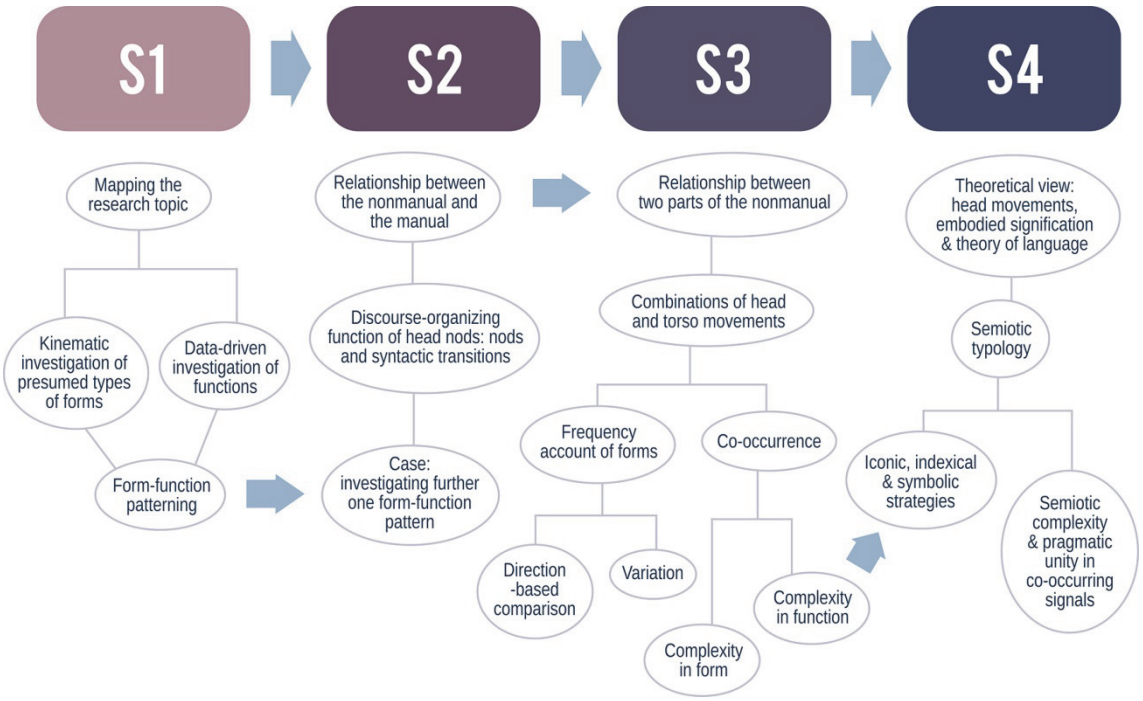

FIGURE 1 A summary of the research process including the connections between Substudies 1–4 (S1–S4).

1.3 Position of the study in the linguistic research tradition of FinSL

Linguistic research on FinSL is a relatively young field of study, as is the case with the study of most sign languages of the world. The first description of FinSL structure was published in 1985 (Rissanen 1985). It included a description of the FinSL lexicon, the phonological structure of lexical signs, and the so-called morphological modifications and processes of signs, as well as some preliminary ideas about FinSL sentences. During the late 1980s and 1990s, this initial description was expanded with linguistic overviews of processes of repetition (Rissanen 1987), mouth actions (Pimiä 1987) and perspective shift (Rissanen 1992) in FinSL, as well as with studies on the phonological acquisition (Takkinen 1995) and grammatical categories of nominals and verbals (Rissanen 1998) in FinSL. In addition, important lexicographic work at the Finnish Association of the Deaf (FAD), in association with the Institute for the Languages of Finland (ILF), has been ongoing since the late 1980s, early 1990s.

When moving into the 21st century, linguistic studies on FinSL increased, with a strong emphasis on the lexicon (including onomastics) and its historical development (e.g. Jantunen 2001; Rainò 2001b; 2004; 2006; Takkinen 2008a; Jantunen 2010), as well as phonetics and phonology and their acquisition (Savolainen 2000; 2006; Takkinen 2002; Fuchs 2004; Jantunen 2005). Some of the relevant findings came from studies on children's language acquisition and

learning (Takkinen 1995; 2002; 2003a; b; 2008b). These studies started a tradition of research on the learning of FinSL, which expanded into studies on the bi-modal bilingualism of FinSL signers (Takkinen 2012; 2013; 2014; Kanto et al. 2013; 2015; 2016), and discursive and sociolinguistic studies on, for example, resources and identities in the multimodality and multilingualism of FinSL signers (e.g. Tapio & Takkinen 2012; Tapio 2013; 2014; 2017; 2019). In addition, it should be noted that the early 2000s saw the beginning of research on Finland-Swedish sign language (FinSSL) and on the social status of the FinSSL community in Finland (e.g. Hoyer 2000a; b; 2004; 2005; 2012; Hoyer et al. 2006; Siltaloppi 2019). The continuous work done by FAD and ILF to strengthen the linguistic and societal rights of sign language communities in Finland has resulted in the recent Sign Language Act (359/2015), which came into effect in May 2015. The societal motives for the Act and its potential implications in the field of sign language policy are discussed in De Meulder (2016) within the framework of critical language policy and the ethnography of language policy. Recently, research has been published also of the experiences of deaf refugees seeking asylum in Finland (Sivunen 2019).

Study of the syntactic structure of FinSL started in the late 2000s (Jantunen 2007a; b; 2008; 2009) and has expanded considerably during the 2010s (e.g. Jantunen 2013b; 2015b; 2016; 2017a; b; 2018a; Jantunen et al. 2016a; De Weerdt 2016; Nordlund in press). At the same time, there has been a growing interest in the study of FinSL prosody and the relations between syntax and prosody (e.g. Jantunen 2015b; 2016; Jantunen et al. 2016a). During these years, there have been two significant methodological developments in FinSL linguistics: the development and employment of different technological methods for SL research, and the collecting and processing of FinSL corpus data. Regarding the former, methods based on computer vision and Motion Capture technologies have been developed since the early 2010s at the Sign Language Centre in the University of Jyväskylä in Finland. The first applications of these technologies to FinSL research focused on testing assumptions about the basic theoretical unit of a sign language, the sign (Jantunen 2011; 2012; 2013a; 2015a). Subsequently, these technologies have been applied to the study of syntax and prosody (Jantunen 2015b; 2016; Jantunen et al. 2016a), in addition to which there has been a large number of publications documenting the development of the technologies themselves (e.g. Jantunen 2010; Karppa et al. 2011; Jantunen et al. 2012; Karppa et al. 2012; Luzardo et al. 2013; 2014).

As regards the latter, international interest in building SL corpora increased during the 2000s – partly due to the pioneering corpus work done on, for example, Australian Sign Language (Auslan; Johnston 2010) and Sign Language of the Netherlands (Crasborn & Zwitserlood 2008) – resulting in several different SL corpus projects during the 2010s. The collection, processing and systematic annotation of FinSL corpora started around 2013 (Puupponen et al. 2014; Nordlund & Savolainen 2014; Salonen et al. 2016; Keränen et al. 2016; Takkinen et al. manuscript) and is still ongoing. As a result, the first corpus-based studies of FinSL started to emerge, and corpus materials have been

applied to the study of, for example, syntax and prosody (Jantunen 2015b; 2016; 2017a; b; Jantunen et al. 2016a;) and depicting verbs (Takkinen et al. 2018). The current study has been involved in this development and has applied new technologies and corpus materials to the study of nonmanuality, using Motion Capture data and corpus narratives and dialogues for the study of head and body movements in FinSL (see Articles I–IV).

Most of what has been said regarding issues in the study of nonmanuals internationally also applies to the study of FinSL nonmanuals. Linguistic studies focusing on the nonmanual features of FinSL are rare. It should, however, be noted that their significance was recognized early on. Among the very first linguistic publications on FinSL was an overview of signers' mouth actions and their semantic characteristics (Pimiä 1987). To date, the body of research on FinSL mouth actions has increased by two studies (Raino 2001a; Rauhansalo 2015). In addition, there have been observations on signers' head movements and facial expressions in a few publications in relation to, for example, negative and interrogative structures (Savolainen 2006) and equative sentences (Jantunen 2007a) in FinSL. During this PhD research project, too, some studies have discussed the role of nonmanuals in relation to the syntactic structure of FinSL (Jantunen 2016; 2017a; Jantunen et al. 2016a). Apart from two MA theses (Puupponen 2012; Puhto 2018), no studies have focused specifically on the actions of the signer's head and body in FinSL.

In FinSL linguistics, the majority of studies have not been done in the generative tradition. All of the above-mentioned studies that discuss or touch upon some aspects of FinSL nonmanuals have been conducted using a descriptive and functional approach, according to which language is described from the premises of the language in question, without any predetermined formalism (an approach that has been referred to in the study of FinSL syntax as Basic Linguistic Theory). The current study continues this tradition. The study is a usage-based, functional investigation of the actions of the signer's head and body in FinSL. It is the first large-scale linguistic investigation of nonmanuality in FinSL, and the first linguistic study focusing on the signals produced with the signer's head and body. The kinematic investigation of signers' head movements, presented in Section 4.2 of this Overview and in Article I, is the first application of Motion Capture technology to the study of FinSL nonmanuals. It expands our knowledge of FinSL phonetics, which is an understudied area of FinSL structure (see, e.g. Fuchs 2004; Jantunen 2006; 2013a; 2015a; Jantunen et al. 2016a; Aalto & Ojala 2014).

1.4 Structure of the Overview

This article-based dissertation consists of four articles (see Original publications) and this Overview. The aim of the Overview is to introduce the topic, objectives and theoretical starting points of the study, to describe the research process and methodology, to summarize the relevant results and

conclusions of the study, and to evaluate the study and its scientific contributions and potential consequences. The Overview is organized in the following way. Section 2 deals with the theoretical framework of the study. Section 2.1 introduces the usage-based cognitive-functional approach to language and the theoretical and methodological implications it has for the current study. Section 2.2 discusses how the current study is linked to sign language linguistics and the study of nonmanuals, particularly the actions of the head and torso, in sign languages. Section 2.3 presents some concepts and theoretical views from the field of gesture studies and their relevance to the current study, followed, in Section 2.4, by a discussion of how the study is connected to semiotic theory.

Section 3 of the Overview presents an outline of the research process, including its data and methodology. Section 3.1 presents the different types of data used in the study, and Sections 3.2–3.5 describe the research process and methodology for each substudy. Section 4 presents the results of the study. Section 4.1 summarizes the main results according to the central research questions. Sections 4.2–4.5 discuss the relevant findings according to each substudy and their study-specific research questions. This is followed by a discussion of the theoretical and methodological contributions, implications and conclusions of the study in Section 5.

2 THEORETICAL FRAMEWORK

Studying nonmanuality – with such objectives and research questions as are presented in the previous section – means that one has to take into consideration many different theoretical issues. As nonmanuality is relevant in many levels of language structure and use, a study investigating this relevance involves influences from several different disciplines. The current study is theoretically rooted especially in the following principal areas: usage-based linguistics, sign language linguistics, gesture studies, and semiotics. The main issues and central concepts of the theoretical framework are presented in Figure 2, followed by a discussion of each research field in turn.

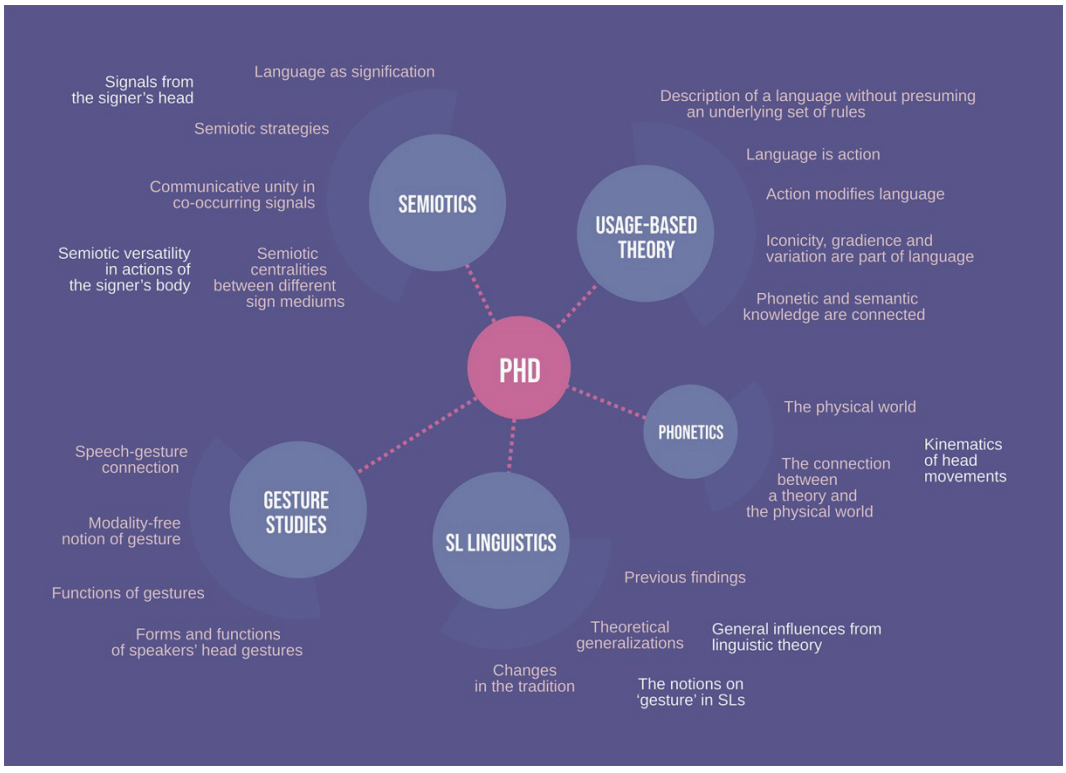

FIGURE 2 The theoretical framework of the study.

2.1 Usage-based linguistics

Like in the field of linguistics generally in the 20th century, so also the linguistic study of sign languages was strongly influenced by Generative Grammar (e.g. Chomsky 1959; 1965). However – in contrast to the langue-parole dichotomy and the arbitrary and static concept of meaning as a signifier-signified relation, characteristic of the Saussurean structuralist linguistic tradition – there have been many other influences in sign language research. Peircean and post-Peircean semiotics, the later period of Wittgenstein's language philosophy (e.g. the concept of 'language-game'), Austin's (1962) Speech Act Theory, and the increasing interest in linguistic anthropology, psycholinguistics, sociolinguistics, cognitive-functional and usage-based approaches to language, the study of speech, and gesture studies have all encouraged views that emphasize the active, embodied and cognitive roots of language as well as the dynamic and motivated nature of linguistic meaning (see e.g. Clark 1996; Kendon 2004; Kockelman 2007; Enfield 2009). These extensions to linguistic theory can be seen in the field of sign language linguistics, and also in the theoretical framework of the current study. If a framework does not assume separation of the linguistic system and the use of a language, and allows language to include also gradient and unconventional characteristics, it enables a broad-minded investigation of an idiosyncratic and multifunctional field of phenomena such as nonmanuality.

Usage-based approaches to language are based on the view that (i) language is a form of action which is connected to other cognitive, embodied and social action; (ii) this action reforms and changes the language system in the course of time; (iii) phonetic and semantic information are directly connected to each other; and (iv) iconicity, gradience and variation are an inherent part of language (Bybee & Beckner 2010; Diessel 2017). In relation to (i), usage-based linguistics differs from the structuralist tradition and classical Generative Grammar in, for example, the fact that language use is not separated from the language system, as presented above (Diessel 2017). Usage-based approaches reject the so-called innateness hypothesis and the concept of a universal deep structure of language presented by Universal and Generative Grammar, which posit that humans are genetically pre-programmed with principles and constraints through which language is adopted and learned, and that this innate grammar can be described with mathematically exact sets of rules, that is, formalisms (Diessel 2017; see also Chomsky 1959; 1965). Instead, usage-based linguistics is built on the assumption that language is embodied social action, in which the linguistic knowledge of a signer or a speaker is built, updated and reformed through the use of language (see ii). This process is affected by several different cognitive processes, as Diessel (2017) summarizes:

> Linguistic structure is influenced by general cognitive processes that concern the categorization and conceptualization of experience [--], the representation and activation of knowledge in memory [--], the linearization of information in utterance planning [--], and the flow of consciousness in discourse processing [--]. (Diessel 2017, 2.)

Usage-based linguistics sees language as an emergent phenomenon in which conventions in the symbolic form-function connections and schematicity of grammatical phenomena emerge in the language as a result of social processes (Hopper 1998; Bybee & Beckner 2010; Diessel 2017). These socially shared habits and characteristics of language use, such as frequency of occurrence and co-occurrence, are important factors in an individual's linguistic knowledge, in the development of language in the individual, and in the historical development of a language system (Diessel 2017). That is, the linguistic action of people, and their action in general, shape the language.

As was summarized in (iii), it is typical of usage-based approaches that semantic knowledge is seen as directly connected to phonetic knowledge. As described above, according to usage-based theories, linguistic knowledge and experiences are cognitively stored in the same way as other perceptual experiences (Diessel 2017). As with these, also in linguistic processing the association between a signal, its meaning and the context is direct, not "filtered through intervening layers of structure" (Bybee 1999). Then, semantics is approached through conceptualization, that is, through the cognitive organization of different experiences (not through referential relations and truth conditions, as in formal semantics) (Bybee 1999). Semantic conventions are seen as being emergent from the repeated conceptualization of similar experiences, and the roots of these experiences are seen not only in cognition but also in the phonetic and social reality (Bybee 1999). This means that, according to usage-based linguistics, theories formed about a language should be based on facts of the physical world, such as psychological, neurological or phonetic knowledge. Therefore, the concepts in any theoretical generalizations should be rooted as realistically as possible in the use and context of language and in physical and psychological reality (Bybee 1999; Diessel 2017). This aim can be seen in the current study, for example in the approach taken in Substudy 1, which is based on kinematic evidence. Finally, as stated in (iv), usage-based approaches see that iconicity, gradience and variation are inherent parts of language, not exceptions which have to be explained in relation to the rules of any given formalism (Diessel 2017).

In the current study, the usage-based approach to language is the extensive theoretical framework that connects its four substudies. The ontological concepts of 'language' and a 'language user' (or human being in general) as well as the data-driven methodologies of this study can be traced back to this general framework. The study is based on data consisting of diverse, naturalistic materials from different communicative situations, and the description and analysis of these materials is carried out from the premises of the language being studied through a multi-phased, systematic annotation, with the aim of minimalizing the involvement of theoretical presuppositions about nonmanuality, including any underlying set of rules behind them (see Section 3). On the basis of this process, the study builds a theoretical view of the actions of signers' head and body in FinSL and discusses the role of nonmanuality in sign languages. The analysis includes a kinematic dimension

based on Motion Capture data, as mentioned in the previous sections of the Overview. In this way the study aims to build a theory that can be traced back to features of the physical reality in which language comes about. The classification of head and body movements in the study is based on the concept of "prototype categories with degrees of membership" (Langacker 2008, 13) rather than the assumption that they form "classical categories with strict boundaries" (ibid.). That is, the analysis is based on the view that gradience, unconventionality and variation are characteristic features of language.

2.2 Sign language linguistics and the research on nonmanuals

While the usage-based approach to language forms the wide theoretical framework for the current study, central to the theoretical starting points of the study are also the theoretical views, conceptions and observations made on nonmanuality, and especially on the actions of signers' head and body, in sign language linguistics (Sections 2.2.1 & 2.2.2). The study also reflects the growing interest in gesturality in the description and theory of sign languages (Section 2.2.3).

2.2.1 Research on SL nonmanuality

As was pointed out in the introduction to this Overview, actions of the signer's face, head and body have been studied in relation to the structure and use of sign languages since the late 1970s. Nonmanuals have been approached, for example, in relation to the lexicon, morphology, syntactic structure, sentence functions, information structure, prosody, enacting discourse strategies and interaction. Some studies, too, have associated signers' nonmanual signals with the co-speech gesturing of speakers and have approached nonmanuals from the viewpoint of gesture studies. Different functions of nonmanual signals are discussed in the current section in general, before focusing on research on actions of the signer's head and torso in Section 2.2.2.

2.2.1.1 Affective and grammatical features of nonmanuals

Generally speaking, discussion of nonmanual signals in sign languages has tended to focus much more on actions of the signer's face than on actions of the signer's head and body, as has already been pointed out in this Overview. This is in many ways understandable. The significance of facial signals in human communication may seem more obvious than the significance of signals of the head and body. The semiotic complexity of the face makes it an interesting subject for research. The upper and lower parts of the face may produce co-occurring signals – such as gaze shifts, eye-brow positions and mouth actions – which all have their own functions in utterances (see e.g. Wilbur 2000). However, despite the distinctness of different parts of the face, the forms and

functions of co-occurring signals from upper and lower parts of the face are always connected to each other in one way or another. Facial actions can also form a unified expression in which different parts of the signer's face do not convey signals of their own, but rather, the face forms one unified signal. The semiotic richness in the actions of the face may attract linguistic investigation more easily than actions of the head and body, as the latter are less often associated with specific semantic information (see Article IV).

The emotive functions of signals of the face and the head are common with speakers as well as signers (e.g. Ekman 1979), and there are evident similarities between the nonmanual actions of signers and speakers from similar cultural surroundings (e.g. Janzen & Schaffer 2002; Goldin-Meadow 2003; Özyürek 2012; Wilcox 2004; Herrmann & Pendzich 2014). In SL linguistics, signals of the signer's face have been discussed in relation to the signaling of one's own emotions and attitudes toward what is uttered, on the one hand, and in relation to the morphology and syntax of sign languages, on the other. Signers' different facial expressions have been said to signal aspects of their own feelings and attitudes (in general or in relation to what is uttered), or to convey meanings related to the qualities of discourse referents or their actions. The former have been referred to as signals of *affect,* and traditionally they have been distinguished from the latter, which are referred to as *linguistically relevant* or *grammatical* nonmanuals (e.g. Corina et al. 1999). According to this traditional view, some nonmanual signals are regarded as *nonmanual markers of morphological phenomena* – nonmanual adverbs and adjectives – because they signal emotions and attitudes of a referent (e.g. joy, concentration, carelessness), the size, weight, or other quality of a referent (e.g. largeness, lightness, stillness, distance), or the characteristics of an action (e.g. repetitiveness, fluidity) (e.g. Liddell 1980; Baker-Shenk 1983; Corina et al. 1999; Wilbur 2000; Pfau & Quer 2010; Herrmann & Pendzich 2014). In other words, these nonmanual signals have been associated with qualifying words and morphemes in speech or text, such as adjectives and adverbs.

It is understandable that signals such as facial expressions have been studied in relation to SL morphology. The meanings conveyed with the face attract such associations, if approached through a traditional grammatical analysis. There are, however, some problems with this traditional view. The most evident issue is that there is not sufficient evidence of whether these facial signals are used in the same way by all the signers of a language, and whether they actually form conventionalized categories such as adverbs or adjectives in the language. It is relevant to query theoretical assumptions that these types of nonmanual signals are comparable to lexical and grammatical (often also highly arbitrary) symbols by asking at least the following questions. Do signers always depict qualities of referents or actions in the same way? Why should we assume that nonmanuals such as these are morphematic any more than, for example, movement features that are regarded as gradient, context-dependent components of manual depicting signs (see Liddell 2003)? Is the signification and interpretation of these signals semiotically similar to or different from that

of arbitrary words and morphemes? If it is found to be different, how useful are concepts such as 'morpheme' or 'phoneme' for describing these signals? In relation to these questions, it is argued in Section 4.5 of this Overview and in Article IV that, semiotically, nonmanuals such as head movements involve the association of analogies and the observation of physical contiguity more than inference of a conventionalized form-meaning relation.

Syntactic facial expressions, on the other hand, have been said to "mark" conditionals, relative clauses and topics, and nonmanuals have been associated with sentence functions such as negative, affirmative and interrogative functions (for an overview, see e.g. Wilbur 2000; Pfau & Quer 2010). Negative and interrogative structures have been the focus of a relatively large number of linguistic studies on sign languages, and signals produced with the signer's face and head have been found to play a significant role in such structures (e.g. Zeshan 2006). According to the traditional view, signals such as particular brow positions, head thrusts, or headshakes are systematically occurring, categorical and conventional markers of grammatical phenomena referred to as *wh-markers* or *negation markers*, for example (e.g. Wilbur 2000; Oomen & Pfau 2017). However, the same problems arise here as arose above in presupposing parallels between spoken language morphology and nonmanual facial expressions characterizing referents and action. For example, signaling nonmanually that information is important (i.e. should be paid attention to) may look much the same, regardless of whether the importance arises from the fact that the information is new, related to something that is going to be uttered in the next clause, or is not known by the utterer. In the final case the lack of information may be shown, for example, by enquiring about it from the interlocutor (e.g. with a polar question) or as a signal of surprise in reaction to the interlocutor's utterance. All of these signals may look quite similar (e.g. raised eyebrows) and be very closely connected, although the traditional view regards only some of them as relevant subject matter for the study of grammar and linguistic meaning in SLs. However, some studies have investigated the functions of nonmanual signals regardless of whether they would be regarded as linguistically relevant according to the traditional view. In a recent study by Johnston (2018), the grammatical status of a particular nonmanual signal, the headshake, was examined, and it was shown that the functional diversity of headshakes was large, and more similar to the functions of corresponding gestures of speakers' than has been assumed in the past.

The need to distinguish between signaling one's own emotions and reactions, signaling qualities of discourse referents and their actions, and signaling functions of sentences, for example, is reasonable. As actions, these are all different. However, considering this difference to be categorical both in form and in function and regarding one type of action as linguistic and the other not (and as separable from the linguistic) are still hypotheses that lack sufficient evidence from comprehensive data on the language use of several different signers of the language to be accepted. The evidence of neurolinguistic studies (see e.g. Corina et al. 1999) and acquisition studies (e.g. Emmorey et al.

1995) show that there are function-dependent differences in how nonmanuals are perceived as adults or acquired as children. However, an important question is whether these differences are clear cut only when describing the interpretation of extremes, that is, extreme signals of emotion, as opposed to signals that, for example, only emphasize – in a maximally "neutral" way – new information in an utterance. Showing extreme anger or gladness is indeed different from highlighting to the interlocutor that they should pay attention to something that is uttered. Extremes do not, however, necessarily describe what is frequent or prototypical in a language. Signers produce surprised, angry or doubtful questions, for example, in which facial signals participate in conveying meanings related to the emotions of the utterer as well as to the grammatical information of the utterance (see de Vos et al. 2009). That is, they signal information that is relevant both for the grammatical interpretation of the utterance and for the interpretation of the emotive meanings related to the utterance and the utterer.

It has been argued that there are differences between linguistic and affective signals not only in terms of their functions but also in their forms, in various ways. Firstly, affective expressions have been said to have "inconstant on- and offsets" in how they are muscularly produced whereas linguistic expressions are rapid and consistent (Corina et al. 1999, 311). Secondly, affective signals have been described as always being *global* expressions of the whole face whereas linguistic signals "single out individual facial muscles that are never individuated in the normal expression of emotion" (ibid.). Thirdly, the scope of linguistic facial signals has been said to be "time-locked to specific linguistic events" (Corina et al. 1999, 312) and to "demarcate discrete grammatical boundaries" (ibid.), whereas affective expressions vary more in their scope (ibid.). Finally, it has been argued that linguistic facial expressions are *required* and dictated by the rules of the linguistic system whereas affective ones are not (although little attention has been paid to the requiredness of affective signals) (ibid.). However, as pointed out in the introduction to this Overview, these statements are still hypothetical as they have not been tested on representative data that includes the natural language use of several different signers in any sign language. In addition, the claims about the activation of facial muscles at the start and finish of different facial signals need more evidence based on the physical characteristics of SL production (articulation) and/or the (video) recognition of these actions from a recording of the signal.

Finally, it should be noted that investigation of nonmanual signals in longer stretches of language use with different signers has revealed that nonmanual signals vary a great deal according to individual signers in terms of both quantity and quality. For example, a study of mouth actions in Australian Sign Language, based on the Auslan corpus (Johnston 2010), gives reason to question prior theoretical assumptions on the conventionality and systematicity of the form-function patterning of mouth actions in sign languages (Johnston et al. 2015). As far as signals from the head and body of signers are concerned, similar findings have been reported in Johnston (2018) and in van der Kooij et

al. (2006). As is presented in Section 4 and in Articles I–IV, the findings of the current study support the above-mentioned findings. It is argued that the description of the use of nonmanual signals from a larger corpus of a sign language reveals that the forms and scope of signals with so-called morphological or syntactic and non-linguistic functions are in many cases identical, that these functions come together in single forms (as in the example with different questions, mentioned above), and that whether a function is interpreted as emotive, as involved in the grammatical contents of the utterance, or as mainly organizing the structure of the utterance may often depend on contextual association rather than rules underlying the use of the language. This means that the current study does not assume a categorical distinction between affectively and grammatically motivated nonmanual signals. It is an important task for future research on sign language structure to bring together more closely the work done on nonmanual signals in sign languages and similar work done in relation to speakers' actions in gesture studies.

2.2.1.2 Nonmanuals, constructed action, information structure of utterances and the organization of discourse

Nonmanual signals characterizing referents or their actions are also those actions of the signer's face, head and body that emerge in stretches of *constructed action*. In the current study, constructed action is considered to be a discourse strategy in which signers *enact* the existence, action, thoughts, feeling or sayings of a discourse referent (see e.g. Liddell & Metzger 1998; Liddell 2003; Hodge & Ferrara 2013; Cormier et al. 2015a). In the enactment, the signer's hands, face, head, and/or body represent the hands, face, head and body of an animate referent. The enactment may be done in different degrees, so that it can involve the engagement of the signer's whole body or just some of the parts of the body just mentioned (see Cormier et al. 2015a). The relevance of this discourse strategy for the structure of sign languages has become more and more evident, and research on the topic has increased considerably during the last 20 years (see e.g. Liddell & Metzger 1998; Liddell 2003; Hodge & Ferrara 2013; Cormier et al. 2013; 2015a; Ferrara & Johnston 2014; Hodge & Johnston 2014; Cormier et al. 2015a). One question concerning nonmanuality that arises from this work is, for example, how often signals traditionally referred to as *nonmanual adverbs* (e.g. Corina et al. 1999; Herrmann & Pendzich 2014) are actually instances of constructed action in some of its degrees. Another question is whether nonmanual signals characterizing some qualities of a referent – traditionally referred to as *nonmanual adjectives* (ibid.) – are cognitively or functionally different from enactment of a referent's action. These questions are related to larger questions, such as how signals in constructed action are related to the structure and grammar of a sign language and how they should be included in the theoretical description of a sign language.

Different nonmanual signals have also been found to connect to the information structure of signed utterances and to the organization of signed

discourse in general. Signals such as brow positions, eye aperture and particular head and body movements have been associated with topic structures (Bahan 1996; Jantunen 2007b; Kimmelman 2015; Sze 2013), as well as new information and contrast (Wilbur & Patschke 1999; van der Kooij et al. 2006; Crasborn & van der Kooij 2013; Herrmann 2015). In addition, movements and positions of the head and body and eye-brow positions have been found to participate in coordination and subordination (e.g. Liddell 1978; 1980; Baker & Padden 1978; Jantunen 2016; Wilbur 2017) in complex sentences. Facial expressions, and movements and positions of the head and body have also been found to parse together stretches of signing into understandable chunks of discourse (e.g. Nespor & Sandler 1999; Sandler 2011; 2012). Because of all these information- and discourse-organizing functions, nonmanual signals have often been treated as parallel to the prosodic features of speech. Signals of the upper face and head, for example, have then been compared to intonational patterns in spoken languages (e.g. Nespor & Sandler 1999; Wilbur 2000; Sandler 2011; 2012). In the discussion of the prosodic functions of nonmanual signals, some people have also distinguished between so-called *domain markers* and *edge/boundary markers*. The former have been said to be nonmanual actions that signal the continuity of syntactic or discourse sequences, such as phrases, clauses, sentences and/or larger discourse sequences (e.g. Wilbur 2000; Pfau & Quer 2010). The latter, on the other hand, have been said to be punctual signals such as eye-blinks or head nods that occur near transitions between the above-mentioned sequences (Wilbur 2000; Pfau & Quer 2010; Herrmann 2010).

Different nonmanual signals have also been noted to play their part in the fluency and turn regulation of signed interaction and in establishing common ground. Signals such as eye-gaze, facial expressions and nodding of the head have been observed to participate in floor-keeping and turn-taking, as well as to emerge as backchanneling signals to the utterances of the interlocutor in conversations. However, studies analyzing the progress and organization of signed conversations are to this date infrequent, and more research is needed on this (see e.g. Baker 1977; Metzger & Bahan 2001; Coates and Sutton-Spence 2001; Lucas 2002).

2.2.2 Previous studies on the actions of the signer's head and body

As is evident from the previous sections of the current Overview, linguistic studies focusing on different types of head and body movements in sign languages are rare. The majority of findings reported on head and body movements in SLs are single mentions in studies on different grammatical phenomena. Exceptions are, for example, Wilbur & Patschke (1999), van der Kooij et al. (2006), Lackner (2013; 2017), Ichida (2004), Tyrone & Mauk (2016), and Johnston (2018). This section presents a short literature review of the findings regarding the forms and functions of head and body movements in sign languages.

2.2.2.1 Head and body movements associated with SL morphology and syntax

In SL literature, head movements are often referred to as movement events or positions such as *single head nods*, repeated *nodding*, *head thrusts*, *backward movements of the head*, single *sideways head turns*, repeated *shaking of the head*, and *sideways head tilts* (e.g. Wilbur 2000; Johnston & Schembri 2007; Ichida 2010). In the current study, the backward movement of the head is referred to as a *head pull*. Also movements such as a *chin-up* or a *chin-down* have been identified in the literature. Movements of the body are usually described as *sideways or sagittal leaning of the torso*, or as moving the feet so that the whole body of the signer changes position (e.g. Johnston & Schembri 2007; Wallin & Mesch 2014). In addition, actions such as the *shrugging of shoulders* have been identified (Johnston & Schembri 2007; Wallin & Mesch 2014). Despite the need for distinguishing between different movement events, it should be noted that because of the multiple muscles and joints involved in movements of the head and body, movements are actually often combinations of the aforementioned movement types (see Article III).

These different types of movements have been associated with all of the functions presented in the previous section: morphosyntax, constructed action, information structure, and the organization of discourse in sign languages. Regarding the first, head movements and positions have been said to participate for example in the so-called adverbial nonmanual elements described in the previous section, which describe the characteristics of an action referred to in the utterance (e.g. Wilbur 2000; Pfau & Quer 2010; Herrmann & Pendzich 2014). However, as our knowledge of constructed action in SLs has increased, it has become clear that these elements may actually be examples of the bodily enactment of a referent, although they are semantically similar to adverbial meanings. Movements of the head and body participate in the enactment of referents in sequences of constructed action, although they may not *necessarily* emerge in enactment, as pointed out by Cormier et al. (2015a). Head and body movements in these instances vary in form, as the enactment of a referent also varies according to the discourse and its requirements. In the current study, it is not assumed that actions of the head and/or body show features commonly found in lexical-grammatical classes such as adverbs, although they may signal similar meanings. The characterizing functions of head and body movements in these types of utterances are more or less dependent on the actions of the signer's hands and face. This issue is discussed further in relation to Substudy 4 in Section 4 of this Overview, and in Article IV.

Head movements have also been found to signal sentence functions. Head nods and repeated nodding have been associated with affirmation (e.g. Liddell 1980; Wilbur 1991; 1999; 2000; Aarons 1994; Geraci 2005; Pfau & Quer 2010; Lackner 2017), and sideways head turns, headshakes and chin-ups with negation (e.g. Liddell 1980; Coerts 1992; Wilbur 2000; Aboh et al. 2005; Zeshan 2004; 2006; Pfau & Quer 2010; Oomen & Pfau 2017; Lackner 2017; Johnston

2018), while head thrusts, head pulls and sideways head tilts have been found to occur in polar and content questions in different sign languages (e.g. Liddell 1980; Sutton-Spence & Woll 1999; Wilbur 2000; Aboh et al. 2005; Zeshan 2006; Lackner 2017). In relation to the above-mentioned findings, headshakes are often referred to as categorical markers of grammatical negation. Zeshan (2004) has argued that the scope and status of headshakes vary in different sign languages, and that the more manual-dominant the negation strategy of a language is, the more restricted is the use of the headshake. However, headshakes have been noted to perform other functions as well. According to Morgan (2006) and Lackner (2017), for example, content questions in Japanese Sign Language and Austrian Sign language may occur with a headshake. A recent study by Johnston (2018) on headshakes in Auslan suggests that the temporal alignment and spreading behavior of headshakes in relation to manually signed sequences is not linguistically constrained, and that the shaking of the head by Auslan signers is similar to the corresponding head movements of English speakers (e.g. signaling the speaker's attitude and emotions regarding the contents of an utterance). Johnston points out that the prototypical negation strategies presented by Zeshan and others (2006; see also Oomen & Pfau 2017) may involve over-systematization of the subject matter due to the data available at that time for typological comparison of different sign languages. He goes on to say that the uncertainties regarding theoretical cross-linguistic generalizations of negation in sign languages can and will be re-addressed, since representative corpora of sign languages can now be used for the testing of these assumptions (Johnston 2018).

Movements such as sideways head tilts or leans of the whole body have also been found to be involved in the coordination of clauses into complex structures (Jantunen 2016). Head nods have been found in elliptical list structures involving multiple coordination (Liddell 1980; Wilbur & Patschke 1999; Wilbur 2000; Puupponen 2012). Head thrusts, on the other hand, have been found to occur in adverbial and relative clauses in ASL subordination (e.g. Liddell 1986; Wilbur 2000). In addition, different head movements have been found to occur also in topic and conditional structures (e.g. Liddell 1980; Aarons 1994; Pfau & Quer 2010). Head tilts have been referred to as markers of subject agreement in sign languages, while changes in the direction of eye-gaze have been said to mark object agreement (e.g. Bahan 1996; MacLaughlin 1997; Wilbur 2000). However, recently these types of nonmanuals, as well as directing the movement of the hand(s), have been considered to be indexical signals that apply the affordances of the visuo-spatial language in order to indicate and track discourse referents, rather than as phenomena comparable to spoken language agreement systems (e.g. Liddell 2003; Cormier et al. 2015b; Schembri et al. 2018; Fenlon et al. 2018). The current study takes as its theoretical starting point this more recent view on referential relations signaled with the head and gaze. Therefore these types of actions of the head and face are not regarded as examples of an agreement system in FinSL, and they are referred to as signals with *reference-tracking functions* (Article III) or as signals *indicating discourse*

referents (Article IV). The reference-tracking function of nonmanual indexicality may emerge in stretches of constructed action, and we do not yet know how frequent nonmanual reference-tracking signals are when there is no enactment in the signing. Finally, head movements have also been said to signal caution, vagueness and existence (Liddell 1980; 1986; Wilbur 2000; Pfau & Quer 2010) and they have been associated with the time frame in which a certain action or event is placed in an utterance (Sutton-Spence & Woll 1999).

In FinSL, nods have been found to occur in equative sentences (Jantunen 2007a), that is, in assertive utterances that have naming, defining and identifying functions. However, Jantunen (2007a, 134) notes that these signals are ambiguous and it is therefore difficult to draw any general conclusions about their syntactic functions. Regarding sentence functions, repeated nodding has been said to perform the same strongly affirmative functions in FinSL (Puupponen 2012) as is generally known to be the case with speakers' nodding, as well (see Section 2.3.2). Savolainen (2006) argued on the basis of an overview that she conducted that polar and content questions in FinSL occur with the same head movements – a chin-down, or a head thrust with optionally a slight chin-up. Savolainen states that the above-mentioned actions of the head and specific eyebrow positions are obligatory for the production of content and polar questions in FinSL. The production of head thrusts in question structures in FinSL was noted also by Puupponen (2012), but it was found then that some thrusts in interrogatives were also produced with a sideways tilt of the head. Puupponen (2012) mentions too that in her data, a backward movement of the head occurred in a content question in which the signer was expressing disbelief, which differs from Savolainen's (2006) previous findings. Regarding negation, it has been suggested that FinSL is an example of a SL with a nonmanual-dominant negation strategy, and that shaking one's head is the most frequent negation strategy of the language (Rissanen 1985; Pimiä 1987; Savolainen 2006). According to Savolainen (2006), headshakes and other non-manuals signaling negation are obligatory in FinSL negation structures. However, this hypothesis needs to be tested with representative data on FinSL use in order to be accepted. Finally, sideways movements of either the whole upper body or only the head have been found to occur in coordination in complex sentences (Jantunen 2016). Otherwise, movements of the body have not been studied in depth in FinSL, although some mentions can be found in relation to constructed action in FinSL (Rissanen 1992; Jantunen 2017a).

2.2.2.2 Head and body movements, the information structure, and the organization of discourse in SLs

Different head and body movements have been found to signal changes and continuities in the structure and information structure of sign languages. Sideways and sagittal movements and positions of the whole upper body or of only the head have been found to participate in distinguishing between shared and new information as well as to signal contrastive and additive relations between signed contents (Wilbur & Patschke 1998; Nespor & Sandler 1999; van

der Kooij et al. 2006; Crasborn & van der Kooij 2013; Lackner 2017). In addition, these same movements have been associated with meanings of exclusion and inclusion (Wilbur & Patschke 1999; van der Kooij et al. 2006). Van der Kooij et al. (2006) showed that these types of movements are also in many ways context-dependent: pragmatic factors affect how contrastive head and body movements come about in discourse. The direction of a movement, for example, may be dependent on the previous discourse.

In addition to the reference-tracking functions presented in the previous section, different head and body movements have also been associated with discourse-organizing functions, in which the movements do not indicate referents. Sideways tilt-like head movements and sideways leaning of the whole upper body (as well as moving the whole body sideways, if standing) have been found to signal the continuity of syntactic or discourse sequences (e.g. Sandler et al. 2011; Sandler 2012; Puupponen 2012; Jantunen et al. 2016a). Single head nods, on the other hand, have been said to signal the boundaries of such sequences in ASL (Wilbur 2000). These signals have been referred to as sign language prosody, as discussed in Section 2.2.1. Wilbur (2000) differentiates between these types of edge- or boundary-marking signals (e.g. head nods or inhibited periodic eye blinks) and so-called domain-marking signals (e.g. brow lowering during questions). She implies that the continuity of syntactic sequences must be signaled during the whole sequence, whereas a signal indicating a transition between syntactic sequences must be punctual and occur after clause-final signs. Wilbur continues that head thrusts differ from the nonmanuals mentioned above in that they are punctual; they do not spread across entire syntactic sequences, nor do they occur after clause-final signs, but rather during them. The current study challenges the assumed discreteness in the division between boundary- and domain-marking, as discussed in Section 4.2 and in Article I.

The findings discussed in this short literature review form the basis on which the results and theoretical conclusions of the current study build. These findings are sporadic but, when taken together, show that the actions of the head and body are involved with different levels of language structure and use. The functions associated with these actions are many: they center around sentence functions; the tracking of reference; constructed action, information structure and the organization of discourse; the fluency of interaction and the establishing of common ground; and signaling speakers' stance and emotions with regard to what is uttered. These functions have been utilized in the analysis of the current study, and the results support the previous findings in many respects. However, especially the arguments regarding the discreteness of these signals as markers of morphosyntactic phenomena are questioned in the light of the results of the current study, as presented in Section 4 and in Articles I and IV.

2.2.3 Usage-based approaches and the concept of 'gesture' in the study of SLs

The effects of Western mainstream linguistics of the 20th century – based largely on Saussurean (1916) structuralist semiotics – on SL linguistics has been pointed out earlier in this Overview. Since the status of SLs among other natural human languages has strengthened, and there is now general acknowledgment that SLs are a part of what the field of linguistics is and should be interested in, several new influences can be found in the theoretical discussion of SL linguistics. For example, SL linguistics has gradually embraced the gestural aspects of sign languages (see e.g. Liddell 2003; Johnston & Schembri 1999; 2010; Johnston 2013; Ferrara & Johnston 2014). This leads to at least two important questions: how is the concept of gesture defined in general and in relation to SLs, and (depending on this definition), what are the connections between sign language and gesture considered to be? The following section (2.2.4) presents different ideas about the relationship between uttering a language and gesturing. At this point it is important, however, to briefly discuss a few ideas that have guided discussion of these questions in the field of SL linguistics.

It has been argued that the gesturing of speakers and signers is different, as signers gesture and sign through the same modalities but speakers do not. This proposed difference has been shown to be false, however, through the study of speakers' so-called vocal gestures, for example (see e.g. Okrent 2002; Liddell 2003; Kendon 2008). The medium from which the signal is produced is therefore not in itself sufficient to define what is a gesture and what is not. Instead, gesture and (sign) language have often been differentiated on the grounds that 'language' forms discrete and categorical units, while 'gesture' is gradient and imagistic (e.g. Goldin-Meadow & Brentari 2017). Formalist approaches to language can easily favor this type of categorical distinction between gesture and sign, as it is assumed that the mental and abstract language system is independent of the use of language, gesturing, and other cognitive and bodily processes (see e.g. Langacker 2008; Haspelmath 2010; Bybee 2010).

As pointed out by Occhino and Wilcox (2017, 36), however, usage-based approaches to languages challenge this view, as they reject the categorical dichotomy that "language (signed or spoken) is wholly categorical while gesture is wholly gradient" (ibid.) and that "gradient elements of signed languages are therefore gesture" (ibid.). According to these approaches, language is not invariable and only discrete, but instead, all linguistic units show gradience (Bybee 2010). Furthermore, "the basic discreteness commonly assumed by linguistic theorists has been discovered in language or imposed on it" (Langacker 2008, 13), rather than drawn from the actual use of a language (see also Occhino & Wilcox 2017). Occhino and Wilcox (2017) also point out that speakers' gestures are not always holistic or idiosyncratic. That is, signals traditionally regarded as language show gradience while signals traditionally regarded as gesture show degrees of conventionality and compositionality.

Generally speaking, it is evident that the concept of gesture is not easy to define, especially in the SL context, and that the definition of what is language has been semiotically too narrow (see e.g. Liddell 2003; Kendon 2008; 2014; Goldin-Meadow & Brentari 2017). Kendon (2017; see also 2008; 2014) has presented a critique on the ambiguity of the concept of gesture:

> "Gesture" is so muddied with ambiguity, and theoretical and ideological baggage, that its use in scientific discourse impedes our ability to think clearly about how kinesic resources are used in utterance production and interferes with clarity when comparing signers and speakers. [--] I argued [in Kendon 2008] that we should get rid of the categories "gesture" and "sign" and proposed, instead, that we develop a comparative semiotics of visible bodily action (kinesis), as it is used in utterances by speakers and by signers. To do this, I suggested, would resolve and clarify the otherwise rather fraught discussions of how "gesture" and "sign" are related, as well as the problems encountered when, in a signed utterance, we sometimes have difficulty in deciding whether a given expression is a "gesture" or a "sign". Visible bodily action in utterance is semiotically diverse in both speakers and signers. Our task as analysts is to set about developing a differentiated vocabulary describing this diversity and to undertake comparative studies of the contexts in which these different forms are used. (Kendon 2017, 30.)

The current study aims to approach the semiotics of signers' bodily actions without getting bogged down in distinguishing what is gesture and what is sign. The theoretical starting points include concepts from the field of linguistics, sign language linguistics, gesture studies and semiotics, as all of these areas are important if one wants to understand nonmanuality while assuming that it may show parallels of form and function with both the vocal and the kinetic signals of speakers. As SL linguistics in the 21st century has more room, so to speak, to embrace the differences as well as the similarities between spoken and signed languages, it is important that we study the differences and similarities in the overall communicative actions of signers and speakers. In this effort, a categorical distinction between language and gesture may only get in the way.

This leads to the important notion that nonmanual phenomena should also be compared to speakers' embodied actions – not only to features of speech and the arbitrary and symbolic units of a language system. Nonmanuals often referred to as prosodic, for example, should be approached in relation to the audiovisual, multimodal prosody of speakers (see e.g. Wagner et al. 2014), not only the acoustic qualities of speech and the prosodic concepts defining those qualities. When we look at speakers, their nonmanual actions have been found to connect to the acoustic features and qualities of speech in many ways (synchronization, proximity of timing). For example, raising and lowering the eye-brows have been found to occur more or less concurrently with changes in pitch in the speech of, for example, French and English speakers (e.g. Cavé et al. 1993; 1996). These signals have been noted to perform functions related to eliciting attention, e.g. in turn-taking, or highlighting important information while speaking (ibid.).

Focusing on the gradient as well as the discrete elements of sign languages is important because discourse strategies involving a lot of gradience, such as

constructed action, have been noted to have an effect on the structure of a sign language – for example on the linkages between clauses (Cuxac 2000; Vermeerbergen 2006; Jantunen 2017). Moving on from the gesture-language dichotomy and embracing the semiotic diversity in signification in signed discourse can be seen, for example, in recent explorations of different aspects of sign languages, such as syntactic structure (Ferrara & Johnston 2014; Hodge & Johnston 2014; Jantunen 2017; Johnston manuscript), reference-tracking and indexicality (Johnston 2013; Cormier et al. 2015b; Schembri et al. 2018; Fenlon et al. 2018), the bi-directional continua between lexicalization and delexicalization processes (Johnston & Schembri 1999; Cormier et al. 2012; Johnston & Ferrara 2012), as well as the general methods of signaling – depiction, indication and description (following Clark 1996) – in sign language discourse (Ferrara & Halvorsen 2017; Ferrara & Hodge 2018). All in all, the general shift of phenomena such as iconicity and gradience from the periphery of linguistics towards its center (e.g. Dingemanse 2017) and the increasing collaboration between gesture studies and sign language linguistics are trends that will greatly benefit the study of sign language nonmanuals in the future. This has also had an effect on the theoretical starting points of the current study, as discussed in the following section.

2.3 Gesture studies

This section discusses how the theoretical framework of the current study is connected to the field of gesture studies. This discipline has influenced the study especially with respect to the discussion of connections between speech and gesture, and the modality-free notion of gesture that links to this discussion (Section 2.3.1). In addition, the study has benefited from findings about the forms and functions of speakers' head gestures (Section 2.3.2). It should be noted that although this section refers to the visual bodily actions of speakers as *gestures*, and to the performing of these actions as *gesturing*, the current study prefers to avoid using the term gesture (largely due to its ambiguity) and instead refers to communicative movements and positions of the head (of speakers as well as signers) as *signals* or *actions* of the head.

2.3.1 Connections between speech and gesture

The connection between speech and gesture is one of the fundamental issues discussed in the field of gesture studies. There are several different views on how speech and gesture are connected, as is summarized in Wagner et al. (2014), for example. In relation to production, there are views such as the so-called *Lexical retrieval hypothesis* (see Krauss & Hadar 1999 and followers), according to which gestures prepare the lexical retrieval of words, and speech and gesture are seen as stemming from separate memory representations (propositional and visuo-spatial representations, respectively). This means that

there is no coordination between them in the processing of semantic features but that there is cross-modal interaction when features happen to be processed by both systems and when gesture prepares the production of words. On the other hand, according to views such as McNeill's (1992; 2005) *Growth Point Theory*, for example, speech and gesture are inseparable parts of one process. Other approaches, such as Kita's (2000) *Information packaging hypotheses*, argue that speech and gesturing interact at an early stage of communicative processing, that in this process information is packaged, organized and distributed across modalities, and that gesture is involved in the conceptualization of information when speaking. The packaging of information is seen as potentially different for speakers of different languages, and gestures are assumed to involve language-specific packaging (Kita & Özyûrek 2003). Some other approaches, such as the *Gesture as Simulated Action model* (Hostetter & Alibali 2008), emphasize the embodied dimension of cognition, and language and imagery are assumed to create mental simulations that lead to motor activations and eventually (especially mimic, action-depicting) gesturing.

With regard to the communicative dimensions of speech-gesture connections, gestures have been noted to organize communication in different ways. Generally speaking, gesturing has been seen as resulting from the needs of communication. This has been supported by evidence of the effects of visibility vs. non-visibility on the forms (e.g. size), functions and frequency of gesturing (e.g. Bavelas 1994; Bavelas et al. 2008; de Ruiter et al. 2012). Gesturing has been widely associated with establishing common ground (Clark & Wilkes-Gibbs 1986): avoiding misunderstanding and maximizing the fluency of communication between the interlocutor(s) (Clark & Wilkes-Gibbs 1986; Holler & Beattie 2003; Holler & Stevens 2007; 2009; de Ruiter et al., 2010; 2012). However, some types of gesturing may also have other sources, as is evident from the fact that so-called *beat gestures* (McNeill 1992), for example – one type of Kendon's parsing gestures that emphasize or align with uttered words – have also been found in situations where interlocutors do not see each other (Alibali et al. 2001).

Kendon (2004), for example, has presented the well-known classification of communicative gestures into *modal*, *performative*, *parsing* and *interpersonal* gestures. *Modal* gesturing conveys meanings related to the speaker's stance towards what is uttered; the functions of *performative* gesturing are related to the speech act or "communicative move" (see Enfield 2009) behind what is uttered; and *parsing* gestures connect to, and participate in, the organization of the discourse structure (Kendon 2004). Interactional or *interpersonal* gesturing may indicate the addressee of an utterance, or it may signal floor-holding or other turn-regulating intentions in conversations (ibid.). In addition, McNeill (1992) has presented a so-called *Pragmatic synchrony rule*, according to which co-occurring signals from different modalities perform the same unified communicative function. Enfield (2009), for example, has continued on this thought in his discussion of how the semiotic complexity in signification with different co-occurring sign-mediums forms *composite utterances*, clusters of

semiotic composites in which different signals come together to form *pragmatically unified* communicative actions.

In addition to the above-mentioned functions, gestures may also be referential. According to Kendon (2004), this means that gestures may be representational (e.g. enactment, non-enacting description, or tracing/drawing contents in the air) as well as indexical (e.g. pointing). As far as their connections to speech are concerned, such gestures have been noted to have complementary and supplementary semantic functions, which means that gestures add information to the semantic content of an utterance in order to improve communication and the cognitive processing involved in it (e.g. Goldin Meadow et al. 1993; Goldin-Meadow 1999). For example, it has been argued that gestures help in the expression of abstract concepts by metaphorical visualizations of abstract thinking (McNeill 1985; Alibali & DiRusso 1999; Cienki & Müller 2008).

The discussion above has summarized some of the different views on the connections between gesture and speech. There is also an increasing interest in a *modality-free notion of gesture* (Okrent 2002; see also McNeill 1992; 2005; Kendon 2008; 2014), according to which speaking a language includes vocal actions that may be regarded as gestural (i.e. gradient, imagistic and unconventional), and the definition of gesture needs to include both vocal and kinesic actions, and therefore be unbound to any specific physical modality (see also the discussion in Section 2.2.3). This view has attracted interest in the field of SL research because it brings the concept of gesture closer to SLs, in which gestural and grammatical actions are known to combine in the same modalities, that is, in the signals from one and the same part of the signer's body. A modality-free approach to communicative actions opens the door to wide semiotic approaches, which do not necessarily categorically differentiate between gesture and language or a linguistic and a non-linguistic sign (see Section 2.4). In this type of approach, the concept of gesture becomes more or less redundant because one sees all the actions of different parts of signers' and speakers' bodies as signals that may be interpreted as signs for something, that include different semiotic strategies (e.g. iconicity, indexicality, symbolicity), and that may be more or less discrete and conventional.

The current study adopts this modality-free approach to signification. In the study, communicative action is seen as including signals from different physical modalities, and these signals are seen both production-wise and interpretation-wise as inseparable and connected parts of human interaction and communication. Further, language is seen as *including* phenomena traditionally associated with gesture, such as iconicity, gradience, and unconventionality. This means that according to the view taken in this study, conventionalized and discrete features and unconventionalized, gradient features come together to form semiotically complex systems through processes involved in their use by a group of people in a given period of time (see also Liddell 2003; Jantunen 2017a). Semiotically speaking, this means that speech/sign and gesture are not considered to always involve different

semiosis (cf. McNeill 2005) but, rather, that speaking/signing include different types of semiosis depending on the type of signification and the proportion of semiotic strategies involved in them (see Section 4.5 and Article IV). The nonmanual signals of signers are presumed to have similar communicational and representational functions to the (manual) gestures discussed in, for example, Kendon (2004). These types of functions have also been associated with the actions of the speaker's head, as is discussed in the following section.

2.3.2 Speakers' head gestures

2.3.2.1 Forms of speakers' head gestures

Different patterns of head movements have been identified in the research on speakers' gestures, of which Wagner et al. (2014) give a comprehensive literature review. In general, it has been noted that in conversations, speakers move their head a lot: in a study by Hadar et al. (1983), English speakers moved their head 89.9 percent of the time during their turn in conversations. This implies that the head of a speaker moves almost constantly, which one can reasonably assume is the case for signers as well. However, in the above-mentioned conversations, not all of this motion was found to be communicative (ibid.), and this too is naturally the case with signers as well.

Communicative movements of the speaker's head are often approached through the concept of an identifiable movement event, a segment. Wagner et al. (2014) have found at least the following head movement events in the literature on co-speech gesture: head *nods* and *upstrokes* (i.e. chin-up), *turns* and *shakes* of the head, head *tilts*, and *protrusions* and *retractions* of the head (i.e. head thrusts and head pulls). In addition, Wagner et al. suggest the addition of a movement pattern which they call a *head slide*. Although these head actions are identifiable from data on spoken face-to-face interaction, they are generalizations of a variety of forms which often occur as segments in a stream of motion. The kinematic characteristics of head movement segments are actually varied and complex as the head moves a lot, in multiple dimensions, and anatomically in different ways (Wagner et al. 2014; see also Article III). Moving one's head activates vertebral muscles and joints in different ways, which results in movements such as spinal rotations around or displacements along three axes of rotation (DeSteno 2011; Wagner et al. 2014; see also Article III). This means that the dynamic qualities of head movements vary, they are always more or less multidimensional, and therefore classification of head movement patterns is difficult (Altorfer et al. 2000; Kousidis et al. 2013; Wagner et al. 2014; see also Articles I & III). It is therefore important when discussing the forms and functions of head movements to acknowledge that they "vary greatly in their exact kinematic realizations (angles, extent), as well as overlap with other movements", as Wagner et al. (2014, 212) put it. Furthermore, it seems that treating these head movement events as discrete classifiable units is a rather simplified way of approaching head gesturing in actual discourse. Kousidis et al. (2013) found that 30 percent of uninterrupted sequences of head movement

may contain up to 10 concatenated head gesture patterns. Nonetheless, identifiable head movement segments form an interesting set of phenomena that allows comparison between the actions of signers and speakers.

In addition to displacement, co-speech head movements have been characterized according to other kinematic features such as direction, cyclicity and intensity (Wagner et al. 2014). Differences in the rate and amplitude of head movements may be significant: for example, Hadar et al. (1985) found that high amplitude nods were often floor-grabbing cues, while low amplitude nods were associated with pitch accented syllables. Smaller nods have also been analyzed as backchannels (Rosenfeld & Hancks 1980) and large amplitude nodding as conveying affirmative meanings (Bousmalis et al. 2012). Also, information concerning attitudes and emotions can be associated with differences in the kinematic characteristic of a head movement: single, rapid nodding implies impatience while moderately fast nodding expresses agreement (Hadar et al. 1985). Finally, the patterns of, for example, lateral (left-right) head gesturing have been described in considerable detail, so that cyclical headshakes, sweeps, slow movements, and repositioning of the head have all been associated with different functions (Heylen 2008; see also Wagner et al. 2014).

2.3.2.2 Functions of speakers' head gestures

Speakers' head gestures are often considered more communicational than referential or semantic (McClave 2000). However, a few types of co-speech head gesturing have been associated with semantic functions, especially as responses to interlocutors' utterances. These are mainly negative meanings with headshakes and affirmative meanings with nodding. Regarding shaking of the head, Kendon (2003) has suggested that, whatever the context, headshakes always share a core meaning of negativity. With regard to the communicational aspects of speakers' head gestures, Wagner et al. (2014) provide a comprehensive literature review of the different functions. Head gestures have been found to play a pivotal role in establishing common ground by giving or eliciting feedback in conversation. Head movements signal attention, understanding and appropriate listening behavior, and elicit feedback together with facial expressions and uninterrupted speech. (Goodwin 1981; Allwood & Cerrato 2003; McClave 2000; Bevacqua 2009; Heylen et al. 2011; Włodarczak et al. 2012; Heldner et al. 2013.)

Nods and upstrokes are frequent head gestures in conversations, especially in the listener role. In a German listener corpus, 81.5 percent of all head movements were found to be nods (Wlodarczak et al. 2012; see also Wagner et al. 2014). Ishi et al. (2014) found that in a Japanese multimodal corpus, 56% of all head movements in conversations – both in speaker and listener roles – were nods. In addition to back-channeling, head nods may highlight verbally expressed information (Wagner et al. 2014). Turns and shakes of the head, on the other hand, have been found to occur as negative responses. Protrusions and retractions of the head (i.e. head thrusts and head pulls), have

been found to occur less frequently in co-speech gesturing than rotation movements (Wagner et al. 2014). They may be associated with signaling surprise and attention, among other functions (Wagner et al. 2014).

In addition, gesturing with the head has been found to have turn-regulating functions when performed together with the gaze (Duncan 1972; Hadar et al. 1984; Jokinen et al. 2010), and to signal changes between direct and indirect discourse (McClave 2000) or changes in topic and narrative (Kendon 1972). In addition, protruding head movements have been associated with deictic functions: abstract deixis related to the discourse (e.g. alternative topic, Wagner et al. 2014), pointing at elements in a list (Kendon 1972; McClave 2000; Heylen 2005; 2008), or participating in the referential use of space (McClave 2000; Heylen 2006). Head movements have also been associated with prosodic phenomena: pitch-accented syllables have been found to occur with low amplitude nods, for example (Hadar et al. 1985). Finally, head gestures together with facial expression have been found to convey meanings related to attitudes and emotions such as disbelief, understanding, interest, surprise, impatience and agreement (Heylen et al. 2008).

Poggi et al. (2010) found that head movements are context dependent and vary greatly in meaning, but that typicalities can be found in their use. They go on to say that many head movements depend heavily on interlocutor role: speaker nods are often seen as signaling importance while listener nods convey meanings of acceptance. As a general point, it should be noted that the co-occurring multimodal and discourse context is important in the interpretation of the functions of head movements (e.g. Rosenfeld & Hancks 1980; Poggi et al. 2010). Interpreting a specific function for a co-speech head gesture is often affected by various factors, including the co-occurring facial expression, prosodic features and gaze. For example, head tilts have been associated with disbelief and not understanding, or interest and surprise, depending on the co-occurring facial expression (Heylen et al. 2008). In addition, nods with a frown have been noted to signal or depict dislike (Heylen et al. 2008), listener nods agreeing and understanding, and listener nods with a smile liking or accepting (Bevacqua 2009). We can conclude that signals from different modalities, such as head movements, gaze, and spoken signals, are very closely connected and their principal functions may be shared. As Wagner et al. (2014) observe:

> These relationships exploit the economy and degrees of expressiveness enabled by the simultaneous activation of channels in the same bodily area. This physical relationship may explain the evident and uncontroversial close meshing of several functions in head gestures: the interactive, the pragmatic and the semantic, as well as the attitudinal and emotive. Manual gestures in comparison, seem to act relatively more independently and to have a differentiated capacity to represent propositional content, adding a mode of expression that is often faster and more effective than speech. (Wagner et al. 2014, 213.)

The connections between signals from different parts of the body are important issues also in the study of sign languages. These aspects of signed discourse call for a semiotic approach that investigates both the central semiotic features in the signals of different parts of the body and their inter-relationships in the

unified actions that they form together. For these reasons, the theoretical starting points of the current study include a semiotic framework, which is presented in the following section.

2.4 Semiotic framework of the study

The modality-free notion of gesture, presented in Section 2.3, guides the theoretical starting points of the study to the field of semiotics. If gesturality can be seen as something defining speech-related phenomena as well as visual bodily action, one cannot presuppose a categorical distinction between signing and gesturing, either. Instead, signals coming from different physical modalities can be approached according to their semiotic characteristics, that is, through how people signify with them, regardless of whether they are produced with the hands, vocal cords, the face, the head, or other parts of the body. In this approach, also the distinction between language and non-language becomes more blurred. An abstract semiotic framework is not based on one specific sign system, such as a natural language, and therefore it does not exclude from investigation signals which are significant but which do not form conventionalized form-function pairs or involve semantic conceptualization, for example. A sign can connect to its object through the analogical association of qualities or physical, spatio-temporal contiguities (e.g. proximity of timing), not necessarily through the recognition of a convention. In this way the semiotic approach includes the idea that a meaning does not have to be a static relation between a signifier and signified but is a dynamic, motivated phenomenon (Hanks 1990; Enfield 2009).

In the theoretical framework of the current study there are influences from Peircean and post-Peircean semiotics (Section 2.4.1). This can be seen especially in Substudy 4, in which actions of the signer's head and body are viewed according to semiotic strategies (Section 2.4.2) and according to the communicational unity of co-occurring signals in linguistic actions (Section 2.4.3), as well as in relation to the semiotic centralities in signification with different parts of the signer's body (Section 2.4.3). The content of the current section is discussed in more detail in Article IV. It should be noted that in the current study, the semiotic analysis focuses only on communicative actions, and the signals of the head and torso are studied from signed discourse.

2.4.1 Semiosis and the sign

C. S. Peirce's (e.g. 1894; 1903) traditional and well-known Theory of signs is a semiotic treatment of *signification*, that is, the process of how things become signs for something else. According to Peirce, knowledge, and the world in general, are comprised of signs, and in his phenomenological philosophy, different aspects of reality can be described on the basis of how things are experienced. The core concept of Peirce's signification is *semiosis*, the event

involved in the interpretation of a sign. Semiosis is a tripartite relation which involves a *sign*, an *object*, and an *interpretant*. In semiosis, things become signs because they are interpreted as standing for something else, their objects (Peirce 1903). The object is what the sign stands for (Peirce 1894, 1903; Kockelman 2005). It may be something perceivable, such as something a person is pointing to (Peirce 1903; Kockelman 2005), or it may be something less precise and more abstract, such as something that directs us to a certain behavior (e.g. stroking a cat) once we have observed a sign (e.g. the cat's purring sound) (Kockelman 2005). The interpretant, on the other hand, is what happens in our minds and/or bodies when we experience that a sign stands for its object; it is the effect that a thing standing for something else has on us (Peirce 1903; Atkin 2013, Kockelman 2005). It need not be mental or verbal, instead it may be "embodied in actual behavior" (Kockelman 2005, 251). These embodied interpretants may be bodily processes without any physical effort or commitment: they are changes in bodily state, such as a feeling of pain or blushing (Kockelman 2005).

In Peirce's semiosis anything may become a sign if it ends up being interpreted as standing for something. For example, an entity or an event (e.g. a flash of lightning) becomes a sign when it is interpreted as standing for its object (e.g. a thunderstorm). The social practice of joint attention is another example of this: when a child turns their attention to what their parent is observing, the change in the child's attention is the interpretant, the direction of the parent's attention is the sign, and the thing that the parent is attending to is the object (Kockelman 2005). Identifying different forms of a language – such as distinguishing boundaries in the speech signal – may in itself already be an interpretation of a sign in the Peircean sense, even though these signs would or could not *have a meaning* in the Saussurean (1916) sense (Nieminen 2010). In other words, signs may signify without being interpreted as meaningful or without being involved in semantic conceptualization (see also Kockelman 2005; Enfield 2009; Diessel 2017). Even though some signs do not have a conventionalized way of being interpreted as standing for some precise event or entity, they connect to other signs to form intentional and meaningful social actions which involve semantic conceptualization (see Enfield 2009). Finally, in relation to the embodied interpretation and involuntary production of signs, it has been suggested that these may show a different level of *control* (also referred to as *agency*; Kockelman 2005; Enfield 2009). Some signals are more deliberate, in that they involve more intention or steering, while others are more reactive, automatic and uncontrolled (e.g. Kockelman 2005; Enfield 2009). Questions regarding the degree of control of different signs are discussed in more detail in Article IV.

2.4.2 Semiotic strategies: iconicity, indexicality, symbolicity

Depending on the type of connection between signs and their objects, Peirce (1903) defined signs as *icons*, *indices* or *symbols*. These three types of connections he refers to as the *ground* of the sign (Peirce 1903). An icon, such as a good portrait of a person, represents its object through qualities. An icon and its

object share these qualities, which means that an icon resembles some aspect(s) of its object (Peirce 1903). An index, on the other hand, connects to its object primarily through a physical relation. This relation comes about as contiguity in time and space; it is, for example, an effect or an impact (Peirce 1903; Kockelman 2005). According to Peirce (1903), this connection between an index and its object does not primarily induce an association of the similarities between them, as with iconic signs. Indices – such as smoke indicating fire or dark clouds indicating forthcoming rain – signify because the physical connection between the sign and the object is observed (Peirce 1903; Kockelman 2005). Finally, symbols are signs, such as the lexical words or signs of a language, that connect to their objects through a convention: something is systematically or according to a certain rule interpreted as standing for something else. A symbol signals that something is of a certain kind (i.e. something is associated with a general rule or habit) rather than a single particular thing (Peirce 1894). This means that a symbol is always a type (in Peirce's terms *a legisign*): a generalization of single token entities (in Peirce's terms *replicas*) of the type (Peirce 1903).

According to Peirce, icons, indices and symbols are essential for human cognition and reasoning (Peirce 1894). However, Peirce (1894) describes these different types of sign-object connections as features rather than categories, and states that human reasoning involves a mixture of them. A single sign may simultaneously have iconic, indexical, and symbolic features: Peirce (1903) states that an index may be also iconic. For example, a sign such as a weather-vane signifies because of a physical connection – the orientation of the vane changing according to the direction of the wind – which means that it is an index of something (Parmentier 1994; Kockelman 2005). However, it also includes the association of similarity between the direction of the object's orientation and the direction of the wind (i.e. iconicity) (Parmentier 1994; Kockelman 2005). Because of these inclusive relations in the Peircean theory, Kockelman (2005, 246) points out that "it is best to talk about iconic, indexical, or symbolic grounds, rather than to talk about icons, indices, and symbols per se".

One frequent example of this connectedness is a footprint in the sand, which can easily be seen as having iconic, indexical and symbolic features. The indexicality in the sign (i.e. a physical connection: the weight of a foot leaving a trace in the sand) links an event (i.e. someone walking) to something in time and space (i.e. that the walking occurred in that particular location), as well as to the person who left the trace behind. That is, this type of spatial, temporal and causal contiguity forms the indexical ground of the sign (Peirce 1903; Kockelman 2005; Enfield 2009). On the other hand, identifying the similarity between a trace on the ground and a characteristic of its source is based on iconicity: on the association between the qualities of the footprint, and the qualities of its object, the foot. This association is central to what makes a footprint a footprint, in addition to the physical phenomenon through which it exists. Finally, although we may see only parts of a footprint, we still might

recognize what it is: we are guided by our knowledge (based on convention) of what footprints are, how they are formed and what they look like. These different semiotic grounds of the sign come together when we use and interpret signs.

In this study, iconicity is defined as "a relation between the sign and its object which is based on perceptual analogies" (Article IV, 9), indexicality is defined as "a relation between the sign and its object that is based on spatial, temporal or causal contiguity" (ibid.), and symbolicity is defined as "a relation between the sign and its object that is based on a norm in a community according to which the sign is regarded as standing for the object" (Article IV, 9; see also Peirce 1903; Parmentier 1994; Kockelman 2005; Enfield 2009; Dingemanse et al. 2015). These three types of signification are referred to as the *grounds* of a sign, or *semiotic strategies*, and no distinction is made between these two terms in the study. Finally, conventions and automatization emerging in one person's communicative actions are referred to as *entrenchment*, while socially shared habits in communicative actions are referred to as *conventionality* (e.g. Wilcox & Xavier 2013).

2.4.3 Semiotically complex utterances and their pragmatic unity

Utterances, intentional social actions occurring in discourse, are semiotically complex, especially when one counts the signals from different sign mediums (e.g. speech, movements of the body) as parts of one and the same utterance (e.g. Kendon 2004; Enfield 2009). According to Enfield (2009, 15), in a communicative action, signs from different *sign mediums* – that is, modalities of semiotic information – come together into a "communicative move that incorporates multiple signs of multiple types". He calls these communicative actions *composite utterances* (ibid.). Some of the co-occurring signs are more conventional (e.g. words, emblems), some more unconventional (e.g. pitch, depicting movements of the hand), and others hybrids of conventional and unconventional features (e.g. pointing actions). The interpretation of these semiotically complex clusters of co-occurring signs happens through the "recognition and bringing together" (Enfield 2009, 11) of the signs while presuming "pragmatic unity despite semiotic complexity" (ibid). This means that although utterances are semiotically complex and consist of simultaneous and multimodal signification from different sign mediums, these parts of signification are connected and come to exist as parts of one event which is driven by intentional social action (Enfield 2009). In relation to the current study, this means that the meanings and functions of head and body movements in signed interaction do not emerge, and are not interpreted in, isolation: they are a part of multimodal social actions of communication which involve several different semiotic resources. The degree to which the functions of different signals are complementary or the function of one signal is dependent on another may vary according to the requirements of the communicative situation and the chosen discourse strategy.

Despite the holistic nature of communicative actions, which brings together signals from different sign mediums, there are also differences in the central semiotic features in the signification with these different mediums that go back to their physical characteristics. There are differences in what kind of information is easy to convey with different parts of the body. Hand movements "are well suited to iconic–indexical meaning thanks to their rich potential for sharing perceptible qualities in common with physical objects and events" (Enfield 2009, 18), whereas the face is a convenient medium for signaling emotions and attitudes (Wagner et al. 2014). The correspondence between the physical characteristics of different parts of the body and the semiotic features central in signification with them is a relevant issue, and exemplifies the fact that the communicative and meaningful aspects of human interaction are connected to the physical world and our embodied experiences and actions in it. This is discussed further in Section 5 and in Article IV. In the discussion, the term *sign medium* will be used to refer to the different parts of the body – the hands, face, head and torso – through which signals are produced in signed discourse (see also Enfield 2009).

3 DATA, METHODOLOGY AND RESEARCH PROCESS

The current PhD research project was conducted between 2014 and 2018 at the Sign Language Centre at the University of Jyväskylä, Finland. The study is built around the usage-based approach to language (see previous section) and is therefore data driven. It uses materials collected from different types of genuine, communicative situations involving different FinSL signers: continuous dialogues on topics related to everyday life or memorable matters related to the deaf world, narrative retellings of stories in picture books, and semi-structured monologue data presenting thoughts on a current question in the Finnish deaf community. These different types of data are approached through a descriptive method in which annotation and analyses of the data are built on observations of the material and interviews with native informants. At the beginning of the research project, in Substudy 1, this descriptive process included multiple rounds of data analysis moving from raw, low-level annotations toward more abstract annotations of forms and functions. In addition, the description of the data included a kinematic analysis of the forms of different head and body movements on the basis of kinematic information from Motion Capture recordings. The work on the data in Substudy 1 formed the basis for an annotation scheme[1] applied in the annotation and analyses of the data used in Substudies 2, 3 and 4. Finally, the theoretical view of signers' head and body movements, presented in Substudy 4, is based on all the previous work – on the annotation and analysis done on these different types of materials. The different datasets and methodologies of the study are discussed further in the following sections, which include an outline of the process. A more detailed account of the data and methodology of Substudies 1–4 can be found in the articles attached at the end of this Overview.

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1 In Substudy 3 the scheme was applied only partly, in the frequency counts of different head movement types. For the purposes of other research questions, annotations of the scheme were combined – for the needs of the comparison between head and torso movements – into broader groups that included annotations of several movement types according to their approximate direction.

3.1 An overview of the data

The datasets used in the research project include video materials from the Corpus Project of Finland's Sign Languages (CFINSL narratives & dialogues) and from the Swedish Sign Language corpus project (CSSL narratives), as well as synchronized motion capture and digital video recordings (MoCap dialogues). All of the substudies in the current study used a slightly different dataset, according to their requirements and research questions. Substudy 1 is based on MoCap data, Substudy 2 on corpus narratives of FinSL and SSL, and Substudy 3 on corpus narratives in FinSL. Substudy 4 draws on work done using all the above-mentioned datasets. The data used in each substudy is summarized in Figure 3. After that comes a discussion of the research process and methods for each substudy in turn.

FIGURE 3 Data used in the research project for each substudy (S1–S4).

The *MoCap dialogue data* includes altogether 2 minutes 15 seconds of synchronized Motion Capture recordings and digital video material of two continuous dialogues in which two native FinSL signers talk about their work, studies, and everyday language use (see Article I). The data was collected during the year 2011 at the motion capture laboratory of the Department of Music at the University of Jyväskylä, Finland, with an eight-camera optical motion capture system. In the Motion Capture recording, infrared cameras track the locations of ball-shaped, light-reflecting markers that have been attached to different parts of a signer's body (see Figure 4). The kinematic investigation of head movements in Substudy 1 was conducted on the basis of location data recorded of the right-forehead marker. The recording and processing of the data is described in more detail in Jantunen et al. (2012).

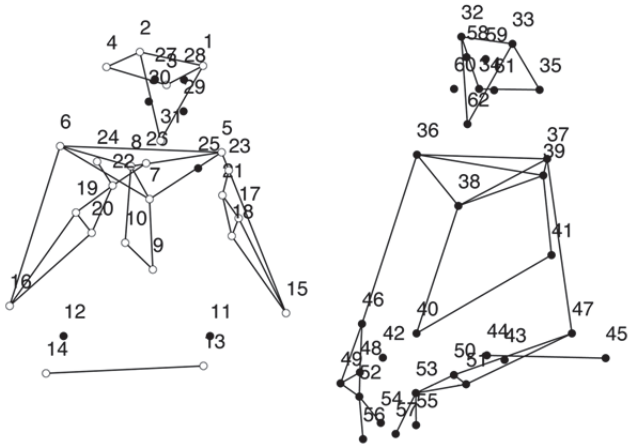

FIGURE 4 The marker setup in the MoCap data (Jantunen et al. 2012).

The corpus materials of FinSL include both narrative and dialogue data from altogether 12 native FinSL signers between the ages of 20 and 59, recorded and processed at the University of Jyväskylä (see e.g. Puupponen et al. 2014; Salonen et al. 2016; Jantunen et al. 2016b). The material was recorded in the Audio-Visual Research Centre at the University of Jyväskylä during 2013, and the recordings were conducted with multiple cameras in a dialogue setting (Figure 5).

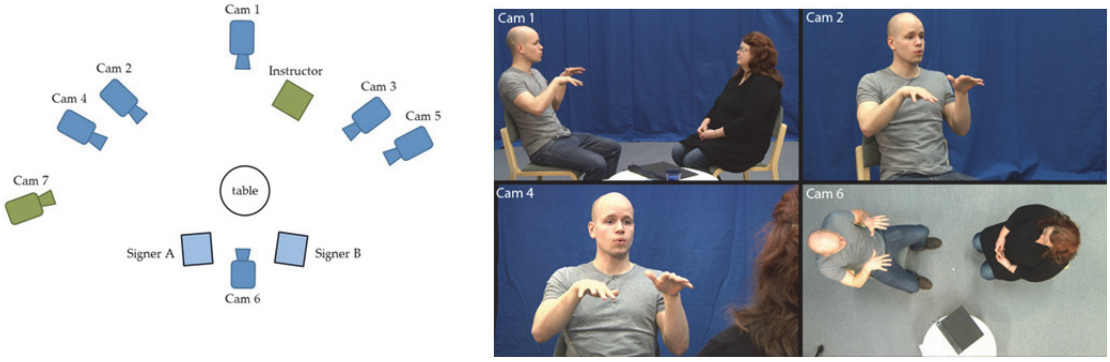

FIGURE 5 The camera setup (a) and screenshots from the material from different camera angles (b). (Images from Puupponen et al. 2014 & Salonen et al. 2016.)

The *CFINSL narratives* include a total of 12 retellings of two picture-books, *The Snowman* (6 narratives), and *Frog, where are you* (6 narratives). The overall duration of the dataset is 45 minutes, and a small part of this data is available in the Language Bank of Finland, which is a part of the Clarin consortium (see Jantunen et al. 2016b; Jantunen 2017a). The *CFINSL dialogue* data consists of altogether 6 dialogues between the same 12 signers as in the narratives. In these dialogues, the signers discuss their experiences and thoughts on various matters related to the deaf world, such as traditions, national and international cultural events, sports, and so on. The overall duration of the dataset is 64

minutes. The *CSSL data,* used in Substudy 2, consists of materials from the Swedish Sign Language corpus: altogether 10 narrations of the picture books *The Snowman* and *Frog, where are you* by 10 native SSL signers between the ages of 20 and 59. Finally, the study also includes other data, such as a 1-minute-8-second-long stretch of video material recorded by the Finnish National Association for the Deaf, in which a native FinSL signer discusses the relationship between young deaf people and traditional national deaf associations. Further information about the participants in the data is presented in Table 2.

TABLE 2 Information about the participants in the data.

Dataset	Nr	Age	Gender	Regional origin
MoCap	2	30-39: 1 50-59: 1	Female: 2	- -
CFINSL	12	18-29: 9 30-39: 1 50-59: 2	Female: 8 Male: 4	Eastern Finland: 2 Southwestern Finland: 2 Western and Inland Finland: 4 Northern Finland: 4
CSSL	10	20-29: 3 30-39: 4 40-49: 1 60-69: 2	Female: 6 Male: 4	Svealand: 4 Götaland: 4 Norrland: 2

3.2 Substudy 1

Substudy 1 describes and analyzes the forms and functions of four different types of head movements in FinSL, all moving in one way or the other in the sagittal dimension: single nods, repeated nodding; head thrusts (forward directed head movements) and head pulls (backward directed head movements). In the early stages of the study, the video materials of the MoCap dialogue data, which already included annotations for manual signs and sentences, were annotated in ELAN for different head movements, of which the four above-mentioned movement types were selected as the focus of the study. Annotations were also created for the frame-number information of each head movement, so that movement-specific numerical information could be located in the Motion Capture data. For all head movements identified as nods, nodding, thrusts, or pulls, corresponding numerical location information from the right-forehead marker was located in the Motion Capture data in the dimension depth. From this data, calculations were made of the Euclidean

Norm of the location vector (referred to in the study as the *amplitude*) in Matlab, using the MoCap Toolbox (Burger & Toiviainen 2013). This numerical amplitude information was then imported into Excel, in which the data was normalized for the need for visual illustrations of the amplitude information. After this, information about the variation and average amplitude of each head movement type was studied and some statistical comparison conducted between two different head movement types, the nod and the thrust.

The functions of different head movements in the video data were annotated and analyzed through a multi-phase process from raw-level annotation towards the creation of a functional typology. This process resulted in a classification of the functions of head movements into altogether seven different types, presented in Section 4.2. Finally, the form-function patterning and central functions of different head movement types were studied through cross-tabulation of the frequency of occurrence of different form-function combinations. A detailed description of the data, annotation and analysis is given in Article I.

3.3 Substudy 2

Substudy 2 is a case study that further investigates one specific form-function connection found in Substudy 1: the discourse-organizing function of single head nods. The study was carried out on the basis of corpus data and it compared the relationship of head nods with syntactic boundaries in the narratives of two historically related sign languages, FinSL and SSL. In the study, the relationship between head nods and syntactic boundaries was investigated in terms of temporal alignment: it studied the proximity of timing of the head nods with manually produced sentences in 10 corpus narratives from each language (the data consised of altogether 20 narratives).

Both the CFINSL and SSL narrative data included annotations for manual signs and sentences. During the study, annotations were created in ELAN for head nods as well as for the alignment information and functions of head nods. In the annotation process the duration of the nods and their timing with syntactic units was studied with the help of the multi-angle video data as well as of computer-vision-based numerical data viewed in ELAN as graphic visualizations (see Article II; Jantunen et al. 2016b). In the analysis, head nods were classified according to their alignment with syntactic units into on-boundary nods and clause-internal nods. After this, on-boundary nods were further divided into 6 subtypes according to how they were exactly aligned with the transitions between syntactic units. In addition, the analysis included a description of the variation between individual signers in the number of head nods and overall duration of the story, as well as a comparison of the frequency counts of the different types of nods in FinSL and SSL. A more detailed description of the head nod classification and the results of the study are given in Section 4.3 and in Article II.

3.4 Substudy 3

Substudy 3 investigates the relationship between actions of the head and the torso in FinSL. It compares the overall activity of these two body parts, that is, the frequency of different types of head and torso movements, and describes the signer-specific variation in this activity using corpus narratives. In addition, the study provides an analysis of the coexistence of signals of the head and the torso in the narratives. The study is based on the CFINSL narrative data, also used in Substudy 2. The data used in Substudy 3 consists of altogether 12 signed narratives and it includes annotations for manuals signs, sentences, syntactic structure, head movement types, torso movement types, and the interplay between head movements and torso movements and their functions. Different portions of the data were annotated and analyzed on different levels according to specific research questions. On the basis of the head and torso movement annotations of the whole data set (12 narratives), the study described the frequency of occurrence of different types of head and torso movements and the variation between individual signers in the overall number of head and torso movements.

The interplay between different forms of head and torso movements was annotated and analyzed from a subset of 6 narratives. Annotations for different movements were merged together in ELAN according to their direction – forward, backward, right, or left – first for the head movements and then for the torso movements. Automatic annotations were then created in ELAN for the co-occurrence of these merged annotation cells, resulting in annotations for overlapping head and torso movements according to their direction. The analysis of the co-occurrence of the head and torso movement combinations included classification of the combinations according to their degree of complexity (i.e. whether the combination included movements in single or multiple directions) and a frequency count of the different types of combinations. After this, the functions of the overlapping torso and head movements were annotated and analyzed from a subset of 4 narratives. Finally, the frequency of occurrence of functionally complex head and torso movement combinations was described in relation to the complexity of the forms in the combinations. For a detailed discussion of the annotation and analysis of Substudy 3, see Article III. The results of the study are summarized in Section 4.4 of this Overview.

3.5 Substudy 4

Substudy 4 presents a semiotic typology of the movements of the signer's head and the relationship of these movements to the semiotic strategies of iconicity, indexicality and symbolicity. In addition, it discusses how the actions of the signer's head are a part of the holistic, semiotically complex communicative

actions carried out with the signer's body, as well as the central semiotic features of the actions of different parts of the signer's body (i.e. different sign mediums). The study draws on the data, annotation and analysis done in Substudies 1–3 as well as on the CFINSL dialogue data and the semi-structured monologue data described in Section 3.1. The semi-structured monologue data (also including computer-vision-based motion analysis) was annotated and analyzed for manual signs and sentences, as well as for head movements, their internal movement phases, and their functions (see Puupponen 2012). The CFINSL dialogue data includes annotations for manual signs and sentences. For the requirements of Substudy 4, examples of different types of head movements were identified by means of an overall visual examination of the data, and with searches on the basis of the annotations, done with the search functions available in ELAN.

On the basis of the above-mentioned materials, a semiotic typology was created of the actions of the signer's head. The typology includes altogether 6 different head movement types, which are summarized in Section 4.5 and discussed in more detail in Article IV. The semiotic features of these different head movement types were studied according to Peircean and Post-Peircean semiotics (see Section 2), and compared with features found in actions of other parts of the body, according to a literary review of sign language linguistics. Drawing on this work, what emerged from the study was the formulation of a metatheoretical view of signers' head movements, a conceptual framework for studying nonmanuals such as head movements in sign language linguistics, and suggestions for implementing nonmanuality in a theory of language.

4 ACTIONS OF THE SIGNER'S HEAD AND BODY IN FINSL

This section presents the main results of the current PhD project in relation to the central research questions of the study (Section 4.1) as well as the most significant results of each particular substudy (Sections 4.2–4.5).

4.1 Main results of the study

The current study was built around the five central research questions presented in Section 1.2. The questions are repeated here for the sake of clarity. (Q1): What kind of movements and positions do signers produce with their head and body? (Q2): What kind of functions do the above-mentioned movements and positions have? (Q3): What kind of relationship do the actions of the head and the body have, and what is their relationship to other non-manual actions? (Q4): What is the relationship between nonmanual and manual actions? (Q5): What is the role of nonmanuality in language in general? The following paragraphs present summaries of the main results of the study in relation to research questions Q1–Q5.

1. **Formal and functional patterning can be found in the actions of a signer's head and body but they form prototypes rather than discrete classes. (Q1, Q2)**

The head movements investigated in the study are kinematically different and their movement patterns can be grouped into formally varying types, of which the average movement may be seen as the most prototypical movement. Head movement events occurring during signing may show features of several prototypes of form and are therefore situated somewhere between these prototypes, as is the case with, for example, some head nods and head thrusts (see Article I). This means that the peripheries of prototypes of form, that is, the

less representative movement events, may be seen as forming continua that merge together. A particular movement event may be situated in different places in these continua according to its formal features. In other words, the patterns in the forms of head movements form types that are gradient, not discrete. Also the movement types of the torso that are identifiable from naturalistic data, such as turning the torso or leaning the torso sideways, are prototypes rather than discrete classes of form. As pointed out in Article III, the anatomical characteristics of the upper body alone involve the activation of several joints and muscles, and movements may emerge as combinations of prototypical movement patterns.

The same holds for the functions of these actions. Signals produced with the signer's head and body perform various functions, which can be grouped into functional prototypes. However, these different types are in many ways overlapping, and the function of a particular movement event may show features of several different types. For example, an affirmative single head nod may emerge at the end of the sentence and in this way organize the discourse by indicating a transition between syntactic and/or discourse sequences (see Article II). Another example is a movement or position of the body that indicates the continuity of a discourse sequence while enacting a referent (see Article III). The discourse-organizing function of the movement is similar to manual discourse-organizing elements such as so-called buoys (see Liddell 2003).

2. Forms and functions in signers' head and body movements rarely show conventional pairing of one form to one function, so types for tokens are rare. (Q1, Q2)

As was shown in the last paragraph, a single movement of a certain type may have several overlapping functions. The study also shows that movements of the same type, such as head nods, may perform different functions in different contexts. Equally, one functional type may be signaled with different types of movements. For example, organizing the discourse by indicating the continuity of a discourse sequence may be signaled with a thrust of the head, the leaning forward of the whole upper body, sideways movements of the head or the whole body, headshakes, and so on (see Articles I and IV). In addition, movements such as head thrusts, head nods and sideways head tilts were all found to occur in multiple coordination structures in which signers produce lists (see Article I). Which movement occurs in a given list structure depends on individual differences and preferences, as well as on the discourse context. How the head and body move before and after the utterance, and how the hands move before, during and after the utterance, are all factors that might affect the form of a specific head movement emerging at a specific moment. This means that the co-occurring signals produced with other sign mediums, and the preceding and following signals from the same sign medium, can all affect the form of the signal. Also, in many cases it may be more significant that *something*

happens in the actions of the head and body, the exact form of the movement being less important (see Article I). If this is the case, it implies that when trying to understand signals of the signer's head and body, contrasts between stillness and motion (movements and positions), or between different formal features, such as direction, may sometimes be more important than the fact that the movement is characterized as a nod or a thrust, for example.

These conclusions on head and body movements highlight the fact that also the functions of these movements often rely on contextual association (Enfield 2009) rather than conventional form-function pairing. That is, signals of the head and body rarely form types for tokens, in which a specific form connects to a particular function conventionally and different actualizations of this relation are tokens of a type (or replicas of legisigns, as Peirce (1903) calls them; see Article IV). According to the current study, only shaking and nodding the head, possibly also shrugging the shoulders, show this level of conventionality and shared norms. These are signals that involve shared norms in their interpretation in many parts of the world, in the communication of both signers and speakers. Functionally they express a variety of closely connected meanings that form a gradient functional type rather than a single specific meaning. Which functional tones are associated with a particular headshake, for example, depends on the context in which the headshake emerges and the communicative move (Enfield 2009) made with the utterance.

3. **The head is much more active than the torso in signing and, in general, these two body parts cannot be seen as one articulator in FinSL. Signals from the head and torso come together into combinations that differ in their degree of complexity both formally and functionally. (Q1, Q3, Q5)**

The head and the torso are not equally active in signed discourse: movements of the head are clearly more frequent than movements of the whole upper body. An average FinSL narrative included four times as many head movements as movements of the whole upper body (see Article III). When a movement of the torso emerges, the whole upper body usually moves together, so that the combination of the head and torso movement is simple and unidirectional. In some cases, however, a movement starting unidirectionally changes so that the combination becomes more complex. This means, for example, that although the torso and the head start to move together, the head may start to produce independent movements during the more global movement of the whole upper body. It may be that the more complex the movement combination is, the more control is needed in its production (cf. Kockelman 2005; Enfield 2009).

Additionally, the more complex the combinations of co-occurring head and torso movements are in form (signals are not uniform), the more complex too are the combinations of the functions of the combined signals (the functions are not alike). For example, while the whole upper body may start to enact a referent, this may be followed by a position of the body that signals the continuity of a stretch of discourse while the head produces different kinds of movements. These head movements may have non-enacting functions, such as

shaking or nodding the head as narrator commentary on the ongoing enactment. In this case, the enactment is only partial, as Cormier et al. (2015a) have pointed out. The functional connections between co-occurring nonmanual signals do not, however, depend only on complexity of form. Factors such as the physical characteristics of different sign mediums, the tendencies or patterns of specific communicative actions, and the semiotic features of co-occurring signals, all play a part in this. This issue is discussed further in 6, below.

4. **Systematicity can be found in the co-occurrence of particular head movements and manual syntactic units both language-specifically and between two historically related sign languages. (Q4)**

Although the form-function patterns of signers' head movements are rarely one-to-one, there are typicalities in how certain head movements connect to certain functions. If a function of a head movement comes about mostly in its relation to the actions of the hands – as is the case in discourse-organizing functions of head movements, for example – this systematicity emerges also in the connection between head movements of a certain type and manually produced signals. According to the study, a certain type of head movement, the single head nod, tends to emerge in the proximity of transitions between syntactic sequences in the narratives of both of the historically related sign languages examined here, that is, FinSL and SSL (see Article II). More specifically, a tendency was found for nods to occur sentence finally in both languages. This shows that, although native FinSL and SSL signers have reported the feeling of a rhythmic difference between these two languages, head nods indicating a transition between syntactic sequences do not seem to be the source of this feeling. Moreover, nods have also been found to coincide with transitions in syntactic structure and discourse with speakers (e.g. McClave 2000; Aoki 2014). This raises the question of how shared this feature is among signers and speakers, and whether it is a result of embodied dimensions of thinking while uttering. However, it should be noted that transitions between discourse sequences are indicated with different kinds of signals, both of the head and of other sign mediums, not only head nods.

5. **Nonmanual signals such as head movements involve different proportions of iconicity, indexicality and symbolicity. In signals of the head, indexicality is generally the most prominent strategy. (Q2)**

According to the study, signals produced with the head involve different proportions of the semiotic strategies of iconicity, indexicality and symbolicity, depending on their type (see Article IV). The most prominent feature in actions of the signer's head is indexicality: all head movements indicate referents, indicate discourse structure or indicate signers' reactions to something. Iconicity is most prominent in enacting head movements and head movements visualizing a time metaphor, but iconic association (association of analogies) is

involved to some degree in all other head movements as well. Symbolicity emerges mostly in the recognition of general ways in which different communicative actions (pointing, organizing discourse, enactment) are executed, rather than as one form connecting to one function regardless of the context. On the basis of this conclusion, signals produced with the face or hands are also expected to involve differences in the proportions of semiotic strategies, depending on the medium. This is discussed further in Section 5.

6. **In signed utterances, nonmanual signals are a part of a semiotically complex but communicationally holistic unity. Despite the unity, there are differences (i) in how complementary co-occurring signals are, and (ii) in the central semiotic features in signification with different parts of the signer's body. The latter can be partly traced back to the physical and anatomical characteristics of different parts of the human body.** (**Q3–Q5)**

According to the study, nonmanual signals such as movements of the head or the body cannot be analyzed as isolated elements. In signed utterances, single signals are always part of semiotically complex bundles of co-occurring signals produced with different sign mediums (here: hands, face, head and the upper body; see Enfield 2009). The signals emerging in these bundles are connected through a unified communicative action in which contextual association plays a large part (see Enfield 2009). Although always connected, the functions of some signals, such as signals organizing the discourse, for example, are more dependent than others on other co-occurring signals. Relations between the functions of co-occurring signals may be emphasizing, complementary, or connected. That is, signals may share exactly the same function (as if they formed one articulation), the interpretation of the function of a signal may be fully dependent on (an)other signal(s) (e.g. head movements organizing manually produced sequences of discourse), or the function of a signal may be more independent and only connect to other signals in the interpretation of the meaning of the whole utterance. These different options are not categorical, but form a gradient continuum from strong connections to weaker connections between the functions of co-occurring signals. The variation in this strength of connection depends on the general function of the communicative action and it is context dependent. Because functionally more independent signals are still seen as connected to other signals, this means that, according to the view taken in the current study, co-occurring signals are always semiotically connected to some extent.

As already discussed in Section 2, it has been suggested that the syntactic structure of a sign language (e.g. how hierarchical as opposed to how flat the linkages between clauses are) is affected by how much of the discourse content is enacted (Jantunen 2017a). In other words, the chosen discourse strategy has a comprehensive influence on the structure of the language and on the semiotic packaging of information, and therefore naturally also on nonmanual signals. For example, in enactment, the interpretation of signals is inter-dependent even if the functions of these signals are not fully identical. Signals from different

sign mediums depict different parts of the holistic imagistic action that is enacted, that is, there is a part-whole relation between the functions of the signals. Even though the communicative action is unified, the functions of different signals are specified in the organization of information in the utterance.

In addition, the current study argues that when we consider the signification of different parts of the signer's body, differences come about in the semiotic centralities in the signals of these mediums. Symbolicity is most prominent in actions of the hands, while it is less evident in signification with other parts of the body. Iconicity and indexicality, on the other hand, are everywhere: they are prominent features in the signals of all sign mediums. However, they come about to different degrees: iconic features in the actions of the signer's head and body are less diverse than in the actions of the hands and face. These differences may be traced back to the physical characteristics of these different body parts.

7. **Nonmanual signals demonstrate how signification, language and cognition are intrinsically connected to how humans navigate (exist, experience, act) in their physical and social surroundings with their bodies. (Q5)**

The study argues for the view that the forms and functions of nonmanual signals are affected by what human bodies are like and how we act and experience things with our bodies in the world. This means that communicative signals are intrinsically connected to other non-communicationally motivated bodily actions. This embodied connection can be seen, for example, in the strong indexicality of nonmanuals such as signers' head movements. Furthermore, it is suggested that this embodied connectivity is also shown in the different degrees of control involved in their production and interpretation. Some signals, such as negative headshakes, are more controlled than signals such as discourse-organizing head movements. The former involves a higher degree of intentionality than the latter, although both are parts of intentional communicative actions, so-called composite utterances (Enfield 2009). For example, discourse-organizing head movements, such as head nods indicating transitions in the syntactic and/or discourse structure, may not involve very conscious action or interpretation, and their existence may become evident only when something is observed to be out of place in their production.

4.2 Substudy 1: forms and functions of sagittal head movements

Puupponen, Anna, Tuija Wainio, Birgitta Burger & Tommi Jantunen. 2015. Head Movements in Finnish Sign Language on the Basis of Motion Capture Data: A Study of the Form and Function of Nods, Nodding, Head Thrusts, and Head Pulls. *Sign Language & Linguistics* 18(1). 41–89.

The result of Substudy 1 is a description and analysis of the different forms and functions of four different types of head movements: single *head nods*, repeated *nodding*, *head thrust* (forward), and *head pull* (backward). The study sought to answer the following research questions:

1. What kind of formal and functional types do nods, thrusts, pulls and nodding of the head form?
2. How do the forms connect to the functions: what are the central functions of these head movement types and how does the distribution of functions differ between different head movement types?

The discussion of the forms of head movements included an account of the frequency of these different head movements: the head nod was found to be the most common and the head pull the most infrequent in the dialogue data. In addition, the co-occurrence of several different head movements was found to be a common feature, the combination of a nod and a sideways head tilt or a nod and a head thrust being the most common combinations. The average movement amplitude of each head movement type, as well as the variation between movement events of each type, were described and demonstrated with graphic illustrations of the kinematic displacement data. All of the four head movement groups were shown to include a lot of variation in the amplitude of movements, which may be the result of the discourse context (preceding and subsequent utterances), the functions of the movements, as well as various factors related to the background, age and personal characteristics of the individual signer. There were seen to be differences between the four head movement types in the amount of variation (min-max) between the amplitude of head movements of a certain type, with nods including the most variation. The average amplitudes of the head movement types were shown to represent the prototypical movement pattern of each movement type. When comparing the kinematic characteristics of nods and thrusts, a strong coefficient correlation was found to exist between the average nod and thrust, while a statistically significant difference was found between all the movement events of the groups.

With relation to the functions of head movements, Substudy 1 presented a typology of 7 different types of functions: *prosodic*, *contrastive* and *additive* stress (E), prosodic *boundary-marking* (B) and *domain-marking* (D), *affirmation* (A), *interrogative* (Q), *copying* (C), and *pointing* (X). A and E functions were shown to be the most frequent ones for head movements in the data, whereas D and C functions were found to be the most infrequent. However, also the more infrequent functions were shown to occur together with other functions in specific head movement events. In fact, the co-occurrence of several overlapping functions was found to be very common in the data. When it comes to form-to-function pairing, most of the functions were produced with several different types of movements; for example, the emphatic E function was a feature found in all four head movement types. According to the analysis, the central functions of the head movement types were the following:

- Nods: signal neutral affirmation and positive feedback (A); tend to occur sentence finally (B).
- Thrusts: used in questions (Q); also emphatic functions of listing and prosodic stress (E) central.
- Pulls: signal emphasis (E), including contrast and semantic exclusion.
- Nodding: signal positive feedback and strong affirmation (A); often occur during the receptive phase of the discourse

Nods were found to perform the largest variety of different functions while head pulls with their mainly emphatic functions are an example of other movements with more limited functions. Single head movement events were very often found to perform multiple functions, and determining one function as more primary than another was found to be problematic and open to question. Like the different forms of head movements, so too their functions were shown to form prototypical classes rather than discrete functional categories. For example, it is argued that the difference between prosodic boundary and domain marking was in many cases a matter of interpretation, and differentiating between prosodic, communicational and grammatical functions was found in many cases to be difficult and potentially theoretically unhelpful. Finally, most of the functions of different head movements identified in the data were found to be familiar from the co-speech gesturing of speakers (see Section 2.3).

According to the substudy, the functions of head movements were difficult to distinguish from the functions of other nonmanual signals, which speaks for the semiotically holistic and complementary nature of co-occurring actions of the signer's body. The systematic and layered annotation of different nonmanual signals was found to be significant in building a picture of the role of the signification of different body parts and the interrelations between signals produced with them. As several forms of head movements were found to perform the same functions, the discussion in Article 1 presented the view that the form of a specific head movement event may not always be significant, and that the fact that something is signaled with the head may be enough, so to speak. The form produced in a specific context may be the result of a signer's idiolectic, personal and physical characteristics as well as of the discourse context. It was argued that the forms and functions of head movements constitute prototypical classes, which may best be approached as forming continua including more and less representative head movement events. Arguments emphasizing differences between 'grammatical' and 'gestural' (non-linguistic) nonmanuals were not supported by the results of the study.

The results of the study differed somewhat from findings on head movements in previous studies on other sign languages. For example, the boundary-marking function of head nods was found to occur sentence finally rather than after the end of a sentence, as in ASL (cf. Wilbur 2000). In addition, one function was discovered which had not been discussed in the literature: pointing with the head in a way that identifies a referent in a similar manner as

index-finger pointing. It was also found that head thrusts were not compulsory for interrogative utterances in FinSL (cf. Savolainen 2006), and that head movements emphasize not only the actions of the hands but also other nonmanual actions (cf. e.g. Liddell 1980; Wilbur 2000). Nodding movements were found to signal epistemic (propositional) modality and deontic (commissive) event modality. Head pulls were found to occur in content questions (cf. Savolainen 2006), but the few head pulls found in the data were not associated with topic marking or polar questions, as in some other sign languages (see Wilbur 2000).

4.3 Substudy 2: a case study on the connections between head nods and syntactic units

Puupponen, Anna, Tommi Jantunen & Johanna Mesch. 2016. The Alignment of Head Nods with Syntactic Units in Finnish Sign Language and Swedish Sign Language. In Jon Barnes et al. (eds.), *Proceedings of Speech Prosody 2016*, 168–72. Baixas, France: International Speech Communication Association.

Substudy 2 investigated the temporal alignment of head nods with syntactic units in FinSL and SSL. The study was built around the following research questions:

1. How are nods distributed with respect to syntactic units in FinSL and SSL?
2. How frequently and how exactly do nods and syntactic boundaries coincide?
3. Do the two languages show similarities or differences in this respect?

The results of the study showed that the number of head nods differed between the two languages: the average FinSL story included twice as many nods as the average SSL story. Possible reasons behind this difference include the duration of the stories, individual characteristics of the signers, as well as different discourse strategies (e.g. the amount of constructed action found in each story). Nods were found to align with syntactic units in a similar way in both languages. The majority of nods emerged in the proximity of syntactic boundaries in both languages (73% in SSL; 80% in FinSL). When co-occurring with syntactic boundaries, both languages showed a tendency for sentence-final head nods (49% of all nods in the data in SSL; 59% in FinSL). The number of sentence-initial nods was clearly smaller than the number of sentence-final nods, which differs from observations on ASL (Wilbur 2000; Pfau & Quer 2010). In addition, a relatively large percentage (20–24%) of all nods in the data did not emerge in the vicinity of syntactic boundaries. In these cases, the

movements emphasized the actions of the hands and/or signaled neutral or strong affirmative meanings, inter alia.

A slight difference was found between the languages in the tendency for nods to occur sentence finally: the tendency was stronger in FinSL than in SSL. This difference may be due to the different annotation conventions for syntactic units in FinSL and SSL data, as well as to differences in the discourse strategies chosen by the signers – the amount of constructed action in the stories, for example. Due to this fact, Article II suggested, as a hypothesis for future research, that there may be differences in the number of prosodic signals, such as single head nods, and in the amount of constructed action occurring in the signing. This question was addressed in Jantunen (2017a), who found that the number of single head nods did seem to be affected by how much enactment the signers engaged in while narrating.

In the discussion in Article II it was pointed out that not all nods emerging in the proximity of syntactic boundaries can be analyzed simply as prosodic boundary markers, at least according to the traditional definition of this function. Firstly, not all sentence-final and sentence-initial nods were punctual, but they co-occurred with multiple manual signs while still clearly signaling the transition between two syntactic sequences. Secondly, most of the syntactic boundaries in both the FinSL and SSL data did not occur with a head nod. That is, *if* a head nod emerged in the data, it tended to occur in the proximity of a syntactic transition, but nods were in no way compulsory for marking the syntactic organization of the stories. Kinematic features in the actions of other parts of the signer's body, such as the velocity, duration and pauses in manual motion, organize the structure of signed discourse. Thirdly, although nods tended to align with syntactic transitions, they often simultaneously performed other functions.

As a general rule, however, head movements do seem to align with syntactic boundaries in narratives, and this was found to be the case in both languages. As speakers have been found to show similar behavior with head nods (see e.g. McClave 2000; Aoki 2014; Wagner et al. 2014), it is an interesting question whether this phenomenon is connected to physical characteristics and embodiment in the experiences and actions of humans in general. Finally, the number of sentence-final head nods was clearly larger in the narrative data of Substudy 2 than in the dialogue data of Substudy 1. In the dialogue discourse, only 37% of nods were found to emerge sentence finally, although nods were the most frequent head movement of the four types investigated in the study (Article I). This indicates that in conversations, turn-taking cues are multiple and complex, and that nods are used for other functions more frequently, especially in signaling feedback or as backchanneling signals.

4.4 Substudy 3: the relationship between actions of the head and torso

Puupponen, Anna. 2018. The relationship between the movements and positions of the head and the torso in Finnish Sign Language. *Sign Language Studies 1*8(2), 175–214.

Substudy 3 focused on the connections between form and functions in the signals produced with the head and the torso in FinSL. The study aimed to answer the following research questions:

1. How do the actions of the signer's head and torso coexist in narratives of FinSL, both in regard to form and function?
2. Does the signer's head move mainly together with the torso, on its own without the torso, or with the torso but independently of it?
3. Do co-occurring torso and head movements perform the same function?

The results of Substudy 3 showed that head movements (n=2482) are clearly more frequent than movements of the whole upper body (n=599) in signed narratives. The most common head movements were sideways turning movements of the head, but movements directed forward and backward and single head nods[2] were also frequent. Shaking and nodding the head were infrequent in the narratives, which emphasizes the backchanneling and discourse-oriented functions of these movement types. The most common movements of the whole upper body were forward and backward leans, but sideways movements (leans and turns) were almost as frequent. Shrugging the shoulders was the most infrequent type of torso movement. Both the number of head movements and the number of movements of the whole upper body showed a lot of variation between individual signers in the data.

As discussed above, according to the study, the head moves a lot without activating the whole upper body. However, when both the head and the torso were active, slightly fewer than half of the co-occurrences were simple combinations of codirectional movements; the second half of the combinations were semi-complex or complex combinations. In the complex combinations, the torso movement is of long duration and may include a static position while the head may be producing several different movements with different functions. According to the results, when a sideways movement of the torso occurs, there is a stronger tendency for complexity in its combination with the co-occurring head movement(s) than when a sagittal torso movement occurs.

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[2] It should be noted that the discourse genre and focus of the study have had an effect on the number of nods. Backchannel nods were not annotated and analyzed in this study, as the analyses focused on the actions of the head and torso in the narratives, rather than on the communicative organization of the discourse. Despite the dialogue setting, the narrative materials include fewer feedback signals and turn-taking than in the dialogue materials, in which both interlocutors are active in the discourse.

When the whole upper body of the signer moved, the head and the torso movements tended to perform a shared function (90.7% in 4 narratives), which was usually the enactment of referents in constructed action (79% in 4 narratives). Other shared functions were, for example, emphasis, or binding stretches of signing together into understandable chunks of discourse. However, in some cases the co-occurring head and torso movements performed more independent functions (9.3 % in 4 narratives). The results show that the more complex the movement combinations were in form, the more complex too were the functions of these combinations: approximately 10% of semi-complex combinations involved differing functions for signals of the head and the torso, whereas in complex combinations, 25% had differing functions for the signals of the two parts of the body.

The results of the study show, firstly, that the head is active in contexts in which the whole body is not. The discussion suggests that activating the whole body, rather than activating only the head, may in some cases be comparable to the manual "loudness" proposed, for example, by Crasborn (2012). The study also suggests that degrees of complexity in movements of the head and torso are, like the complexities in manual signals, relevant when describing the phonological structure of a sign language (see e.g. Brentari 1998). Secondly, Substudy 3 shows that long torso movements that form complex combinations with head movements function in a similar way to so-called manual theme buoys and fragment buoys (Liddell 2003) or other signals of continuity of discourse sequences. They keep the interlocutor's attention on a particular theme or sequence of discourse for as long as it is relevant for the content of the discourse. Thirdly, the study argues for the view that the torso and head cannot be described as one articulator, although in many cases they come together in signification in both form and in function.

4.5 Substudy 4: a semiotic treatment of head movements and nonmanuality

Puupponen, Anna. 2019. Towards understanding nonmanuality: a semiotic treatment of signers' head movements. Glossa: a journal of general linguistics 4(1): 39, 1–39.

Substudy 4 is a semiotic treatment of signers' head movements, their relationship to signers' bodily actions in general and the implementation of nonmanual signals in a theory of language. The study focuses on the following research questions:

1. How do head movements signify?
2. What kind of semiotic strategies do different head movement types involve?

3. How are head movements connected to signification with other parts of the signer's body, and what are the differences between the central semiotic features of actions of the head and actions of other parts of the signer's body?

Substudy 4 presents a typology of head movements and their relation to the semiotic strategies of iconicity, indexicality and symbolicity. The typology is the following: (i) *enacting* movements; (ii) *time-metaphor* movements; (iii) movements *indicating referents*: pointing & placing; (iv) movements *indicating discourse structure*: binding, separating & emphatic; (v) movements *indicating/depicting reactions*: inclusion/exclusion; (vi) more *conventional types-for-tokens*: negative shake & affirmative nod(ding). These different types of signals of the head are demonstrated in Figure 6 according to their semantic strategies. A more detailed discussion of the typology is given in Article IV.

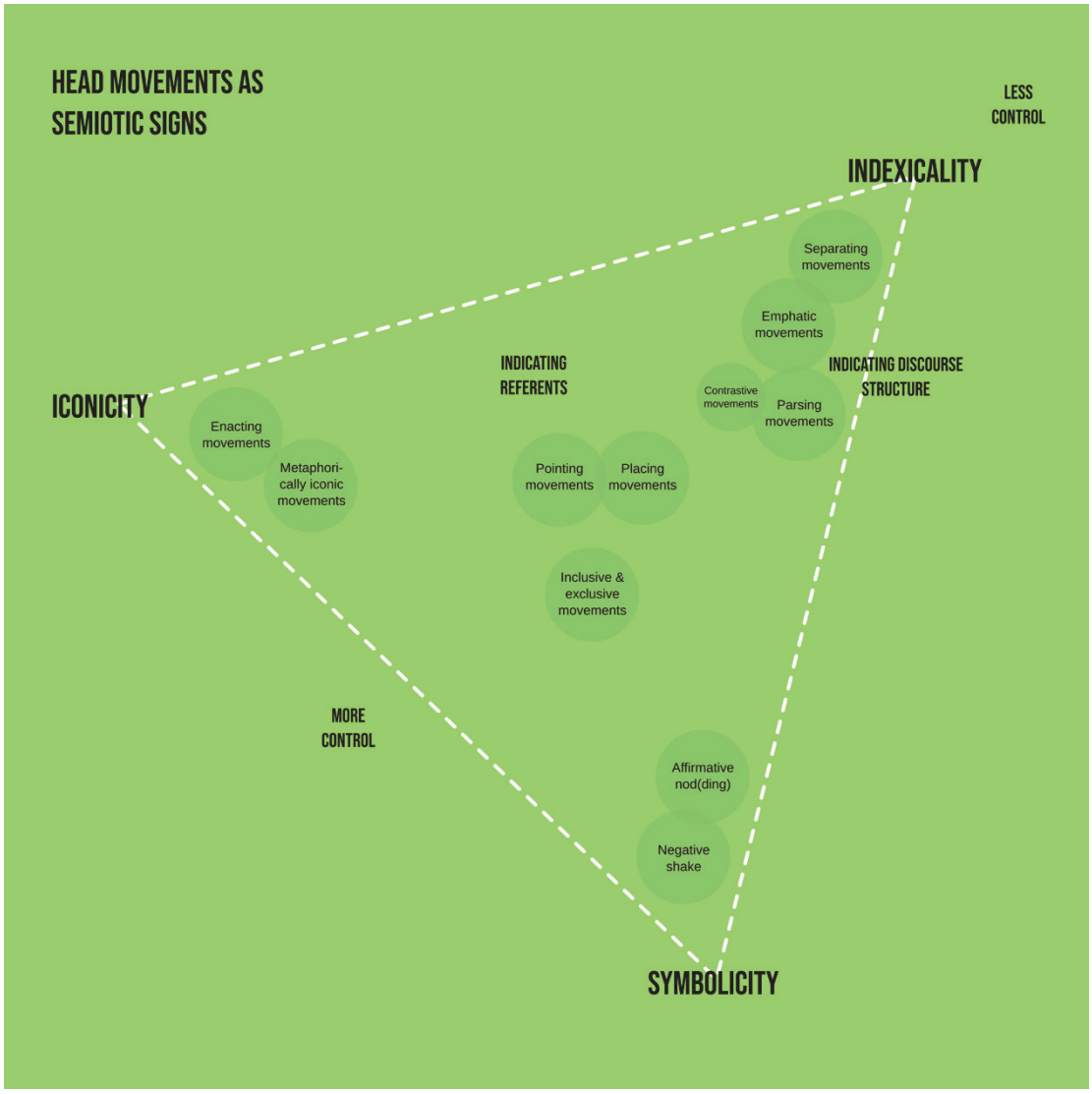

FIGURE 6 A typology of actions of the signer's head according to the semiotic strategies of iconicity, indexicality and symbolicity (Article IV).

As illustrated in Figure 6, different types of actions of the signer's head are related to the semiotic strategies of *iconicity*, *indexicality* and *symbolicity* in the following ways. Iconic strategies are central in enacting and time-metaphoric movements. In these movements, the prominent semiotic strategy is *association of analogy* between a sign and its object (see e.g. Peirce 1903; Dingemanse et al. 2015). In movements indicating referents or discourse structure, iconic strategies emerge when the manner of indication is associated with the more or less conventional patterns and habits of communicative actions, i.e. with their "general manner of execution" (Enfield 2009, 19). Regarding the more conventional types-for-tokens, negative shakes and affirmative nodding of the head are recognized as tokens of their types through iconic association, that is, their symbolicity is recognized through iconicity. Indexical strategies, on the other hand, are central in all head movements, especially in movements indicating referents and discourse structure. In enacting and time-metaphoric movements, the indexical strategy lies in the context-specific and referential spatial relations between referents (enacting) or temporal relations (time metaphors). In addition, enacting movements may include indexicality by indicating the continuity of a discourse sequence through timing and duration (e.g. the "buoy-like" discourse-marking movements of the body presented in Section 4.4). Negative shakes and affirmative nod(ding), on the other hand, are (reaction-based) indexical signals that have become more socially shared, conventional types-for-tokens. This means that symbolic strategies are especially central in these movements. In movements indicating referents or discourse structure, enacting movements, and time-metaphoric movements, the symbolicity lies in the socially shared, recognizable habits of these communicative actions (see Enfield 2009), which are recognized through iconic association. For example, a particular enacting or parsing movement of the head at a particular moment is iconically associated with the general manners in which these actions are produced (cf. Enfield 2009). The understanding of this habituality is rooted in the symbolic strategy.

As we have seen, then, indexical strategies are central in head movements. Iconic strategies are most evident in enacting actions of the head and time-metaphor movements, and less strong in other types of head movements. The study suggests that non-enacting description is less common for signification with the head. Symbolic types-for-tokens are rare, although some signals, such as shaking or nodding the head, may become more conventional or schematized. In most signals of the head, the symbolic strategies are related to recognizing and understanding the typicalities in the social, communicative and processing related actions behind them, rather than in the pairing of certain forms with certain functions. The study argues for the view that different head movements involve different proportions of iconicity, indexicality and symbolicity. The study also argues that all head movements form one part of holistic, semiotically complex communicative actions, so-called composite utterances (Enfield 2009), and that actions of the head cannot be singled out and studied in isolation.

Despite the general communicative unity between co-occurring nonmanual signals, the semiotic treatment of head movements in Substudy 4 indicates that there are differences in how dependent the interpretation of a given signal is on co-occurring signs in other sign mediums. Some signals (e.g. shaking the head) convey a more independent and socially shared meaning or function (although this may be a more or less gradient map of several, closely connected functions), whereas the functions of other signals (e.g. movements indicating the discourse structure) emerge only in their relation to the actions of the signer's hands and other actions of the signer's body. In addition, the study suggests that there are differences in the degree of control in the interpretation and production of different types of actions of the head. Movements indicating discourse structure have a more abstract object (i.e. what the signal stands for, see Peirce 1903; Kockelman 2005) and their interpretant (i.e. the effect that the signal that stands for something has on an individual, see Kockelman 2005) is embodied and less conscious. A negative headshake involves more control, has a more specified (although gradient) object, and a more conscious interpretant. In signals with less control, the indexicality is implicit (see Enfield 2009). Temporal alignment (i.e. proximity with another sign) is pivotal in these signals: their interpretation is holistic and dependent on contextual association, in which timing and other types of indexical contiguity emerge as triggers that guide one to conceive the signal and other co-occurring signals as parts of a single, unified communicative action with a certain pragmatic function.

5 DISCUSSION, IMPLICATIONS AND CONCLUSION

5.1 Theoretical and methodological implications

As discussed in the introduction to the current Overview, the current study on sign language nonmanuality has been motivated by various issues in the field of sign language linguistics. Firstly, our understanding of the role of nonmanuality in sign languages is still rather limited, and we still have little information particularly about the activity of the head and the torso, the functions of these signals in sign languages, or the relations between co-occurring nonmanual signals in sign languages. Secondly, we do not know very much about the relationship between signers' nonmanual and manual actions. Thirdly, in the study of nonmanuals in sign languages there is a shortage of research with a usage-based, cognitive-functional approach to language. Finally, there is not enough kinematic evidence behind the notions and conceptualizations of nonmanual signals.

The current study has presented a description, analysis and discussion of the actions of the signer's head and body in FinSL. Substudies 1–4 contribute to our knowledge of the role of nonmanuality in sign languages, and particularly, of the signals of the head and torso, which are a relatively uninvestigated area of nonmanuality. In the study, the forms and functions of head and body movements are shown to form gradient prototypes rather than discrete categories. The analysis of the form-function connections of signers' head movements makes clear the difficulties of defining one function for what are often multifunctional head movements, and the discussion points out that defining one function of a head movement as more dominant than another is problematic. The study suggests that the analysis of nonmanual signals such as head and body movements would benefit from a wide semiotic approach, as the interpretation of these signals is often found to involve analogical association, or an observation of contiguity between the signal and what the signal stands for, rather than a recognition of a conventionalized one-form-to-

one-function type-token relation. In other words, according to the study, signification with the signer's head and body rarely involves conventionalized types-for-token, but, although often emerging as token events, such signals are still significant due to the association of similarities, observation of physical contiguity such as temporal co-occurrence or pointing, and contextual association (cf. e.g. Clark 1996; Kockelman 2005; Enfield 2009).

With its semiotic framework, the study connects Peircean and post-Peircean semiotics to more traditional linguistic frameworks and views on nonmanuality in SL linguistics. In the semiotic treatment of signers' head movements and actions of the body in general, the study presents semiotically motivated terminology for signals of the head and body which, it is hoped, while corresponding to some of the terms for actions of the head and body already put forward in the literature on SL linguistics, will express these notions in new ways and make it possible to include them in the more general discussion of the multimodal and semiotically diverse communicative actions of both signers and speakers (see e.g. McNeill 1992; Clark 1996; Liddell 2003; Enfield 2009; Kendon 2014; Johnston & Ferrara 2012; Johnston 2013; Schembri et al. 2018; Ferrara & Hodge 2018). The discussion of the semiotic strategies and centralities of the signals of the head, and the visual demonstrations summarizing this discussion (see Figures 6 & 7), have similar aims: to contribute to the theoretical discussion on the existence of gradient and unconventional features in language, both signed and spoken (see Section 2.2.3). In this way, the study seeks to contribute to the theoretical discussion of nonmanuality in sign language linguistics, and to present a way to apply semiotic theory to the study of head and body movements in sign languages. As a result, the study questions some of the traditional views on nonmanuals, such as the dualistic differentiation between gestural (e.g. affective) and non-gestural (i.e. grammatical or linguistically significant) nonmanuals (see e.g. Baker-Shenk 1983; Corina et al. 1999; Wilbur 2000). In so doing, the study offers comparable concepts which could be used for comparison of the bodily actions of speakers and signers in the field of gesture studies and sign language linguistics.

The study is data driven and, using corpus data, presents results on the frequency, variation and coexistence of different signals produced with the head and torso in FinSL. The study also presents results, obtained with the help of technology, on the kinematic characteristics and prototypicalities of these signals. The study discusses the physical reality behind assumed formal categories of specific nonmanual signals, the idiosyncrasy of use of specific nonmanual signals, the overall activeness of specific sign mediums while signing, and the complexity of form and function in combinations of co-occurring nonmanual signals. Additionally, in describing the alignment of a specific type of nonmanual signal, the head nod, with manually produced syntactic sequences in signed discourse, the study contributes to our knowledge about the connections between nonmanual signals and signers' manual actions. While contributing to the theoretical discussion of these topics, the study

develops the methods and concepts used for the description and analysis of nonmanuality. In addition, the study builds an empirical foundation for theoretical generalizations on the connections between co-occurring nonmanual signals, and between manual and non-manual signals, in the organization of signed discourse (see Sections 4.2–4.4). The application of Motion Capture technology to the study of nonmanuality is novel and contributes to the growing fields of kinematic analysis and phonetics of sign languages. The annotation scheme for the forms and functions of head movements, presented in Substudies 1–3, the descriptive concepts presented in the analysis of head and body movements and their functions in these studies, as well as the theoretical concepts and visual schematizations in Substudy 4 (see Figures 6 & 7), are the concrete 'end products' of the methodological contributions of this study. Taken as a whole, the usage-based, functional framework within which the study is conducted contributes to research on sign languages, as there is a shortage of such approaches in the study of nonmanuals.

As the first in-depth investigation of FinSL nonmanuality, one of the major implications of this study is that it contributes to the long-term objective of producing a descriptive reference grammar of FinSL. Without the study of nonmanual signals, this goal is unreachable, as is evident from the significance of nonmanuality in different levels of sign language structure and use, discussed in Section 2. One can also see practical implications for the current study. The study provides new information that can be applied in the fields of FinSL teaching, education and interpreting. The teaching of nonmanuality is still largely dependent on the intuition of individual professionals, and nonmanuals have not been discussed in depth in FinSL teaching materials. In addition, the study seeks to participate in the description and preservation of one of Finland's minority languages – FinSL. While doing so, it aims to contribute to the ongoing efforts of Finland's sign language communities to raise awareness of FinSL (and FinSSL), of sign language people in Finland, of the history and socio-cultural features of these communities, and of the benefits of sign languages and multilingualism to the social and cognitive development of deaf and hard-of-hearing (as well as hearing) children. Understanding nonmanuality and the semiotically complex and rich world of signers' communicative actions in general is important, because it could help to prevent misconceptions about sign languages, and thus the social marginalization of sign languages and the people who use them.

5.2 Semiotics of signers' head and body movements and nonmanuality

The study presents a theoretical view of signers' head movements and the semiotic characteristics and interrelations of the co-occurring bodily signals of signers. In addition, the study discusses the connection between nonmanuality

in intentional communicative actions and the actions of the body in general. The theoretical suggestions and conclusions are data driven in that they arise from work carried out on a variety of data, most of it processed and analyzed in the studies presented in the first three articles of the PhD project. This doctoral study approaches the actions of the signer's head from a wide semiotic perspective in order to avoid the problems, reported in Article 1 (as well as in other studies on SL nonmanuality, see e.g. Herrmann & Steinbach 2011), that emerge when trying to categorically distinguish between grammatical, gestural and prosodic nonmanuality. The approach embraces the dynamic nature of language and the contextuality of meaning in language (e.g. Clark 1996; Kockelman 2005; Enfield 2009), and describes the compositional, holistic, semiotically complex nature of communicative actions (see Enfield 2009) by exploring the semiotic connections between head movements and other nonmanual and manual signals.

As discussed in Section 4.5, the study argues for the view that head and body movements, also those that have traditionally been analyzed as grammatical (e.g. Baker-Shenk 1983; Wilbur 2000; Pfau & Quer 2010; Herrmann & Pendzich 2014), all involve different proportions of iconic, indexical and symbolic strategies. This view is illustrated and summarized in Figure 7 – which applies Capirci's (2018) suggestion for visualizing semiotic strategies of linguistic signs – and it is followed by a short discussion.

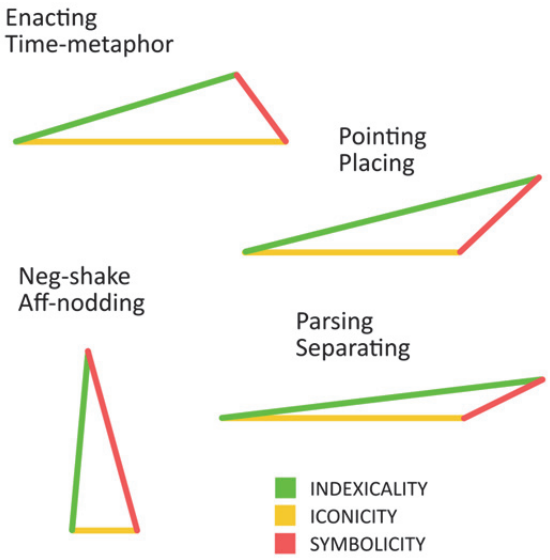

FIGURE 7 Different proportions of semiotic strategies in head movements (Article IV; method of visualization from Capirci 2018)

As can be seen from Figure 7, the study suggests that different nonmanual signals such as movements of the signer's head all involve iconicity, indexicality and symbolicity, but that there are differences in the proportions of these

strategies according to the type of function the signal performs. Figure 7 shows that indexical features (green) are prominent in all head movements, but the symbolic strategy (red) is strong in only a few of them. The iconic strategy (yellow) is also strong in head movements, but there are a few movements in which it emerges only in the analogical association of token movement events to their more or less conventional types.

In addition, the current study argues that, as presented in Sections 4.1 and 4.5, nonmanual signals such as actions of the signer's head and body are always functionally connected, with different degrees of dependence, to co-occurring signals from other sign mediums. However, despite this connectedness, when taking the signals produced by them as a whole, there are differences in the central semiotic features of the sign mediums of a signer's hands, face, head and upper body. The study suggests that the distribution of iconic, indexical and symbolic strategies is different in the signification of the hands, face, head and upper body: iconicity and indexicality are important in all mediums, but symbolic signs (in the sense of Peircean legisigns) are mostly produced with the hands. It is suggested here that these differences between the centralities in signification with different sign mediums can be visualized with the same method that was used in Figure 7, borrowed from Capirci (2018). In Figure 8 this is demonstrated in relation to actions of the head.

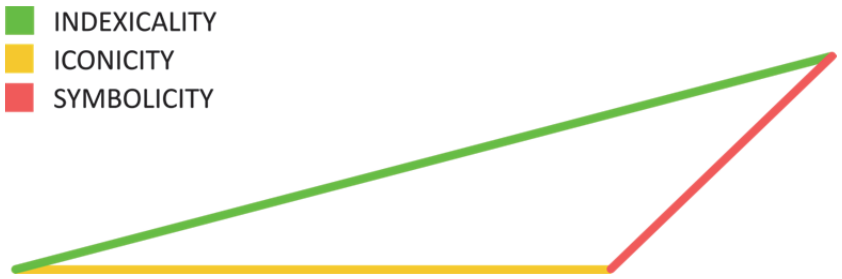

FIGURE 8 Proportions of semiotic strategies in the signals of the head in general (visualization from Capirci 2018).

The study suggests that the differences between different sign mediums are in many ways connected to the physical and anatomical characteristics of the human body (see Article IV; Wagner et al. 2014; Enfield 2009). Hands are well suited to iconic representation of the forms of physical objects through, for example, different handshapes or tracing movements. This is less convenient for the actions of the signer's face which, on the other hand, are well suited to conveying meanings related to the size or other qualities of inanimate referents (e.g. stillness, distance, repetitiveness) or to the characteristics, emotions and attitudes of animate referents or of oneself. The head and the torso are not physically well-equipped for producing signals that share characteristics with physical entities and events, other than the characteristics and actions of the head and the torso in enactment. They do, however, point, place, show reactions and organize discourse. Pointing with the head and the torso is less

precise than pointing with the hands, as they are larger, and the torso is the body part *to which* appendages suitable for pointing are joined, and the head as an appendage is much less mobile than the arm, for example. These physical characteristics are shared among humans in the world, whether speakers or signers.

The study argues that nonmanual signals in signed utterances, such as the actions of the head and body, are inseparably connected to how humans experience the world with their bodies in general (see e.g. Streeck 2015). This can be seen, for example, in the indexical basis of more conventionalized head movements such as shaking and nodding the head – in their roots in human bodily reactions. It can also be seen in the fact that signals for emotions and attitudes, and signals characterizing features of discourse referents are, according to this study, often identical in form. Also the lower degree of control that, it is suggested, is involved in some head movements implies that many nonmanual signals are closely connected to unintentional bodily actions. That is, the study argues for the view that nonmanual signals in signers' communication show how signification is embodied, context-dependent and iconic as well as symbolic, and that linguistically significant phenomena are connected to humans' general embodied experiences, actions and navigation in their physical and social surroundings.

The study suggests that the dualistic differentiation between 'grammatical' and 'gestural' is of no value when trying to understand the nature of nonmanuality and its role in sign languages. In the light of the results of the current study, nonmanual signals such as head and body movements are examples of context-dependent token signification. There is great flexibility in which forms are associated with which functions. This means that similar movements may emerge as more or less essential for the grammatical features of utterances. Even when conveying meaning (e.g. through enactment), head movements rely on analogical association and the observation of physical contiguity, although in a few movements a more conventionalized connection between the form and the function has emerged (i.e., nodding and shaking one's head). However, these few cases are more conventional in the communication of both speakers and signers (see Wagner et al. 2014).

When the above-mentioned distinction is not made categorically and the different functional environments of head movements are seen as forming continua, functional and cognitive approaches to nonmanuals – and to language in general – present themselves as worthwhile frameworks. Usage-based functional approaches to language and the modality-free approaches to the semiotics in human communication, presented in Section 2, consider gradience and variation to be inherent features of linguistic utterance. It is suggested here that with this type of broad approach there is a lower risk of settling for a biased (e.g. by overemphasizing symbolicity) or incomplete (e.g. by allowing frequent but non-systematic elements to fade into the background) view of the subject being studied. If linguistic research on sign languages was only interested in conventional, symbolic meaning-making, most of the signals

presented in the current study would be seen as linguistically irrelevant. That is, as pointed out in fourth research article of this dissertation, ”Symbolicity may not be the prime motor of this type of signification [signals produced with the head], but still head movements are significant. This [--] speaks for the need for a theory of language that embraces less symbolic and unconventional elements instead of pushing them to the periphery.” (Article IV, 23.)

5.3 Evaluation of the study and its reliability and validity

This Overview has presented a study of the actions of the head and torso in FinSL. As always with research projects, the current one too was a process, which can be seen in the contents of the articles reporting the study as well as in this Overview. Although the approach was data driven right from the start, there are many echoes of predetermined (and, as argued in the introduction to this Overview, premature) theoretical assumptions concerning nonmanuals in, for example, the terminology used in Article I, reporting the results of Substudy 1. Although in the analysis the methodological choice was to name different functional types using neutral terms (i.e. A, E and X functions etc.), the paper talks about discourse-organizing movements as ‘prosodic markers’, for example. During the research process the study moved towards a more abstract, semiotic approach in order to avoid making empirically uncertain and controversial metatheoretical assumptions. In addition, the cross-tabulation of forms and functions of head movements, presented in Article I, can be seen as being at odds with the view that head movements are multifunctional, and it was, indeed, found difficult in the study. On the other hand, the method was a way to discover the reality of this multifunctionality, and it demonstrated the result of the study, that conventional one-form-to-one-function type-token signification is rare in signals of the head and body. All in all, as a first step it successfully charted the field of the phenomena being studied. Furthermore, in Article I, forms of head movements are said, on the basis of the kinematic analysis, to form prototypical and gradient classes rather than distinct categories. However, the head movements that were grouped together in the motion-capture-based description and analyses were based on classification done through visual examination of the digital video material. As the terms used for forms of head movement in the then-existing linguistic SL literature were more or less ambiguous, this classification could have been different if carried out by other researchers. It should, however, be noted that the kinematic study of the actions of the head nonetheless succeeds in describing the variability and gradience of form. In addition, the fact that the annotation of the data was carried out by several people, both together and individually, strengthens the reliability of the method.

In the current study one can also see the trends and influences that were emerging in the field of sign language linguistics during the period when the research was being carried out. Firstly, the recent shift towards a more gesture-

friendly approach to sign languages (see Section 2.2), and the growing number of studies related, for example, to constructed action can be seen in the analysis and terminology of the study. The effect of constructed action on nonmanual signals is brought out for the first time in Article II, which reports Substudy 2, and the shared function of enactment is within the focus of Substudy 3, reported in Article III. Secondly, the growing use of language technologies and corpus materials in the study of sign languages is also reflected in the current study. As, at the start of the study (and still today), there were no conventions for the annotation of head and body movements and their functions in larger corpora, the study has had to build some of its methods and solve some of its methodological issues rather independently. It is assumed that the methods for research on nonmanuals in sign languages will develop further in the future, along with methods for the annotation and analysis of any multimodal corpora in linguistics and gesture studies.

With regard to the data and methodology, it is important to note that while a systematic annotation of the forms of head and body movements has been done for most of the data, the functions of head and body movements have been systematically annotated only for subsets of data, according to specific substudy-related research questions. This means, for example, that judgements on the conventionality of different head movements are not something that the data allows at this time, as the frequency counts of different types of functions are not representative enough. In addition, it should be noted that the annotation scheme in the present study allows several annotations for co-occurring head and body movements and positions, as the head and the body move in many dimensions simultaneously. This should be taken into consideration when viewing the frequency counts of different head and torso movement types in Substudy 3. In addition, one should bear in mind that in this study, the definition of a movement is that it may include a position phase (i.e. a hold). In the future it would be useful to distinguish between movements and positions in the annotation and analysis of head and body movements, in order to better understand the dynamics of these actions. Furthermore, when viewing the Motion Capture marker-data used in Substudy 1, it should be borne in mind that the kinematic description and analysis in the study are based on placement data on one marker in one dimension. This methodological choice was essential in order to be able to conduct the time-consuming processing and analysis of a very large amount of numerical data. However, the study succeeds in testing the application of this technology for the study of signer head movements, and shows that already with this method, one can see clear kinematic typicalities in the forms of head movements. It also demonstrates the large amount of variation between different head movements of a certain type (i.e. the gradience of formal types). Furthermore, the fact that the analysis is based on Motion Capture data of continuous discourse is novel and contributes to the kinematic study of sign languages both methodologically and in terms of the results.

It should be remembered that much, although not all, of the systematically annotated data is narratives, which means that the results of the study should be compared to corresponding results in conversations. However, the study does include data for several different types of language use, involving different types of collection methods and processing. The relatively diverse set of different types of materials is considered a strength of the current study. Finally, the functions of actions of the signer's head and body described in the current study are not regarded as forming an all-inclusive presentation of the topic. It may well be that other functions, not mentioned in this study, are discovered in future research.

5.4 Conclusion

The current Overview has presented a study of the actions of signers' head and body in FinSL, including a discussion of the role of nonmanuality in sign language linguistics. According to the study, the forms and functions of signers' head and body movements form gradient types rather than distinct categories. These signals are multifunctional and rarely form one-form-to-one-function type-token relations. The head is generally much more active than the torso in signing, and signals of the head, the torso and the face come together in combinations that differ both formally and functionally in their degree of complexity. In both FinSL and SSL, two historically connected sign languages, a relatively high systematicity can be found in the discourse-organizing function of head movements of a particular type, the head nod. However, although nods show a tendency to sentence-final position, there are other significant factors that indicate the organization of discourse, and most syntactic transitions are not indicated with a nod.

The study presents the view that nonmanual signals, such as movements of the signer's head and body, involve different proportions of the semiotic strategies of iconicity, indexicality and symbolicity, depending on their functional type. In general, in movements of the head and body, indexical strategies are most central. It is argued, further, that nonmanual and manual signals combine into unified communicative actions (Enfield 2009), and that these unified combinations involve differences in how mutually complementary and co-dependent co-occurring signals are, and in what kind of signification is most frequent in different sign mediums (i.e. different parts of the body). The results of the study indicate that nonmanual signals such as movements of the head and body are inherently connected to the living human body and to communicatively non-motivated embodied action.

As linguistic research on the actions of the signer's head and body is relatively young, and our knowledge of these signals is still rather fragmented, there are a lot of topics that deserve attention in future studies. I will name here just a few. Firstly, the so-called pointing and placing functions of the signals of the head and body suggested in the current study should be investigated

further, including cross-linguistic cross-discourse-genre comparison of corpora and comparison of these actions with the co-speech pointing gestures of the head. As a hypothesis, this study suggests that pointing with the head occurs more frequently together with manual pointing actions than independently of them (Article IV). However, this needs to be further explored with data including discussions of both imaginary and present referents, and with the latter, both near to and far from the signer. Secondly, knowing more about the duration and directionality of signals indicating continuity of syntactic or discourse sequences would help us understand better the discourse-organizing function of nonmanual signals, as would comparing the frequency of these signals to signals indicating transitions between sequences of syntax and discourse. Thirdly, the interplay between eye-gaze and head movements, and their discourse-organizing and turn-regulating functions, is a topic that should be investigated systematically using representative data. Fourthly, the processing of different nonmanuals is of interest, and neuro- and psycholinguistic testing of, for example, the hypothesis presented in the current study of more vs. less control-involving signals could yield interesting results. All in all, comparing the actions of the head and body of signers and speakers is an important and realistic topic for future investigation as there are many interesting and still unanswered questions regarding the differences and similarities between the embodied actions of signers and speakers.

YHTEENVETO (FINNISH SUMMARY)

Tutkimuksen teoreettinen tausta ja motivaatio

Niin viittojat kuin puhujatkin viestivät koko kehollaan. Ääntöväylällä, käsillä, kasvoilla, päällä ja keholla voidaan tuottaa erilaisia signaaleja, jotka ovat monin tavoin kytköksissä toisiinsa viitotussa tai puhutussa vuorovaikutuksessa. Tässä tutkimuksessa tarkastellaan *ei-manuaalisuutta* eli muilla kehonosilla kuin käsillä tuotettuja elementtejä suomalaisessa viittomakielessä. Tarkemmin ottaen tutkimus keskittyy viittojien *pään* ja *kehon* liikkeisiin ja niiden funktioihin kielen rakenteen, merkitysten välittämisen, yhteisymmärryksen saavuttamisen sekä vuorovaikutuksen etenemisen kannalta.

Ei-manuaaliset signaalit ovat saaneet yhä enemmän huomiota viittomakielten lingvistisen tutkimuksen kentällä viime vuosikymmeninä. Huolimatta kasvavasta kiinnostuksesta tietomme viittojien kasvojen, pään ja kehon signaaleista ovat vielä vähäiset, ja ei-manuaalisuutta koskevat teoreettiset päätelmät ovat vielä monelta osin kiistanalaisia. Ei-manuaalisten signaalien on todettu olevan monifunktioisia, ja esille on noussut vaikeus erotella toisistaan niin kutsuttuja *ei-manuaalisia eleitä*, *kieliopillisia ei-manuaalisia signaaleja* ja *ei-manuaalista prosodiaa* (esim. Pfau & Quer 2010; Herrmann & Steinbach 2011). Pyrkimys edellä mainittuun erotteluun perustuu siihen, että ei-manuaaliset signaalit on perinteisesti jaoteltu niin kutsuttuihin elemäisiin eli *kielenulkoisiin* signaaleihin ja *kielellisesti merkittäviin* signaaleihin (esim. Baker-Shenk 1983; Corina et al. 1999; Wilbur 2000; Pfau & Quer 2010; Herrmann & Pendzich 2014). Tätä dikotomiaa on perusteltu tietyillä muoto- ja funktiokriteereillä. Funktioiden osalta kielellisesti merkittäviä signaaleja on kutsuttu muun muassa *ei-manuaalisiksi adjektiiveiksi ja adverbeiksi,* kun taas kielenulkoisilla signaaleilla on viitattu useimmiten niin kutsuttuihin *affektisiin* signaaleihin, jotka viestivät enimmäkseen viittojan omista tunteista ja asenteista (esim. Baker-Shenk 1983; Corina et al. 1999; Wilbur 2000). Signaalien erottelu funktioiden perusteella liittyy siis pitkälti siihen, miten referentiaalista niillä viestiminen on.

Merkillepantavaa on, että tietyllä viittojan kehon osalla voidaan tuottaa sekä kielellisiksi että kielenulkoisiksi määriteltyjä signaaleja, jotka voivat olla muodoltaan identtisiä. Esimerkiksi informaation puute saattaa johtaa muodoltaan samankaltaiseen kehollisen signaaliin, kulmakarvojen kohoamiseen, oli toiminta sitten kysymistä (uuden informaation hankintaa), yllättymistä (reaktiota uuteen informaatioon, informaation uutuuden osoittamista keskustelukumppanille) tai uuden informaation korostamista (keskustelukumppanin huomion johdattelemista ilmauksen tuomaan uuteen informaatioon). Kysyvät ja uutta informaatiota korostavat signaalit on perinteisesti nähty kielellisinä, kun taas yllättymisen osoittaminen on määritelty kielenulkoiseksi.

Koska niin kutsuttujen kielellisten ja ei-kielellisten signaalien muodot ovat samanlaisia, niiden erottaminen toisistaan on vaikeaa esimerkiksi viittomakielistä aineistoa tarkasteltaessa. Näin ollen koko kahtiajako asettuu kyseenalaiseksi. Tästä syystä erottelua on pyritty perustelemaan tarkemmilla muotopiir-

teillä. Kielellisten signaalien on sanottu olevan tarkkarajaisesti artikuloituja, johdonmukaisia ja ajoittuvan systemaattisesti suhteessa käsillä tuotettuihin lingvistisiin elementteihin (Corina et al. 1999). Kielellisten signaalien on tällä tavoin argumentoitu merkitsevän diskreettejä kieliopillisia rajoja ja olevan kielijärjestelmän kontrolloimia (Corina et al. 1999). Ei-kielellisten signaalien taas on sanottu olevan muuttuvaisesti artikuloituja, alaltaan varioivia ja kielen rakenteen ja kieliopin kannalta ei-välttämättömiä (Corina et al. 1999). Näitä eroja kielellisten ja kielenulkoisten signaalien muotopiirteissä ei kuitenkaan ole pystytty näyttämään toteen kattavista, luonnollista kielenkäyttöä sisältävistä viittomakielisistä aineistoista, eli kahtiajaon empiiris-teoreettiset lähtökohdat eivät ole ongelmattomat. Lisäksi on tärkeää huomioida, että kahtiajako kielellisiin ja kielenulkoisiin signaaleihin on esitelty viittojien *kasvojen* toimintaa koskevien neurolingvististen havaintotestien yhteydessä eräänlaisena oletusarvona (esim. Corina et al. 1989; Corina et al. 1999; McCullough et al. 2005), vaikka riittävää näyttöä kahtiajaosta ei vielä löydykään. Kasvoihin perustuvaa kahtiajakoa on tämän jälkeen ryhdytty soveltamaan teoreettisena lähtökohtana kaikkeen eimanuaalisuuteen (esim. Wilbur 2000; Pfau & Quer 2010; Herrmann & Pendzich 2014). Ei-manuaalisuuden tutkimusperinteessä voidaan siis ajatella olevan epäsuhta, jota kutsutaan tässä väitöstutkimuksessa *kasvovinoumaksi* (facial bias).

Tässä työssä argumentoidaan, että kielellisen ja kielenulkoisen eimanuaalisuuden kategorinen erottelu juontaa juurensa laajemmista kielitieteen metateoreettisista kysymyksistä sekä viittomakielilingvistiikan kehityksestä näiden kysymysten keskellä (ks. esim. Liddell 2003). 1900-luvun länsimainen valtavirtalingvistiikka perustui pitkälti strukturalistiseen semiotiikkaan ja oletuksille kielellisen merkin arbitraarisuudesta ja symbolisuudesta (de Saussure 1916). Niin kutsutussa modernin viittomakielilingvistiikan *ensimmäisessä aallossa* 1960–80-luvuilla (Kusters et al. 2017) pyrkimyksenä oli luoda viittomakielten rakenteesta ja kieliopista kuvaus, josta kielitieteen kentälle kävisi ilmeiseksi, että viittomakielet ovat luonnollisia kieliä. Koska vallalla ollut kielitieteen perinne oletti kielen perusyksiköiltä arbitraarisuutta ja symbolisuutta, tuli myös viittomakielten arbitraarisuutta ja symbolisuutta korostaa (esim. Liddell 2003). Esimerkiksi amerikkalaisen generatiivisen kielioppiperinteen laajat vaikutukset ovat nähtävissä viittomakielten tutkimusperinteessä niin tutkimusotteiden, metodologioiden kuin kielikäsitystenkin osalta. Variaatio, vaihtelu ja hämärärajaisuus on nähty (myös) viittomakielten lingvistisissä kuvauksissa perifeerisinä ilmiöinä, poikkeuksina, koska on katsottu, että kielen ominaisuuksia kontrolloi johdonmukainen, ihmiselle sisäsyntyinen syvärakenne. Kognitiivis-funktionaaliset lähestymistavat ja kielitypologian kehitys ovat olleet tärkeässä tehtävässä käänteessä, jonka myötä aineistolähtöinen, deskriptiivinen viittomakielen tutkimus, edustavat videoaineistot ja variaation tarkastelu ovat nousseet keskeisempään rooliin viittomakielilingvistiikassa. Tästä ovat esimerkkejä muun muassa 2000-luvulla syntyneet ensimmäiset viittomakielikorpukset (Johnston 2010; Crasborn & Zwitserlood 2008) sekä näiden seurauksena useissa Euroopan maissa käynnistyneet korpusprojektit.

Tässä tutkimuksessa esitetään, että väite, jonka mukaan viittomakielissä on konventionaalisia ja diskreettejä ei-manuaalisia signaaleja, jotka on selvästi eroteltavissa kielenulkoisista hämärärajaisista ei-manuaalisista signaaleista (i) on ennenaikainen, (ii) perustuu pääosin kasvojen ilmeihin liittyviin neurolingvistisiin havaintotesteihin (esim. Corina 1989; Corina et al. 1999; McCullough et al. 2005), (iii) sen taustalta ei löydy riittävästi aitoihin kieliaineistoihin perustuvaa tutkimustietoa, (iv) tällainen oletus voi johtaa tiettyjen ei-manuaalisten signaalien valikoitumiseen kielentutkimuksen kannalta olennaiseksi tutkimuskohteeksi toisten jäädessä kokonaan tutkimuksen ulkopuolelle. Lisäksi viimeaikaiset aineistolähtöiset tutkimukset eivät tue kyseistä väitettä (Johnston et al. 2015; Artikkeli I ; Johnston 2018). Tässä työssä argumentoidaan, että kyseinen lähestymistapa yliyksinkertaistaa tutkittavan ilmiökentän ja johtaa ei-manuaalisten signaalien *symbolisuuden ylikorostumiseen* hämärärajaisten, epäkonventionaalisten ja tilanteisten piirteiden työntyessä taustalle (Artikkeli IV). Samankaltaista marginalisoitumista on aikaisemmin havaittu myös viittojien käsien toiminnan tutkimuksessa (esim. Liddell 2003) sekä puhuttujen kielten kohdalla muun muassa niin kutsuttujen ideofonien, huudahdusten ja muiden ikonisten ja indeksisten elementtien tutkimuksessa (esim. Dingemanse 2017).

Ei-manuaalisuuden tähänastisesta tutkimuksesta on siis löydettävissä esikäsitteellisiä vinoumia, jotka ovat vaikuttaneet siihen, *mitä* ja *miten* on tutkittu. Tämä näkyy jo tavassa, jolla kutsumme kyseistä ilmiökenttää: EI-manuaalisuudella tarkoitetaan 'kaikkea muuta kuin sitä mitä kädet tekevät viitottaessa'. Kutsun kyseistä asetelmaa viittomakielen tutkimusperinteessä esiintyväksi manuaaliseksi vinoumaksi (manual bias). Käsiin keskittyminen on toki monin tavoin ymmärrettävää: käsillä tuotetuilla elementeillä on tärkeä rooli merkitysten rakentumisessa viitotussa diskurssissa. Tämä johtaa kuitenkin helposti ei-manuaalisuuden lähestymiseen manuaalisen kautta, sekundäärisenä. Lisäksi myös ei-manuaalisuuden kaoottisuus ilmiökenttänä on osaltaan voinut johtaa kasvojen, pään ja kehon tuottamien signaalien marginalisoitumiseen viittomakielten tutkimuksessa: signaalien monifunktioisuus, varioivuus ja kontekstisidonnaisuus tekee ei-manuaalisuudesta haastavan tutkimuskohteen.

Edellä esitetyistä tekijöistä johtuen tämän tutkimuksen teoreettiset lähtökohdat eivät oleta kategorista eroa niin kutsuttujen elemäisten ja kielen rakenteeseen ja kielioppiin kuuluvien signaalien välille. Viitotun kielen rakenteen ja kieliopin kannalta tärkeä signaali voi sisältää eleisiin usein yhdistettyjä piirteitä, kuten ikonisuutta, hämärärajaisuutta ja epäkonventionaalisuutta. Toisaalta perinteisesti elemäisiksi määritellyt viitotun kielen elementit voivat sisältää kielen perusyksiköihin usein yhdistettyjä piirteitä, kuten konventionaalisuutta ja skemaattisuutta. Tutkimuksen teoreettiset lähtökohdat ovat käyttöpohjaisessa teoriassa (Bybee 1999; Diessel 2017), viittomakielilingvistiikassa (esim. Liddell 2003; Johnston et al. 2015), eletutkimuksessa (esim. Kendon 2004; Okrent 2002; Wagner et al. 2014) ja semiotiikassa (esim. Peirce 1903; Kockelman 2005; Enfield 2009). Tutkimus lähestyy kieltä toimintana, joka kytkeytyy erottamattomasti muuhun kognitiiviseen, keholliseen ja sosiaaliseen toimintaan. Kielijärjestelmä ja kielellinen merkitys ovat dynaamisia ja kehittyviä ilmiöitä, jotka ovat suoraan

kytköksissä kielen fyysiseen olomuotoon ja foneettiseen tietoon. Kielellisen toiminnan nähdään koostuvan signaaleista, joita tuotetaan erilaisilla *merkkimedioilla* eli fyysisisillä kanavilla (tässä: kädet, kasvot, pää, keho). Nämä signaalit kytkeytyvät toisiinsa muodostaen kielellisiä ilmaisuja, jotka ovat semioottisten osien kimppuja (*composite utterances*) ja joiden tuottamista ja tulkitsemista sitoo yhteen enemmän tai vähemmän tavoitteellinen sosiaalinen toiminta (ks. Enfield 2009). Näiden signaalien joukkoon, eli osaksi kieltä, luetaan myös perinteisesti elemäisinä nähdyt keholliset signaalit, jotka sisältävät runsaasti muun muassa ikonisuutta, hämärärajaisuutta ja epäkonventionaalisuutta.

Ikonisuudella tarkoitetaan tässä tutkimuksessa, että merkin (ihmisen tuottaman tai fyysisessä ympäristössä esiintyvän) ja sen kohteen välinen suhde perustuu havaittavissa oleviin samankaltaisuuksiin. *Indeksisyydellä* taas tarkoitetaan, että merkin ja sen kohteen välinen suhde perustuu aika–paikkaiseen yhteyteen. Symbolisuudella viitataan merkin ja sen kohteen väliseen suhteeseen, joka perustuu sosiaalisesti jaettuun normiin tai tapaan. (Artikkeli IV; ks. myös Peirce 1903; Parmentier 1994; Kockelman 2005; Enfield 2009; Dingemanse et al. 2015.) Näitä kaikkia kolmea suhdetta nimitetään *semioottisiksi strategioiksi*. *Esittävillä* (enacting) signaaleilla viitataan ei-manuaalisiin (tai manuaalisiin) elementteihin, jotka ilmenevät tilanteissa, joissa viittojat esittävät referenttien toimintaa, olemassaoloa, tunteita tai ajatuksia. Kyseistä esittävää diskurssistrategiaa kutsutaan painotuksesta riippuen myös *konstruoiduksi toiminnaksi* tai *roolinvaihdoksi* (esim. Hodge & Ferrara 2014; Cormier et al. 2015a).

Tavoitteet ja tutkimuskysymykset

Tämä tutkimus pyrkii tuottamaan viittomakielten ei-manuaalisuudesta käytyyn keskusteluun uutta tietoa melko vähän tutkitusta osa-alueesta ei-manuaalisuudessa: viittojien kehon ja pään liikkeistä ja asennoista sekä näiden tehtävistä. Lisäksi tutkimuksessa pyritään kuvaamaan erilaisten ei-manuaalisten signaalien välisiä suhteita sekä ei-manuaalisen toiminnan ja käsien toiminnan välisiä suhteita. Tutkimus rakentuu seuraavien tutkimuskysymysten ympärille:

(K1) Millaisia liikkeitä ja asentoja viittojat tuottavat päällään ja kehollaan?
(K2) Mitä tehtäviä yllä mainituilla liikkeillä ja asennoilla on?
(K3) Millainen yhteys pään ja kehon liikkeillä on toisiinsa sekä muuhun ei-manuaaliseen toimintaan?
(K4) Mikä on ei-manuaalisen ja manuaalisen toiminnan välinen suhde?
(K5) Millainen osa kieltä ei-manuaalisuus ylipäätään on?

Tutkimus koostuu neljästä osatutkimuksesta, joista kukin lähestyy tutkimuskysymyksiä hieman erilaisin painotuksin. Osatutkimus 1 on aihetta kartoittava tutkimus, jonka painopiste on tutkimuskysymyksissä 1 ja 2. Tutkimuksessa tarkastellaan neljän erityyppisen päänliikkeen muotoja ja funktioita suomalaisella viittomakielellä käydyissä keskusteluissa. Tutkimuksessa kuvaillaan ja analysoidaan liikekaappausaineiston pohjalta kyseisten päänliikkeiden kinemaattisia

piirteitä ja piirteiden perusteella niiden muodostamia prototyyppisiä muotoluokkia. Lisäksi tutkimuksessa kartoitetaan ja tyypitellään kyseisten päänliikkeiden funktioita. Lopuksi tutkimuksessa kuvaillaan, miten kyseiset neljä päänliikettä yhdistyvät yhteensä seitsemään erityyppiseen vuorovaikutukselliseen, diskurssia jäsentävään, foneettiseen ja syntaktiseen funktioon.

Osatutkimus 2 on tapaustutkimus, jossa tarkastellaan yhtä osatutkimuksessa 1 esille nousseista muoto–funktioyhdistelmistä: pään nyökkäysliikkeiden diskurssia jäsentävää funktiota. Tutkimus keskittyy tutkimuskysymykseen 4 eli käsien toiminnan ja ei-manuaalisten signaalien välisiin kytköksiin, ja siinä tarkastellaan pään nyökkäysliikkeiden ajallista sijoittumista suhteessa käsillä tuotettuihin syntaktisiin jaksoihin. Tutkimuksessa vertaillaan kahta historiallisesti toisiinsa kytkeytynyttä viittomakieltä – suomalaista ja ruotsalaista viittomakieltä – molemmista kielistä kerättyjen korpusaineistojen perusteella. Tutkimuksessa kuvaillaan pään nyökkäysliikkeiden sijoittumista suhteessa syntaktisiin jaksoihin, kuten virke- ja lauserajoihin, sekä analysoidaan erilaisten nyökkäysliikkeiden funktioita.

Osatutkimuksessa 3 keskitytään kahdenlaisen ei-manuaalisen toiminnan, päänliikkeiden ja kehonliikkeiden, väliseen suhteeseen eli tutkimuskysymykseen 3. Tutkimus pohjautuu suomalaisesta viittomakielestä kerättyyn korpusaineistoon, ja siinä tarkastellaan pään ja kehon aktiivisuutta viitotuissa tarinoissa sekä sitä, minkälaisia muodoltaan ja funktioltaan eriasteisesti kompleksisia yhdistelmiä samanaikaiset pään ja kehon liikkeet muodostavat. Tämä pään ja kehon liikkeiden funktioiden kompleksisuus johdattelee työn viimeiseen osaan, jossa tarkastellaan ei-manuaalisten signaalien semioottisia piirteitä. Osatutkimus 4 käsittelee viittojien päällään tuottamien signaalien ikonisuutta, indeksisyyttä ja symbolisuutta ja laajentaa tutkmuskysymyksiin 1–4 liittyvää keskustelua kohti tutkimuksen viidettä pääkysymystä: ei-manuaalisuuden roolia viittomakielissä. Tutkimus esittelee semioottisen typologian viittojien päänliikkeistä sekä teoreettisen esityksen viittojien kehollisten signaalien semioottisesta kompleksisuudesta ja viestinnällisestä yhtenäisyydestä.

Aineisto ja menetelmät

Tutkimuksen aineisto koostuu yhteensä kolmesta osasta. Aineiston ensimmäisen osan muodostavat ajallisesti synkronoidut liikekaappaus- ja videotallenteet, jotka on kuvattu kahdesta yhtäjaksoisesta keskustelusta kahden viittomakieltä äidinkielenään käyttävän henkilön välillä. Keskusteluaineisto on kokonaiskestoltaan noin kaksi minuuttia, ja sen aikana viittojat keskustelevat työstään, opinnoistaan sekä jokapäiväisistä kielenkäyttötilanteistaan. Viittojien päänliikkeiden kinemaattinen analyysi perustuu viittojien oikeaan ohimoon kiinnitetyn liikekaappaussensorin kautta saatuun numeeriseen liikkeenseurantatietoon. Liikekaappausaineisto on tallennettu kahdeksankameraisella optisella liikekaappausjärjestelmällä. Menetelmää ja aineistonkeruuprosessia kuvaavat tarkemmin Jantunen et al. (2012) sekä Artikkeli I. Videoaineisto sisältää viittojien käsien toiminnan pohjalta tehdyt viittoma- ja lausetason annotaatiot.

Aineistoa käytetään osatutkimuksessa 1, jossa tarkastellaan yhteensä neljäntyyppisiä päänliikkeitä: *nyökkäysliikkeitä*, toistollista pään *nyökyttelyä*, pään *työntöliikkeitä* eteenpäin sekä pään *vetoliikkeitä* taaksepäin. Tutkimuksen alussa videoaineistosta annotoitiin ELAN-ohjelmassa kaikki päänliikkeet, joista tutkimus keskittyi nimenomaan neljään edellä mainittuun liiketyyppiin. Päänliikkeiden ajallisen sijoittumisen perusteella videoaineistosta merkittiin muistiin kaikkien nyökkäys-, nyökytys-, työntö- ja vetoliikkeiden esiintymien ruutunumerot, ja niiden avulla liike-esiintymät paikannettiin liikekaappausaineistosta. Liikekaappausaineiston avulla tarkasteltiin päänliikkeiden kinemaattisia piirteitä: liikeratojen laajutta (tarkemmin ottaen paikkavektorin euklidista normia eli pituusmittaa) syvyyssuunnassa viittojien oikean ohimosensorin seurantatiedon perusteella. Tämän numeerisen paikkatiedon perusteella kuvattiin liiketyyppien sisäistä variaatiota (eli eri liike-esiintymien liikeratoja) sekä kunkin liiketyypin keskimääräisiä liikeratoja. Lisäksi kahden liiketyypin, pään nyökkäys- ja työntöliikkeen välillä tehtiin tilastollista vertailua. Aineiston päänliikkeiden funktiot annotoitiin monivaiheisessa prosessissa. Alkuvaiheessa tehtiin funktioita koskevat raaka-annotaatiot, joiden pohjalta kehiteltiin päänliikkeiden funktioita koskeva systemaattisempi tyypittely. Typologia sisältää yhteensä seitsemän funktiotyyppiä, ja sen perusteella aineiston päänliikkeistä merkittiin muistiin kunkin liike-esiintymän funktiotyyppiä koskeva tieto. Edellä selostetun prosessin pohjalta tutkimuksessa kuvattiin päänliikkeiden muoto–funktiosuhteita ristiintaulukoinnin avulla sekä määriteltiin kunkin liiketyypin keskeisimmät funktiot aineistossa.

Aineiston toisen osan muodostaa yhteensä 12:lta suomalaista viittomakieltä äidinkielenään käyttävältä 20–59-vuotiaalta henkilöltä kerätty korpusaineisto. Aineisto on kerätty osana Suomen viittomakielten korpusprojektia (Salonen et al. 2016) ja se sisältää dialogiasetelmassa tallennettua kerronta-aineistoa ja keskusteluja. Kerronta-aineisto sisältää *Lumiukko*- ja *Sammakko, missä olet?* -kuvakirjojen pohjalta viitottuja tarinoita, ja sen yhteiskesto on 45 minuuttia. Keskusteluaineisto on kokonaiskestoltaan 64 minuuttia, ja se sisältää dialogeja, joissa viittojat kertovat kokemuksistaan muun muassa kuurojen yhteisöön liittyvistä perinteistä ja tapahtumista. Aineiston kolmas osa koostuu Tukholman yliopistossa kerätystä ruotsalaisen viittomakielen korpusaineistosta. Aineisto on sisältää *Lumiukko*- ja *Sammakko, missä olet* -tarinoita yhteensä kymmeneltä 20–59-vuotiaalta ruotsalaista viittomakieltä äidinkielenään käyttävältä viittojalta. Suomalaisesta ja ruotsalaisesta viittomakielestä kerättyä korpusaineistoa käytettiin tämän tutkimuksen osatutkimuksessa 2 ja suomalaisesta viittomakielestä kerättyä korpusaineistoa osatutkimuksissa 3 ja 4.

Osatutkimuksessa 2 korpusaineiston pohjalta vertailtiin pään nyökkäysliikkeiden ajallista sijoittumista suhteessa käsillä tuotettuihin syntaktisiin jaksoihin suomalaisen ja ruotsalaisen viittomakielen korpusten kerronta-aineistoissa. Kokonaisaineisto koostui yhteensä 20 viitotusta tarinasta: kymmenestä suomalaisella viittomakielellä ja kymmenestä ruotsalaisella viittomakielellä tuotetusta tarinasta. Molemmat osa-aineistot sisälsivät viittoma- ja virketason annotaatiot, ja suomalaisella viittomakielellä tuotettu kerronta-aineisto si-

sälsi lisäksi annotaatiot pään nyökkäysliikkeille. Tutkimuksen aikana myös ruotsalaisella viittomakielellä tuotettuihin materiaaleihin luotiin nyökkäyksiä koskevat annotaatiot. Tämän jälkeen pään nyökkäysliikkeet luokiteltiin niiden ajallisen sijoittumisen perusteella *rajoille sijoittuviin* nyökkäyksiin sekä *lauseiden sisäisiin* nyökkäyksiin. Rajoille sijoittuvat nyökkäykset luokiteltiin lisäksi kuuteen alatyyppiin sen perusteella, miten ne tarkasti sijoittuivat suhteessa laserajoihin. Molempiin osa-aineistoihin luotiin nyökkäysten ajallista sijoittumista ja funktioita koskevat annotaatiot ELAN-ohjelmassa. Tutkimuksessa kuvailtiin myös yksittäisten viittojien välistä variaatiota nyökkäysten määrässä sekä vertailtiin eri tavoin laserajojen tuntumaan sijoittuneiden nyökkäysten frekvenssejä suomalaisen ja ruotsalaisen kerronta-aineiston välillä.

Osatutkimuksessa 3 tarkastellaan pään- ja kehonliikkeiden välisiä kytköksiä suomalaisessa viittomakielessä. Kuten osatutkimuksessa 2, myös osatutkimuksessa 3 käytettiin suomalaisen viittomakielen korpusaineistoa, yhteensä 12:n äidinkielenään suomalaista viittomakieltä käyttävän henkilön viitottuja tarinoita. Tutkimuksen alkaessa aineisto sisälsi annotaatiot käsillä tuotetuille viittomille ja lauseille sekä päänliikkeille ja kehonliikkeille. Tutkimuksen aikana aineistoon luotiin myös samanaikaisten pään- ja kehonliikkeiden muodostamia liikeyhdistelmiä sekä niiden funktioita koskevat annotaatiot. Tutkimuksen ensimmäisessä vaiheessa tarkasteltiin pään ja kehon aktiivisuutta koko tarina-aineistossa. Pään- ja kehonliikkeiden muototyyppikohtaisten annotaatioiden perusteella esiteltiin erityyppisten liikkeiden esiintymisfrekvenssit sekä yksittäisten viittojien välinen variaatio erilaisten liikkeiden määrissä. Tutkimuksen toisessa vaiheessa tarkasteltiin pään- ja kehonliikkeiden muodostamia liikeyhdistelmiä yhteensä kuudessa viitotussa tarinassa. Tätä varten ELAN-ohjelmassa luotiin ensin pään- ja kehonliikeannotaatioiden (esim. pään kallistus, kääntö, työntö) pohjalta pää- ja kehokohtaiset suurpiirteisemmät annotaatiot liikkeiden suunnan perusteella (ts. liike eteen, taakse, oikealle, vasemmalle) ja tämän jälkeen automaattiset annotaatiot näiden suurpiirteisten annotaatiosolujen yhteisesiintymille. Tuloksena oli samanaikaisia pään- ja kehonliikkeitä koskevat annotaatiot, joista kävi ilmi, olivatko liikkeet samansuuntaisia (esim. pää ja keho liikkuvat eteenpäin) vai sisälsivätkö liikeyhdistelmät myös erisuuntaisia liikkeitä (esim. keho liikkuu eteenpäin pään kallistuessa sivulle). Tämän työn pohjalta tutkimuksessa luokiteltiin liikeyhdistelmät niiden kompleksisuusasteen mukaisesti *yksinkertaisiin*, *semi-kompleksisiin* ja *kompleksisiin* liikeyhdistelmiin. Kunkin yhdistelmätyypin esiintymisfrekvenssit kuvattiin kaikkien kuuden tarinan osalta. Lopuksi liikeyhdistelmissä esiintyvien pään- ja kehonliikkeiden funktiot analysoitiin yhteensä neljästä viitotusta tarinasta ja kullekin liikeyhdistelmälle luotiin funktioita koskevat annotaatiot. Liikeyhdistelmien muotojen ja funktioiden analyysin perusteella tutkimuksessa tarkasteltiin pään- ja kehonliikkeiden funktioita suhteessa liikeyhdistelmien muodon kompleksisuuteen.

Osatutkimus 4 pohjaa osatutkimuksissa 1–3 tehtyyn aineistotyöhön ja analyysiin. Tämän lisäksi tutkimuksessa käytettiin muun muassa suomalaisen viittomakielen korpusaineiston keskustelumateriaaleja, jotka sisälsivät viittoma- ja lausetason annotaatiot. Tutkimusta varten keskusteluaineistosta identifioitiin

esimerkkejä erilaisista päänliikkeistä aineiston silmämääräisen tarkastelun sekä ELAN-ohjelman hakutoimintojen avulla. Kerronta- ja keskusteluaineistojen perusteella tutkimuksessa rakennettiin semioottinen tyypittely viittojien päänliikkeistä. Typologia perustuu peirceläiseen ja post-peirceläiseen semiotiikkaan (esim. Peirce 1903; Kockelman 2005; Enfield 2009) ja se sisältää yhteensä kuusi erilaista semioottisten piirteiden perusteella määriteltyä päänliiketyyppiä: (i) referenttejä esittävät liikkeet, (ii) aika-metafora-liikkeet, (iii) referenttejä osoittavat liikkeet, (iii) reaktiota osoittavat tai kuvailevat liikkeet, konventionaalisemmat muoto-funktio -parit eli kielteinen päänpudistus ja myönteinen nyökyttely. Lisäksi tutkimuksessa tarkasteltiin päällä tuotetuista signaaleista havaittuja semioottisia piirteitä suhteessa viittomakielilingvistisessä kirjallisuudessa annettuihin määritelmiin muilla kehonosilla tuotetuista signaaleista. Tutkimus tarjoaa metateoreettisen katsauksen viittojien päänliikkeisiin, käsitteellisen viitekehyksen viittomakielten ei-manuaalisuuden lingvistiseen tarkasteluun sekä pohdintaa ei-manuaalisuuden implementoimisesta kielen teoriaan.

Tutkimuksen päätulokset

Tutkimuksen päätulokset voidaan tiivistää yhteensä seitsemään kohtaan, jotka käydään läpi seuraavassa. Jokainen päätulos annetaan suhteessa niiden taustalla olleisiin tutkimuskysymyksiin (K1–K5).

1. Viittojien pään ja kehon toiminnasta voidaan löytää tyypillisyyksiä sekä muotojen että funktioiden osalta, mutta kyseiset signaalit muodostavat pikemminkin prototyyppisiä kuin tarkkarajaisia luokkia. (K1, K2)

Tutkimuksessa analysoidut päänliikkeet voidaan jakaa niiden kinemaattisten piirteiden perusteella erilaisiin tyyppeihin. Tiettyyn tyyppiin assosioituvat liike-esiintymät (esim. nyökkäykset) voivat varioida keskenään, ja esiintymien pohjalta laskettuja keskimääräisiä liikkeitä voidaan pitää kunkin liiketyypin prototyyppeinä. Yksittäisellä liike-esiintymällä (esim. nyökkäyksellä) voi olla useampaan liiketyyppiin (esim. nyökkäys- ja työntöliikkeeseen) liittyviä muotopiirteitä, joten tyypit sijoittuvat prototyyppien väliselle jatkumolle. Päänliikkeiden muototyypit ovat toisin sanoen hämärärajaisia, eivät tarkkarajaisia. Sama koskee kehonliikkeitä: kehon liikuttamiseen liittyy usein anatomisesti useamman nivelen ja lihaksen aktivointia, joten liikkeet voivat usein ilmetä useamman liiketyypin yhdistelminä (esim. kehon samanaikainen nojaus ja kääntäminen). Myös pään- ja kehonliikkeiden funktiot muodostavat pikemminkin prototyyppejä kuin tarkkarajaisia luokkia. Funktiotyypit ovat osin päällekkäisiä, ja yksittäisen liike-esiintymän voidaan nähdä toimittavan useammantyyppistä tehtävää (esim. lauseenloppuinen, diskurssia jäsentävä ja myönteisyyttä viestivä pään nyökkäysliike; diskurssijakson yhtäjaksoisuutta jäsentävä ja referentin toimintaa esittävä kehonliike).

2. Viittojien pään- ja kehonliikkeet muodostavat harvoin yksi yhteen muoto–funktio-pareja. (K1, K2)

Yksittäiset liike-esiintymät, kuten esimerkiksi pään nyökkäysliikkeet, toimittavat erilaisia tehtäviä eri konteksteissa. Tämä tarkoittaa sitä, että yksittäistä tehtävää voivat toimittaa erimuotoiset päällä tai keholla tuotetut signaalit. Esimerkiksi diskurssijakson yhtäjaksoisuutta voidaan osoittaa muun muassa pään työntymisellä eteenpäin, koko ylävartalon nojaamisella sivulle tai pään pudistusliikkeellä. Se, minkälainen signaali esiintyy missäkin rakenteessa, riippuu viittojien yksilöllisistä piirteistä, diskurssikontekstista, edeltävistä pään- ja kehonliikkeistä sekä siitä, mitä kädet tekevät ennen, jälkeen ja samanaikaisesti kyseisen signaalin kanssa. Monin paikoin olennaisempaa kuin se, *mitä* tapahtuu viittojan kehon ja pään toiminnassa, voi olla se, että *jotain ylipäätään tapahtuu*, tarkan muodon ollessa näin toisarvoisempaa. Tutkimus esittääkin, että viittojien pään ja kehon signaaleja tulkittaessa keskeiseksi nousevat liikkumattomuuden ja liikkeen väliset kontrastit tai tiettyjen muotopiirteiden (esim. liikkeiden suuntien) väliset erot.

Edellä mainitut havainnot osoittavat, että pään ja kehon signaalien funktiot ovat usein riippuvaisia kontekstuaalisesta assosiaatiosta (Enfield 2009) enemmän kuin tiettyjen konventionaalisten muoto–funktio-parien tulkinnasta. Kyseiset signaalit eivät siis muodosta tyyppejä, joiden esiintymät yhdistetään aina tiettyyn funktioon. Tutkimuksen perusteella symbolisuuteen perinteisesti liitettyä konventionaalisuutta (ks. Peirce 1903; Kockelman 2005) esiintyy lähinnä pään pudistelu- ja nyökyttelyliikkeiden sekä kenties olkien kohautuksen yhteydessä: nämä keholliset signaalit ovat monin paikoin tuttuja, ja niiden tulkintaan liittyy jaettuja normeja niin puhujien kuin viittojienkin keskuudessa. Esimerkiksi päänpudistusten eri konteksteissa toimittamat tehtävät muodostavat hämärärajaisen, toisiinsa läheisesti kytkeytyvien funktioiden kentän: yleisesti kielteisyyteen assosioidun päänpudistuksen funktio on kielteisyydessään erilainen riippuen diskurssikontekstista ja viittojan pyrkimyksistä sosiaalisessa tilanteessa (ks. Kendon 2002; Enfield 2009).

3. Viitottaessa pää on huomattavasti aktiivisempi kuin ylävartalo, eikä päätä ja ylävartaloa voida pitää yleisesti ottaen yhtenä ja samana artikulaattorina suomalaisessa viittomakielessä. Päällä ja keholla tuotetut signaalit muodostavat yhdistelmiä, jotka ovat eriasteisesti kompleksisia niin muodoltaan kuin funktioltaan. (K1, K3, K5)

Tutkimuksen mukaan päänliikkeitä esiintyy viitotuissa tarinoissa huomattavasti enemmän kuin koko ylävartalon liikkeitä: tutkimusaineistossa keskimääräinen tarina sisälsi ylävartalon liikkeisiin nähden nelinkertaisen määrän päänliikkeitä. Kun koko ylävartalo liikkuu, pää ja keho liikkuvat useimmiten yksinkertaisesti ja samansuuntaisesti yhdessä. Mitä kompleksisempi liikeyhdistelmä on muodoltaan, sitä kompleksisempi on myös pään- ja kehonliikkeiden funktioiden yhdistelmä. Esimerkiksi ylävartalo ja pää voivat ensin yhdessä esittää refe-

rentin toimintaa, mutta sitten pään ja ylävartalon liikkeet voivat eriytyä niin, että viittojan keho jää paikalleen osoittamaan diskurssijakson yhtäjaksoisuutta, kun taas pää samaan aikaan tuottaa monenlaisia liikkeitä (esim. ei-esittävää tarinankerronnan kommentointia päänpudistuksella). Samanaikaisten ei-manuaalisten signaalien funktioiden väliset kytkökset eivät kuitenkaan riipu ainoastaan muotojen kompleksisuudesta, kuten käy ilmi tuonnempana kohdassa 6.

4. Tiettyjen päänliikkeiden ja käsillä tuotettujen syntaktisten jaksojen yhteisesiintymisestä on löydettävissä systemaattisuutta sekä yksittäisessä viittomakielessä että kahden toiselleen sukua olevan viittomakielen välillä. (K4)

Vaikka viittojien päänliikkeiden muodot ja funktiot yhdistyvät harvoin yksi yhteen, tyypillisyyksiä on havaittavissa tiettyjen päänliikkeiden yhteyksissä tiettyihin funktioihin. Tutkimuksen mukaan pään yksittäisiä nyökkäysliikkeitä ilmenee taajaan syntaktisten jaksojen taitekohtien tuntumassa sekä suomalaisessa että ruotsalaisessa viittomakielessä. Molemmissa kielissä pään nyökkäysliikkeillä oli selkeä tendenssi esiintyä lauseenloppuisesti. Huolimatta siitä, että äidinkieliset viittojat ovat kertoneet intuitiivisista kokemuksista rytmisestä erosta suomalaisen ja ruotsalaisen viittomakielen välillä, tämän tutkimuksen tulokset antavat siis ymmärtää, ettei kyseisten kokemusten taustalla ole pään nyökkäysliikkeiden ja käsien toiminnan välinen yhteys. Merkillepantavaa on, että myös puhujien on havaittu tuottavan pään nyökkäysliikkeitä syntaktisten jaksojen, puheenvuorojen ja pidempien diskurssisekvenssien rajoilla (esim. McClave 2000; Aoki 2014). Kiinnostavaa onkin, miten jaettu kyseinen piirre on eri kulttuurialueiden viittojien ja puhujien kesken, ja kuinka paljon ilmiö on kytköksissä ajatteluun ja kognitiiviseen prosessointiin puhuttua tai viitottua kieltä tuotettaessa. Lisäksi on tärkeää nostaa esille, että viitottua diskurssia jäsentävät nyökkäysten lisäksi myös monet muut ei-manuaalisesti ja käsillä tuotetut signaalit.

5. Päänliikkeiden kaltaisiin ei-manuaalisiin signaaleihin liittyy erilaisissa määrin ikonisuutta, indeksisyyttä ja symbolisuutta. Päällä tuotetuissa signaaleissa indeksisyys on yleisesti ottaen keskeisin semioottinen strategia. (K2)

Tutkimuksen mukaan erityyppisiin viittojien päällään tuottamiin signaaleihin liittyy erilaisissa määrissä ikonisuutta, indeksisyyttä ja symbolisuutta eli erilaisia semioottisia strategioita. Keskeisin semioottinen strategia päällä tehdyissä signaaleissa on indeksisyys: päänliikkeet identifioivat referenttejä sekä osoittavat diskurssin rakennetta tai viittojien reaktioita johonkin. Ikonisuus ilmenee vahvimmin referenttejä esittävissä päänliikkeissä tai aikametaforia (tarkemmin ottaen syvyyssuuntaista aikalinjaa) visualisoivissa liikkeissä, mutta se liittyy jonkinasteisesti myös muihin päänliikkeisiin. Symbolisuus eli konventionaalinen suhde merkin ja sen kohteen välillä (ks. Peirce 1903; Kockelman 2005) tulee ilmi enimmäkseen siinä, miten päällä tuotetuista signaaleista tunnistetaan niiden taustalla olevat yleiset viestinnälliset käytänteet (esim. osoittaminen, dis-

kurssin jäsentäminen, esittäminen) sen sijaan, että yksi muoto assosioitaisiin tiettyyn funktioon kontekstista riippumatta. Edellä esitetyn perusteella myös kasvoilla ja käsillä tuotettuihin signaaleihin oletetaan liittyvän eriasteisesti semioottisia strategioita, riippuen kunkin kehonosan ominaispiirteistä.

6. Viitotuissa ilmauksissa ei-manuaaliset signaalit ovat osa semioottisesti kompleksisia mutta viestinnällisesti yhtenäisiä kokonaisuuksia. Yhtenäisyydestä riippumatta eroja on havaittavissa (i) siinä, miten komplementaarisessa suhteessa samanaikaiset signaalit ovat, ja (ii) siinä, mitkä ovat eri kehonosien merkkitoiminnan semioottiset painopisteet. Kohdan (ii) painopisteet voidaan osin palauttaa ihmiskehon eri osien fyysisiin ja anatomisiin piirteisiin. (K3–K5)

Tutkimuksen mukaan pään- ja kehonliikkeiden kaltaisia ei-manuaalisia signaaleja ei voida analysoida irrallisina elementteinä. Viitotuissa ilmauksissa yksittäiset signaalit ovat aina semioottisesti kompleksisten, samanaikaisesti eri merkkimedioilla (tässä: käsillä, kasvoilla, päällä ja keholla) tuotettujen signaalikimppujen osia (vrt. Enfield 2009). Signaaleja sitovat yhteen viestinnällisen toiminnan piirteet, joissa kontekstuaalisella assosiaatiolla on keskeinen rooli (Enfield 2009). Vaikka samanaikaiset signaalit ovatkin aina toisiinsa kytköksissä, joidenkin – esimerkiksi diskurssia jäsentävien – signaalien funktiot ovat riippuvaisempia muista signaaleista kuin toisten. Nämä signaaleja sitovat yhteydet voivat olla toisiaan voimistavia, komplementaarisia tai ainoastaan viestinnälliseen kokonaismerkitykseen kytkeytyneitä. Signaali voi siis yhdessä toisen signaalin kanssa tehdä artikulaatiosta voimakkaampaa (esim. pelkän päänliikkeen sijaan koko ylävartalo liikkuu samansuuntaisesti), signaalin funktio voi syntyä nimenomaan sen yhteydestä toisiin signaaleihin (esim. päänliike jaksottaa käsillä tuotetuista signaaleista koostuvaa kokonaisuutta) tai signaalin funktio voi olla itsenäisempi, mutta yhdistyä muihin signaaleihin tulkittaessa kokonaisen ilmauksen merkitystä tietyssä tilanteessa (esim. pään pudistusliike tuo kielteisiä (lisä)merkityksiä yhdessä käsien ja kasvojen signaalien kanssa tuotettuihin ilmauksiin). Nämä erilaiset samanaikaisten signaalien väliset kytkökset eivät ole kategorisia vaan ne voidaan sijoittaa jatkumolle vahvemmista kytköksistä heikompiin. Kytköksen vahvuus riippuu myös viestinnällisen toiminnan yleisemmästä funktiosta, ja se on kontekstisidonnaista.

Viitotun kielen lauserakenteiden on esitetty olevan vahvasti kytköksissä viestinnän taustalla olevaan strategiaan, esimerkiksi siihen, miten paljon referenttien esittämistä viittomisessa ilmenee (Jantunen 2017a). Diskurssistrategia siis vaikuttaa kielen rakenteeseen ja semioottisen informaation jäsentymiseen ja näin ollen luonnollisesti myös ei-manuaalisuuteen. Esimerkiksi viittojan esittäessä referentin toimintaa (ks. määritelmä tämän yhteenvedon alussa) samanaikaisten signaalien tulkinta on toisistaan riippuvaista, vaikka signaalien funktiot eivät olisikaan identtisiä. Tilanteessa, jossa eri kehonosilla miimisesti esitetään eri osia samasta referentistä (pää esittää referentin päätä, kasvot referentin kasvoja jne.), eri merkkimedioilla tuotetut signaalit yhdessä kuvailevat holistisesti,

kuvallisesti, toiminnan eri osia. Tällöin signaalien funktiot ovat toisiinsa nähden osa-kokonaisuussuhteessa: ne kuvailevat eri osia samasta kokonaisuudesta.

Tutkimuksesssa argumentoidaan myös, että viittojan kehon eri osien semioottiset painopisteet ovat yleisesti ottaen erilaisia. Symbolisuus on ilmeisintä käsien toiminnassa, kun taas muiden kehon osien signaaleissa se ei ole niin keskeisessä roolissa. Ikonisuutta ja indeksisyyttä on sen sijaan kaikkialla: nämä semioottiset strategiat ovat merkittäviä kaikkien merkkimedioiden signaaleissa. Eroja on kuitenkin löydettävissä siinä, minkäasteisesti kyseiset strategiat tulevat ilmi eri kehonosien toiminnassa. Pään ja kehon signaalien ikonisuus on lähinnä esittävää ja siksi rajatumpaa kuin käsien ja kasvojen signaalien ikonisuus, joka on sekä esittävää että ei-esittävää (esim. käsillä tuotettujen kuvailevien viittomien ikoniset piirteet; kasvoilla tuotetut ei-esittävät referenttien laatujen luonnehdinnat, kuten esineen koon kuvailu suun/poskien toiminnalla).

7. Ei-manuaaliset signaalit osoittavat, miten merkkitoiminta, kieli ja kognitio ovat erottamattomasti kytköksissä siihen, miten ihmiset navigoivat (ovat, kokevat, toimivat) kehollaan fyysisissä ja sosiaalisissa ympäristöissä. (K5)

Tutkimus argumentoi näkemyksen puolesta, jonka mukaan ei-manuaalisten signaalien muotoihin ja funktioihin vaikuttavat ihmiskehon ominaispiirteet sekä se, miten koemme maailman kehollamme ja toimimme maailmassa kehollisesti. Tämä tarkoittaa, että keholliset viestinnälliset signaalit ovat erottamattomasti kytköksissä muuhun ei-viestinnällisesti orientuneeseen kehollisen toimintaan. Yhteys näkyy muun muassa muoto–funktio-suhteeltaan vakiintuneemmille päänliikkeille esitetyssä reaktiopohjaisessa alkuperässä (esim. torjuva tai väistävä ele päänpudistuksen alkuperänä; Darwin 1872; Stern & Bender 1974). Tutkimuksessa ehdotetaan, hypoteesina jatkotutkimukselle, että tämä kehollinen kytkös näkyy myös erilaisten ei-manuaalisten signaalien eriasteisessa *kontrollissa* (Enfield 2009; Kockelman 2005). Jotkin signaalit, esimerkiksi kielteiset päänpudistukset, ovat kontrolloidumpia kuin toiset signaalit, esimerkiksi diskurssia jäsentävät päänliikkeet. Ensin mainitut liitetään voimakkaammin tietoiseen ja tarkoituksenmukaiseen toimintaan, kun taas jälkimmäisten yhteydessä tietoisuus niiden tuottamisesta ja tulkitsemisesta saattaa kasvaa vasta, kun jonkin havaitaan olevan epätyypillistä. Oli kyseessä enemmän tai vähemmänkin kontrollia sisältävä yksittäinen signaali, on se kuitenkin osa intentionaalista viestinnällistä toimintaa.

Pohdinta ja loppusanat

Tämän tutkimuksen tuloksena on syntynyt kuvaus, analyysi ja teoreettinen esitys pään ja kehon signaaleista suomalaisessa viittomakielessä. Tutkimus osallistuu viittomakielistä käytyyn kansainväliseen keskusteluun tuottamalla uutta tietoa vähän tutkitusta osa-alueesta: viittojien pään ja kehon liikkeistä. Kuten työssä käy ilmeiseksi, yksittäisen funktion nimeäminen tietylle pään- tai kehonliikkeelle ei ole aina yksinkertaista, sillä sama liike voi toimittaa useampaa teh-

tävää. Tämän lisäksi tietyn funktion kutsuminen toista ensisijaisemmaksi on tulkinnanvaraista ja ongelmallista. Päällä ja keholla tuotetut signaalit osoittavat ylipäätään suurta joustavuutta siinä, mitkä muodot voivat yhdistyä mihinkin funktioihin. Tämä tarkoittaa, että muodoltaan samanlaiset signaalit voivat ilmetä enemmän tai vähemmän olennaisina viitottujen ilmausten kieliopillisten piirteiden kannalta. Jopa välitettäessä merkityksiä, esimerkiksi referenttejä esittämällä, pään- ja kehonliikkeiden tulkinta on riippuvaista samankaltaisuuksien havaitsemisesta ja aika-paikkaisista yhteyksistä, vaikka esimerkiksi pään pudistelu- ja nyökyttelyliikkeisiin onkin kehittynyt vakiintuneempia kytköksiä muodon ja funktion välille (niin puhujilla kuin viittojilla).

Tutkimuksessa argumentoidaan, että ei-manuaalisuuden perinteinen, varsin kategorinen luokittelu kieliopilliseen, eleiseen ja prosodiseen on ongelmallinen (esim. Baker-Shenk 1983; Corina et al. 1999; Wilbur 2000; ks. myös Herrmann & Steinbach 2011). Ei-manuaalisuuden lingvistinen tarkastelu hyötyy laajemmasta semioottisesta viitekehyksestä nimenomaan siksi, että ei-manuaalisten signaalien tulkintaan liittyy konventionaalistuneita tyyppi–tokeenisuhteita enemmän edellä mainittua samankaltaisuuden tunnistamista, fyysisen tila-aikaisen yhteyden havaitsemista sekä kontekstuaalista assosiaatiota (ks. esim. Clark 1996; Kockelman 2005; Enfield 2009). Vaikka päänliikkeet usein ilmenevätkin yksittäisinä merkkitapahtumina, ne ovat merkityksellisiä. Niiden viestinnällinen ja kielellinen merkityksellisyys ei rakennu symbolisuuden varaan (sen perinteisesti kieleen yhdistetyssä merkityksessä), vaan se on semioottiselta painotukseltaan erilaista. Tästä syystä tutkimus yhdistää peirceläistä ja post-peirceläistä semiotiikkaa perinteisempiin viittomakielilingvistisiin lähestymistapoihin. Semioottisen viitekehyksensä myötä työ pyrkii toisaalta kytkeytymään olemassaolevaan tutkimustietoon viittojien pään ja kehon signaaleista ja toisaalta tuomaan aihetta lähemmäs yleisempää keskustelua viittojien ja puhujien multimodaalisesta ja semioottisesti monimuotoisesta viestinnällisestä toiminnasta (esim. McNeill 1992; Clark 1996; Liddell 2003; Enfield 2009; Kendon 2014; Johnston & Ferrara 2012; Johnston 2013; Schembri et al. 2018; Ferrara & Hodge 2018). Tutkimuksessa pyritään myös tarjoamaan käsitteistöä viittojien ja puhujien kehollisten signaalien vertailuun eletutkimuksen ja viittomakielen lingvistisen tutkimuksen kentillä. Näin ollen työ pyrkii osallistumaan myös laajempaan teoreettiseen keskusteluun kielessä – niin puhutussa kuin viitotussa – esiintyvistä hämärärajaisista ja epäkonventionaalista piirteistä (ks. esim. Jantunen 2018b).

Tutkimuksen mukaan kaikkiin pään ja kehon signaaleihin – myös sellaisiin, jotka on perinteisesti määritelty kieliopillisiksi – sisältyy erilaisissa suhteissa ikonisia, indeksisiä ja symbolisia piirteitä (vrt. Capirci 2018). Lisäksi tutkimuksessa esitetään, että eri kehonosilla on erilaisia semioottisia painopisteitä ja että nämä painopisteet ovat osittain palautettavissa takaisin ihmiskehon eri osien fyysisiin ja anatomisiin piirteisiin (Artikkeli IV; Wagner et al. 2014; Enfield 2009). Kädet soveltuvat hyvin fyysisten objektien ikoniseen kuvaamiseen esimerkiksi erilaisten käsimuotojen ja piirtävien liikkeiden avulla. Tämä on vähemmän mahdollista kasvoilla, jotka taas soveltuvat hyvin luonnehtimaan elol-

listen referenttien piirteitä, tunteita ja asenteita, välittämään viestijän itsensä tunteita ja asenteita tai luonnehtimaan elottomien referenttien kokoa ja muita havaittavissa olevia piirteitä (esim. toistollisuutta, etäisyyttä ja paikallaanoloa). Pää ja ylävartalo eivät ole fyysisesti otollisia tuottamaan signaaleja, jotka jakavat piirteitä fyysisten olioiden ja tapahtumien kanssa, lukuun ottamatta elollisten referenttien pään ja kehon toimintaa esittävässä viestinnässä. Sen sijaan pään- ja kehonliikkeillä osoitetaan, paikannetaan, näytetään reaktioita ja jäsennetään diskurssia. Fyysiset tekijät vaikuttavat myös siihen, että päällä ja ylävartalolla osoittaminen on suurpiirteisempää kuin käsillä osoittaminen. Tällaiset fyysiset piirteet ovat ihmisille ominaisia huolimatta siitä ovatko he viittojia vai puhujia.

Lisäksi tutkimuksessa argumentoidaan, että ei-manuaaliset signaalit ovat erottamattomasti kytköksissä siihen, miten me ihmiset elämme maailmassa ja koemme maailman kehoillamme (esim. Streeck 2015). Päänliikkeiden osalta tästä kertovat muun muassa funktioiltaan vakiintuneemmat pään pudistusliikkeet, joiden alkuperänä on nähty keholliset reaktiot ärsykkeisiin. Kytköksiä ei-viestinnälliseen kehollisuuteen havainnollistaa myös se, että tunteita ja asenteita osoittavat signaalit ja referenttejä luonnehtivat signaalit ovat tämän tutkimuksen perusteella usein muodoltaan identtisiä. Tutkimus ehdottaa, että yhteys ei-viestinnälliseen kehollisuuteen näkyy lisäksi muun muassa diskurssia jäsentävien päänliikkeiden matalammassa kontrollin asteessa (Kockelman 2005; Enfield 2009). Tutkimuksen mukaan viittojien viestinnässä esiintyvät ei-manuaaliset signaalit ovat siis esimerkkejä siitä, että ihmisten välinen merkkitoiminta on kehollista, kontekstisidonnaista ja ikonista yhtä lailla kuin symbolista, ja että lingvistisesti merkittävät ilmiöt ovat kytköksissä ihmisten yleisiin kehollisiin kokemuksiin, toimintaan ja navigointiin fyysisissä ja sosiaalisissa ympäristöissä.

Tutkimus esittää, että dualistinen jako elemäiseen ja kielelliseen tarjoaa vähäisesti apua pyrkimyksessä ymmärtää ei-manuaalisuuden roolia viittomakielissä. Kun kielellisen ja eleisen välille ei pyritä tekemään kategorista erottelua, pienenee myös riski siihen, että tutkimuskohteesta muodostuu vinoutunut tai puutteellinen kuva. Kognitiivis-funktionaaliset lähestymistavat kieleen soveltuvat hyvin runsaasti monifunktioisuutta, variaatiota ja hämärärajaisuutta sisältävien ei-manuaalisten signaalien kuvaamiseen. Jos viittomakielten lingvistinen tutkimus olisi kiinnostunut ainoastaan konventionaalisesta, symbolisesta merkkitoiminnasta, suuri osa tässä tutkimuksessa esitellyistä signaaleista nähtäisiin epäolennaisina. Väitöskirjan neljättä tutkimusartikkelia lainaten:

> Symbolicity may not be the prime motor of this type of signification [signals produced with the head], but still head movements are significant. This [--] speaks for the need for a theory of language that embraces less symbolic and unconventional elements instead of pushing them to the periphery. (Artikkeli I, 23.)

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ORIGINAL PAPERS

I

HEAD MOVEMENTS IN FINNISH SIGN LANGUAGE ON THE BASIS OF MOTION CAPTURE DATA: A STUDY OF THE FORM AND FUNCTION OF NODS, NODDING, HEAD THRUSTS, AND HEAD PULLS

by

Puupponen, A., Wainio, T., Burger, B. & Jantunen, T. 2015

Sign Language & Linguistics 18(1), 41–89

Head movements in Finnish Sign Language on the basis of Motion Capture data

A study of the form and function of nods, nodding, head thrusts, and head pulls

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This paper reports a study of the forms and functions of head movements produced in the dimension of depth in Finnish Sign Language (FinSL). Specifically, the paper describes and analyzes the phonetic forms and prosodic, grammatical, communicative, and textual functions of nods, head thrusts, nodding, and head pulls occurring in FinSL data consisting of a continuous dialogue recorded with motion capture technology. The analysis yields a novel classification of the kinematic characteristics and functional properties of the four types of head movement. However, it also reveals that there is no perfect correspondence between form and function in the head movements investigated.

Keywords: non-manuals, head movements, prosody, Finnish Sign Language, Motion Capture

1. Introduction

This paper presents the first in-depth study on various movements produced by the head in a sign language: an investigation of head movements produced primarily in

* The corresponding author of the current paper is Anna Puupponen, and the study presented here is a part of her PhD dissertation. The corresponding author has carried out the most significant part of the research, including the writing of the manuscript. The co-authors have been involved in the study especially in the process of collecting and processing the data. All co-authors have also contributed to scientific discussions concerning the content of the paper, and have accepted the final version of the manuscript.

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the dimension of depth (i.e. the sagittal plane) in Finnish Sign Language (FinSL). Specifically, the movements in focus in the present paper are the head nod, nodding, head thrust, and head pull. The goal of the study is to investigate both the phonetic forms and the prosodic, communicative, and syntactic functions of these movements. In signing, the head also moves along the horizontal and vertical dimensions. The forms and functions of head movements in these dimensions (e.g. headshakes, tilts) are not dealt with in the current paper but are to be discussed in the future. For observations on such movements in sign languages other than FinSL, see, for example, Liddell (1980), Winston (1991), Bahan (1996), Wilbur (2000), and Zeshan (2004, 2006).

In the field of sign language linguistics, the study of different articulations produced by the torso, the head, and the upper and lower parts of the face, that is, non-manual elements, has been an area of increasing interest over the past few decades (see e.g. Wilbur 2000; Pfau & Quer 2010; Herrmann & Steinbach 2011; Sandler 1999ab, 2012). Some of the ongoing research concerns the methods of annotation and analysis of different non-manuals as well as the prosodic vs. grammatical vs. affective nature of non-manuality. The multi-layered articulation and form-function relationship of different non-manual elements are other topic areas with many unanswered questions (see e.g. Herrmann & Steinbach 2011). With regard to FinSL, non-manuals and their functions are for the most part still unexplored. One exception to this is the actions produced by the lower face, i.e. mouthing and mouth gestures, which have been investigated (Pimiä 1987; Rainò 2001). There are also a few single references to other non-manual cues in FinSL, such as the articulation of the head in different functional sentence types (Rissanen 1985) or in equative sentences (Jantunen 2007); the articulation of the head and face in interrogative and negative constructions (Savolainen 2006); and head or body movements and eye gaze in role shift (Rissanen 1992; Luckasczyk 2008). Recently, the study of non-manuals in FinSL has started to include the detailed analysis of the activity of the head (Puupponen 2012; Puupponen et al. 2013). The results of the present paper draw partly on this recent work.

One of the shortcomings in work done so far in the study of different non-manuals is the lack of a detailed description of the forms of, for example, different head movements. Our approach in this study differs from previous studies in that it has a strong phonetic basis: the investigation of the forms and functions of different sagittal head movements was carried out utilizing data derived from two FinSL dialogues recorded with Motion Capture (mocap) technology. As Crasborn (2012) has noted, the phonetic description of sign languages is still in its beginnings, although several phonological models have been developed in order to make it possible to understand the structure of sign language utterances in more detail. Recent technological developments in video recording, motion tracking,

and 3D computer animation, however, offer new possibilities for research on sign language phonetics. By utilizing, for instance, mocap technology in collecting and analyzing sign language data, researchers can base their study upon reliable empirical data in a manner hitherto unparalleled in detail and accuracy (see Wilbur 1990; Wilcox 1992; Duarte & Gibet 2010ab; Tyrone et al. 2010; Jantunen et al. 2012). It is our conviction that the study of non-manuals has a lot to gain from this technical progress.

This paper focuses on a description of the forms of nods, nodding, head thrusts, and head pulls on the basis of their movement amplitude as well as on a meaning-based analysis of their functions. The manner of the investigation is descriptive and functional: the study aims to describe the different forms and functions of FinSL head movements from the premises of the language in question, without the use of any specific formalism, and with the goal of (eventually) forming a theory of the nature of this particular sign language (cf. Dixon 2009; Dryer 2006). In this way, this current research follows the tradition in which most of the existing studies on the basic structure of FinSL have been conducted to date, that is, Basic Linguistic Theory (ibid.). In the analysis and classification of different head movements, we see the functions of head movements as grammatical, communicative, prosodic, and/or textual in nature. These functions correspond closely to the experimental, interpersonal, and textual metafunctions in language proposed by Halliday (1994; see also Thompson 1996): representing the external world or our inner worlds in the contents of our language use; interacting and communicating with each other while influencing each other's behaviour; and constructing our communication so that the messages we express are situated in the narrower and wider contexts of other messages and information. Consequently, continuous dialogue data has been chosen in order to study the actions of the head in situations which are common and offer typical examples of actual language use.

The paper is organized as follows: Section 2 presents some findings of earlier work on different head movements and their functions in various sign languages. Section 3 describes the data and methods used in the analysis of FinSL head movements produced in the dimension of depth. The results of the study are presented in the following sections: the forms of sagittal head movements in Section 4 and the different functions of these movements in Section 5. This is followed by a discussion and conclusion in Sections 6 and 7, respectively.

2. Forms and functions of head movements in sign languages

Different head movements and other non-manual elements have received attention in the investigation of sign languages since the early research on American

Sign Language (ASL) syntax (e.g. Baker & Padden 1978; Coulter 1979; Liddell 1986). Head movement types frequently referred to in the existing literature are the following: nod, nodding (i.e. repeated nod), head thrust, head pull, sideways tilt of the head, head turn, and headshake. In the current study, we examine the first four of these head movements. These head movements are said to have several phonological, morphological, syntactic, textual, communicative, and prosodic functions in different sign languages. Section 2.1 presents a few general remarks on non-manuality, prosody, and grammar, and in Sections 2.2–2.4, we provide a brief overview of the different types of head movements and their functions.

2.1 On non-manuals in sign languages

Traditionally, non-manual elements have been divided into *linguistic* and *affective* non-manuals (e.g. Baker & Padden 1978; McIntire & Reilly 1988; Reilly et al. 1990; Anderson & Reilly 1997; Wilbur 2000). According to Pfau and Quer (2010), affective non-manuals are linguistically insignificant facial expressions or head movements that express, for example, disgust, disbelief, or surprise, and which are used by both speakers and signers. According to the standard view, linguistic non-manuals, on the other hand, are non-manual articulations that have grammatical functions, prosodic functions, or both (Wilbur 2000; Pfau & Quer 2010; Herrmann & Steinbach 2011; Sandler 2012). Examples of phonological non-manuals are, for instance, single sideways head movements (i.e. head turns) accompanying negative signs, or mouth gestures that are essential in the production and comprehension of a particular lexeme. Non-manuals such as combinations of certain mouth gestures and head movements have been said to be morphological and to convey adjectival or adverbial information when accompanying nominal or verbal signs. However, the morphemic status of mouth gestures has also been questioned in recent research on, for example, Australian Sign Language (Johnston & van Roekel 2014). Examples of syntactic non-manuals are, for example, headshakes or head nods in negation or affirmation, as well as distinct eyebrow positions and head or shoulder movements in polar and content questions, conditionals, and relative clauses. Non-manuals that are traditionally classified as pragmatic are, for example, the head and body movements that mark contrastive focus (Wilbur & Patschke 1998; van der Kooij et al. 2006) or the body shifts, head movements, changes in the direction of eye gaze or facial expressions that occur when a signer produces a quotational or non-quotational role shift[1] (e.g. Liddell 1980; Padden

1. Role shift is produced in situations which include constructed discourse (reported speech) or constructed/reported action. In FinSL, role shift has been noted to occur in both formal/informative signing and narratives (Lukasczyk 2008; Lautala 2012).

1990; Engberg-Pedersen 1995; Lillo-Martin 1995; Emmorey & Reilly 1998). The meaningful use of the three-dimensional signing space, which is a well-known and frequent characteristic of all the sign languages studied so far (see e.g. Winston 1991; Engberg-Pedersen 1993; Bahan 1996; Neidle et al. 2000; Liddell 2003), includes non-manual means of making signed texts coherent. In FinSL, text cohesion is produced with head tilts, head nods, body leans, and changes in the direction of the eye gaze in addition to directing the motion of the hands towards predetermined referents (Lautala 2012; Puupponen 2012).

Other features that create cohesion and organize signed utterances, texts and discourses, are different prosodic cues. The prosodic functions of non-manuals in sign languages have traditionally been divided into domain markers and edge markers (see e.g. Wilbur 2000; Pfau & Quer 2010; Neidle et al. 2000). In domain marking, non-manuals spread across syntactic domains such as topics and questions or construct prosodic units such as prosodic words or intonational phrases (Wilbur 2000; Sandler 2012). Edge markers are said to be punctual cues occurring at the borders of syntactic and/or prosodic sequences. According to Wilbur (2000) and Sandler (1999ab, 2011, 2012), non-manuals form a layered structure in which simultaneous changes in the actions of different non-manual articulators mark the boundaries and domains of prosodic and/or syntactic units. Pfau & Quer (2010: 400) state that "prosodic structure frequently aligns with syntactic constituency" in sign languages. However, as has been pointed out by e.g. Nespor & Vogel (1986), Nespor & Sandler (1999), and Sandler (2012), this alignment is not one-to-one, which means that prosodic and syntactic structures are autonomous parts of grammar that are in close relation but are not fully isomorphic.

It has been pointed out that distinguishing between purely affective and linguistic non-manuals is not always easy (Pfau & Quer 2010; Herrmann & Steinbach 2011; see also De Vos et al. 2009). However, studies on non-manuals suggest that the scope and timing of linguistic non-manuals is more constrained than the scope and timing of affective non-manuals (Baker-Shenk 1983; Wilbur 2000; Pfau & Quer 2010). Furthermore, it has been argued that in the acquisition of (American) sign language, children use affective non-manuals from an early stage, but only later use non-manuals for linguistic purposes (Anderson & Reilly 1997; Reilly & Bellugi 1996). It should be noted that the division of non-manuals into linguistic and affective ones seems to be based on facial articulation (movements and positions produced by the upper and lower face). Affective and linguistically significant head and body movements, however, have received far less attention in the sign language literature. In Sections 2.2–2.4, we will give a short overview of the forms and functions of different head movements in sign languages according to the existing literature.

2.2 Nod and nodding

Nods are head movements in which a signer moves his/her head up and down (Liddell 1980; Wilbur 2000). The prototypical movement path of a nod is a tilt movement in the dimension of depth: the signer's chin moves up and down and the orientation of the signer's face changes accordingly (see Figure 1). According to Puupponen (2012), head nods consist of three movement-internal phases: preparation, stroke, and recovery. During preparation, the position of the head changes slightly in order to prepare for the stroke phase, in which the signer's chin moves towards the chest. The movement amplitude is largest during the stroke, after which, during the recovery, the head movement becomes smaller again and the head moves towards a 'neutral' position or a subsequent head movement.

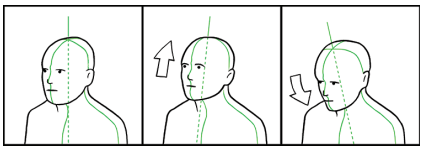


Figure 1. The prototypical movement path of nods and nodding.

According to the standard view, head nods perform a large variety of functions, such as emphasis, assertion, affirmation, and existence (Liddell 1980; Wilbur 2000; Pfau & Quer 2010). It has been argued that in ASL, nods perform as existential markers when occurring with lexical signs in verbless assertions (Liddell 1980; Aarons 1994). Liddell (1980: 30,37) offers the following examples of a verbless simple sentence (1), and an elliptic utterance, in which the signer conveys information in the form of a list (2) ('hn' = headnod).

(1) JOHN DOCTOR
hn
'John is a doctor.'

(2) HAVE WONDERFUL PICNIC. PRO.1 BRING SALAD, JOHN BEER,
hn hn
SANDY CHICKEN, TED HAMBURGER.
hn
'We had a wonderful picnic. I brought the salad, John (brought) the beer, Sandy (brought) the chicken, and Ted (brought) the hamburger.'

According to Liddell, if sentence (1) was produced without a head nod, it would convey the meaning 'John's doctor'. Liddell states that also in (2), the head nods are obligatory markers of existence. Wilbur (1991), on the other hand, has suggested

that nods, like voluntary blinks, mark focus when they occur with lexical signs in structures such as the one in (2).

Head nods have not been reported in elliptic structures in FinSL (Jantunen 2013), although Puupponen (2012: 3) presents the example shown in (3), which involves a series of vertical movements of the head ('hn'), combined with side-to-side head tilts ('hts' = head tilt sideways), which were used to organize an utterance with a list structure without the use of a list buoy (i.e. a manual listing sign; cf. Liddell 2003).[2] However, nods have been found in FinSL utterances similar to the one presented above in (1). Jantunen (2007) observed that head nods occur in equative sentences, which are assertive utterances with naming, defining, and identifying functions, such as the sentence in (4) (Jantunen 2007: 123; 'ews' = eyes widened/squinted; 'brw' = brows raised/wrinkled; 'b' = blink).

	hn	hn+hts	hn+hts	hn+hts
(3)	EXAMPLE	BOARD	INDEX	CHAIRPERSON MONEY HANDLE SECRETARY

'For example, in the board, there is a chairperson, a treasurer, and a secretary.'

	hn		
	ews/brw		
b	b		b
(4)	A-N-I-S	PI	SPICE PLANT

'Anis is an aromatic herb.' (*Suvi* 350/1)

Jantunen notes that it is difficult to draw any overall conclusions about the syntactic function of the head nod because of its ambiguity. Head nods often co-occurred in Jantunen's equative data with the sign PI,[3] and they can be seen as copying the manual path movement of this specific sign (cf. Woll 2009).

In ASL, head nods have also been associated with the edges of syntactic units. Nods have been said to occur after clause-final signs marking syntactic boundaries (Wilbur 1994; 2000). According to Wilbur (2000), the then existing research implied that single head nods perform as boundary markers whereas slow (i.e. 'deliberate') single head nods are used as focus markers for lexical signs. The occurrence of nods as boundary markers after clause-final signs or as focus markers with lexical signs has not yet been investigated for FinSL.

2. The glosses in examples (3) and (4) have been translated into English; in (4) mouthings from the original example are neglected.

3. The sign PI in equative sentences is a modal element that expresses certainty. The gloss is based on the mouth gesture accompanying the sign. For a discussion, see Jantunen (2007).

In addition to single nods, signers also produce nodding movements of the head while signing. Nodding movements are head movements consisting of repeated nods, and they are longer in duration than for example head thrusts or single nods. According to Puupponen's (2012) data, nodding is made up of six to seven movement phases, of which two or three are downward-directed stroke movements. Nodding has been generally associated with the positive polarity of clauses, as in the following Italian Sign Language example from Geraci (2005; see also Liddell 1980: 27).

(5) _____hn
SOMEONE ARRIVE
'Someone *did* arrive.'

Wilbur (2000; see also Liddell 1986) states that large and deliberate nodding performs the function of strong assertion, whereas rapid nodding is present in counterfactual conditionals, or signals cautiousness or vagueness in ASL utterances. When performing such tasks, nodding has been said to have a smaller movement amplitude and a higher frequency of repetition than nods (Wilbur 2000). According to Wilbur (2000: 230), a "repetitive head nod conveys what semanticists refer to as the speaker's commitment to the truth of the assertion". Also in FinSL, nodding movements have been said to perform strongly affirmative functions (Puupponen 2012). However, the presence of nodding in counterfactual conditionals or to signal cautiousness has not yet been investigated in FinSL.

2.3 Head thrust and head pull

Head thrusts are movements of the head in which the signer's head is pushed forward in the dimension of depth. In a typical thrust the signer's chin moves forward without a substantial change in the orientation of the face. Wilbur (2000: 231) states that a head thrust is "separated from the other non-manual markers by virtue of its articulators" in addition to differences in scope. Wilbur does not, however, specify this difference in articulation except by mentioning that the sideways tilt, nod and shake of the head all involve the neck muscles, whereas a head thrust is produced with the neck muscles "that move the lower jaw or chin forward" (Wilbur 2000: 227). The prototypical movement pattern of a head thrust is presented in Figure 2.

Wilbur (2000) and Liddell (1986) have found that head thrusts occur with clause-final signs in conditional and time clauses in ASL. Wilbur suggests that the function of a head thrust is semantic, not syntactic or prosodic, and it expresses the signer's commitment to the certainty of the assertion. Wilbur states that thrusts differ from other syntactic or edge-marking non-manuals: they are punctual and

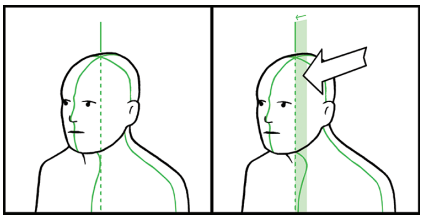


Figure 2. The prototypical movement path of head thrusts.

do not spread across entire syntactic domains like non-manual domain markers (e.g. brow lowering in content questions), but neither do they occur *after* clause-final signs as other non-manual edge markers do (head nods or inhibited periodic eye blinks), but rather *during* them.

Although Wilbur states that head thrusts in ASL are punctual and do not spread, thrusts are also familiar elements when discussing the marking of interrogatives in sign languages. In the non-manual marking of polar (*yes/no*) questions in several sign languages, thrusts accompany brow raise and usually movements of the shoulders, and the non-manual marking accompanies the entire clause (Pfau & Quer 2010). This is known to be the case, for instance, in ASL (Liddell 1980; Fischer 2006), Flemish Sign Language (van Herreweghe & Vermeerbergen 2006), and New Zealand Sign Language (McKee 2006). In addition to polar questions, however, thrusts occur with brow lowering also in the non-manual marking of content (*wh*) questions in some sign languages, such as Indo-Pakistani Sign Language (Aboh, Pfau & Zeshan 2005) and British Sign Language (BSL; Sutton-Spence & Woll 1999). In content questions, non-manuals can accompany the entire clause or only the interrogative signs if they are in sentence-final position.

The status of the head thrust as a punctual movement during clause-final signs and/or as a domain marker spreading across interrogative structures is still open for discussion. More research on the issue is needed in order to establish whether these two types of thrusts are different in their form and function, and further, if these differences exist in other sign languages besides ASL. It should be noted that the use of head movements varies from sign language to sign language, and it has been argued that, for example in polar questions in BSL, the head moves backward, not forward, as mentioned above for several other languages (Sutton-Spence & Woll 1999). In addition, the form of the head movement in questions can vary, due to the fact that thrusts can be accompanied by several other head movement features, such as chin-up, chin-down, or a sideways tilt of the head.

According to Savolainen (2006), in FinSL both polar and content questions are marked with the same head movements: a head tilt forward or a head thrust with optionally a slight chin-up as in (6) (Savolainen 2006: 286; 'htf' = head tilt forward, 're' = raised eyebrows).

(extra) htf
htf + re
(6) POSS2 BICYCLE STEAL
'Has your bicycle been stolen?'

Savolainen states that the above-mentioned head movements and specific eyebrow positions are obligatory for the production of content and polar questions in FinSL. Also Puupponen (2012) noticed the production of head thrusts in question structures in FinSL. However, Puupponen stated that in her data, thrusts were produced also with a sideways tilt of the head in interrogatives. Savolainen (2006) argues that in polar questions, non-manual articulation occurs either during the whole utterance or during the questioned element (the focus of the question). In content questions, non-manual articulation is produced either during the whole question or accompanying the interrogative sign (Savolainen 2006).

While in head thrusts, the signer's head moves forward in the dimension of depth, the head has also been said to move backwards in different ways while signing. When describing different non-manual articulations accompanying different types of topics in ASL, Aarons (1994) mentions a backward movement of the head as one of the features. Backward head movements are also said to occur in polar questions in BSL (Sutton-Spence & Woll 1999) as well as in content questions in ASL (Liddell 1980; Pfau & Quer 2010). Puupponen (2012) mentions that in her data, a backward movement of the head occurred in a content question in which the signer was expressing disbelief. Crasborn & van der Kooij (2013), on the other hand, found that backward and/or upward head movements[4] accompanied the object in information and contrastive focus. In the current paper, we refer to these types of movements as head pulls. The prototypical movement pattern of a head pull is demonstrated in Figure 3.

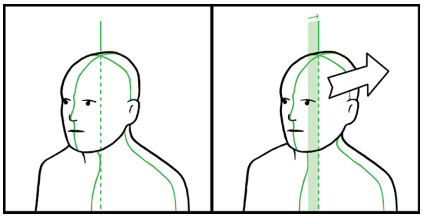


Figure 3. The prototypical movement path of head pulls.

4. Another example of a backward movement of the head is a backward head tilt, also referred to as a raised chin or chin-up. In this movement, the head tilts in the dimension of depth so that the chin is lifted and the orientation of the signer's face moves up. The similarities in the forms and functions of head pulls and chin-ups should be investigated further in future research.

In addition to what has been stated earlier, head thrusts and head pulls are also associated with different focus constructions in the sign language literature. Forward movements of the head, the shoulders, or the whole upper body have been said to occur as a primary feature of stress-for-focus in information or completive focus sentences in ASL (Wilbur & Patschke 1998), and in Sign Language of the Netherlands (NGT), the same has been noted for focused subjects in information focus (Van der Kooij, Crasborn & Emmerik 2006; Crasborn & van der Kooij 2013). These prosodic body movements have no specific meaning in themselves. In addition, forward-backward head and/or body movements have been found in the prosody of contrastive focus constructions in ASL and NGT.[5] Corrective focus is expressed with a backward head/body movement on the utterance that is corrected, followed by a forward movement on the utterance which replaces the earlier one. Head and/or body movements marking contrastive focus may also convey meanings related to the semantics of inclusion and exclusion on the lexical level. These movements can appear with both nominal and verbal signs, and they have been found in both ASL and NGT. Inclusive movements are produced with signs conveying meanings of, for example, participation, involvement, and agreement, and exclusive movements with signs conveying meanings such as rejection, avoidance, resistance, and disagreement.

According to Wilbur & Patschke (1998), ASL signers also produce forward-backward (or side-to-side) head and/or body movements in so-called parallel focus constructions. In utterances with parallel focus, signers use these head/body movements in order to contrast two or more elements with each other, to make identification of the elements easier. Wilbur and Patschke argue that parallel focuses are commonly list structures[6] in which signers also produce manual list buoys. As stated earlier, a structure in which several elements are contrasted with a combination of head nods and side-to-side head movements has been observed in FinSL (Puupponen 2012; see Section 2.2) without a manual list buoy. Also Jantunen (submitted) states that in clausal co-ordination in FinSL, the basic strategy is asyndetic (juxtaposition without manual co-ordinators), and the co-ordinants are typically separated by changes in the actions of the head and/or body.

According to Sutton-Spence and Woll (1999), in BSL, head and/or body movements forward and backward may express information about the time frame in which a certain action or event is placed. For example, when making an enquiry,

5. In NGT, however, this contrast is expressed more frequently with head/body movements from side-to-side rather than forwards and backwards.

6. Wilbur and Patschke present ASL utterances in which forward-backward body leans contrast two elements in conjunctive co-ordination ('and'), and side-to-side leans contrast elements in disjunctive co-ordination ('either-or').

a signer may produce manually articulated signs conveying meanings regarding an action or event, while a forward head and/or body movement indicates that the event is placed in future time, and a backward head and/or body movement signals that the action or event is related to the past. However, as Sutton-Spence & Woll (1999) underline, interpreting these head articulations as temporal markers would be misleading as they spread across the whole utterance, not only across the verbal sign (on an opposing view, see e.g. Zucchi 2009).

2.4 Summary

Sections 2.2 and 2.3 dealt with the characteristics of nods, nodding, head thrusts and head pulls in different sign languages. An overview of the functions of these movements is given in Table 1.

As is evident from the discussion in Section 2.3, the movements of a signer's head and torso are often dealt with as one unit: as the articulators are physically

Table 1. Overview of the different functions of nods, nodding, head thrusts, and head pulls in different sign languages, as identified in previous studies.

	Nod	**Nodding**	**Thrust**	**Pull**
Prosodic stress	Stress-for-focus		Stress-for-focus	
Contrastive stress			Corrected subject Replacing utterance Parallel focus/listing	Replaced utterance
Copying manual movement	With sign PI in equative sentences			
Boundary marking	After clause-final signs		Punctual with clause-final signs in conditionals	
Domain marking (syntactic and/or prosodic)		Strong assertion/affirmation (slow) Counterfactual conditionals (rapid)	Polar/content questions	Topics Polar/content questions
Semantic content (lexical & syntactic level)	Assertion Affirmation Existence in verbless utterances	Cautiousness/vagueness (rapid)	Inclusion Commitment to certainty of assertion (conditionals) Reference to future time	Exclusion Reference to past time

connected, many head movements may be produced together with the torso or shoulders. However, in their research on focus structures in NGT, van der Kooij et al. (2006) found an expression in which a body movement expressed contrastive focus when going from side to side, whereas a headshake negated the repeated item and a thrust marked the corrected subject during the correct item. This NGT example illustrates the potential of head and body to move differently, performing mutually connected but independent functions. Similar observations were made for FinSL by Puupponen (2012).

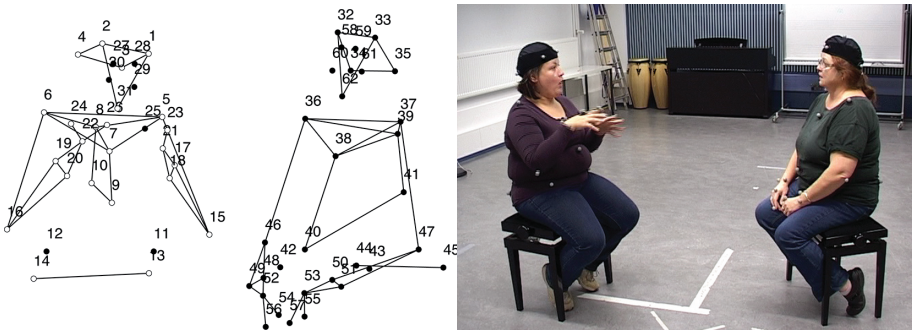
3. Data and method

3.1 Description of the data

The investigation of head movements described in the current paper was done on the basis of two FinSL dialogues recorded in the motion capture laboratory of the Department of Music at the University of Jyväskylä, Finland (see Jantunen et al. 2012). These recordings consist of altogether 2:15 minutes of mocap data of two continuous dialogue situations (Data 1 & Data 2), in which two native FinSL signers (Signer A & Signer B) talk about their work, studies, and everyday language use. The relatively small amount of data in the current study is explained by the fact that mocap data includes a large amount of numerical articulator-specific location information. The processing and use of mocap data is a time-consuming process, with its own technological demands (see Jantunen et al. 2012). In the data collection, the signing of the informants was recorded with an eight-camera optical motion capture system (Qualisys ProReflex MCU120). The cameras recorded the motion of the signers at the frame rate of 120 Hz by tracking the three-dimensional locations of ball-shaped markers attached to the signers' hands, arms, head, and torso (Figure 4a). In addition, digital video cameras recorded the signers from different angles, and provided video material (Figure 4b) that was synchronized with the motion capture system.

Of the total number of thirty-one markers per signer in the setup, shown in Figure 4a, four were attached to the upper part of each signer's head and one to the chin. Two markers were attached to the shoulders of each signer, two markers to the upper torso, and six to the lower torso. The rest of the markers were attached at the main joints in the arms and hands of both signers.

Mocap data is generally considered to be the most accurate type of data available for phonetic research into sign languages (e.g. Jantunen et al. 2012). The results of the mocap recording are produced as a numerical co-ordinate matrix, which can be used when analyzing the kinematic properties of the movements of signers'



a. b.

Figure 4. (a) A skeleton image of the marker setup in the data-recording situation; (b) a screenshot of the digital video material (Jantunen et al. 2012).

articulators. In addition to the phonetic analysis, mocap data can be used in several other research areas when accompanied with video. For the present study, mocap data was used in the analysis of the phonetic properties of different head movements as well as in the investigation of phonetic differences between different types of head movements. In our analysis of the head movements, we used the recordings of the markers attached to the right forehead of each of the two signers. We investigated the amplitude (displacement) of movements of the signers' head in the dimension of depth on the basis of the numerical data received from the recordings of these markers. When examining the amplitude of head movements in a specific dimension, one marker, in this case the right forehead marker, provides highly detailed location information related to that specific marker (mm/Hz; recording speed of 120 Hz). In this way, the numerical information received from one marker provides sufficient data for evaluating the characteristics of movement amplitude in different head movement phenomena.

3.2 Data processing, annotation, and analysis

The collected mocap and video data were imported into ELAN for the identification and annotation of the different head movements. This process was carried out in several different stages. The starting point of the identification process was the different head movement types found in the existing sign language literature, as described in Section 2. First, each head movement in both of the dialogue data sets was given an empty annotation cell by two annotators. From these annotations, we took for investigation the ones where the head movement was recognized as representing a nod, nodding, thrust, or pull of the head, described in the literature. These empty 'raw annotation' cells of the forms of different head movements were then specified concerning, for example, the beginning and ending of the different

head movements, with the help of the visualizations of numerical mocap data in ELAN. Subsequently, the annotations were given values according to their head movement type and individual numbers according to their chronological appearance in the data (e.g. Nod-3, Thrust-5, etc.). In situations where a signer produced multiple head movements at the same time, annotations were also created for the simultaneous head movements. Information concerning the movement characteristics of the head movements or the relationship between actions of the head and manual articulation was added as 'form remarks' in a specific annotation tier when necessary.

The movement analysis of the data was done in Matlab using the *MoCap Toolbox* developed by Burger & Toiviainen (2013). For each identified head movement, we created an annotation cell in ELAN with the movement-specific frame number information. With the frame number information, we could locate the movements from the mocap data and calculate information concerning the amplitude of the movement. The numerical data of the amplitude of different head movements was then used in Excel to study the kinematic properties of different head movement types, variation between head movements of a certain type (different nods, thrusts, etc.), and the overall differences between different head movement types. For details in collecting and processing mocap data for sign language research, see, for example, Jantunen et al. (2012).

Thorough annotations were also created for the functions of different head movements in the data. Firstly, raw annotation cells were created for each function of the different head movements in the data. The data-driven annotation values of these cells were based on the observations and intuition of a native FinSL signer. The fundamental question behind the raw annotation was simply, "What is the role or function of this specific head movement in this context?" On the basis of the raw annotations, a more systematic annotation that could be used for purposes of classification was then developed. Finally, on the basis of the two-level annotation process, the different functions of the head movements were classified and categorized into different functional groups. Each head movement in the data was given an annotation cell in ELAN containing information about the function type. If the head movements were considered to have several overlapping functions, all the necessary functions were marked in the annotations. Finally, the annotation matrix (minus the 'in-progress' level annotations) for each head movement consisted of annotations in six different tiers: head movement type and individual number, frame number information, simultaneous head movements, form remarks, function type, and function remarks.

Finally, the information given in the annotations (shown in Figure 5) of both data sets was gathered in a table in Excel. The table included information about each head movement of each data set according to their chronological appearance

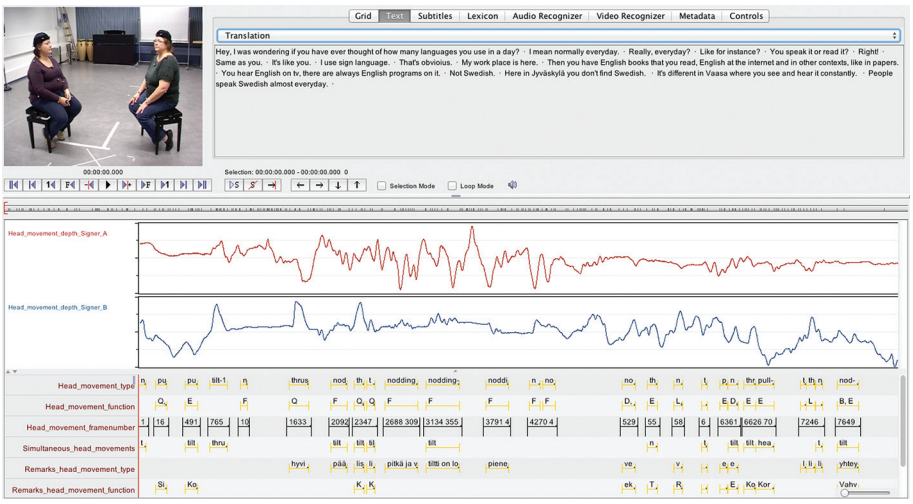


Figure 5. A screenshot of ELAN showing overall visualizations of the motion of the head of Signer A (red graph) and Signer B (blue graph) in the dimension of depth in Data 1. The annotations of head movements are shown in the annotation tiers below the graphs (i.e. head movement type, function, frame number information, simultaneous head movements, form remarks, and function remarks).

in the data: head movement type, individual number, simultaneous head movements, comments or remarks on the form of the movement, functional category, and comments or remarks concerning the function(s) of the movement. The functions and forms of different head movements were then cross-tabulated and evaluated generally, movement-type specifically, and concerning the relation between different movement types. In the results, several regularities and irregularities arose, which are discussed in Sections 5 and 6.

3.3 Methodological observations

The kinematic information received from the numerical mocap data was found to be useful in the annotation and analysis of different sagittal head movements. The visualization of the motion of the head made it possible to investigate in detail the inner structure of different head movements and to identify more precisely changes in the direction of the movement of the head. In this way, the mocap data usefully complemented the traditional frame-by-frame investigation of the data. Occasionally, the movement produced by the head was so subtle that it was difficult to detect and annotate it by merely looking at the video material (movements appear in the video on a much smaller scale than in real life). The visualization of the different head movements (i.e. the mocap data imported into ELAN)

illustrated the differences between different head movement events. This allowed a more thorough and detailed examination of variation in the forms of different head movements belonging to a specific movement type, as well as comparison between movements of different types.

Assigning a function to a specific head movement was not always easy. Differentiating between the function of a head movement or posture and the function of the whole expression (or the functions of other non-manual articulations) was in some cases found to be tricky. Also, the overlapping of several (2–3) different functions resulted in the fact that defining a clear 'main function' for a particular head movement was not always clear-cut. It was important to examine the functions of head movements throughout the annotation process, that is, already when annotating the forms of the movements. We therefore came to the conclusion that a native signer is required for the annotation of head movements, for example in order to distinguish the linguistically significant and interesting phenomena from the overall activity of the head. It should also be noted that some functional categories, described in Section 5, are wide, as the categorization was done on the basis of a wide view of what is considered language.

Physiologically, the connection between the movements produced with the head and the torso is obvious: the cervical spine and neck muscles participate in the motion of both the head and the body. In the current research, we have analyzed the forms and functions of different types of head movement regardless of whether they are produced together with the torso and shoulders. The status of the head and the upper body as independent articulators as well as connections between the functions produced by the actions of these articulators are important issues for forming a theory of non-manuality in FinSL. These questions will be dealt with in future research.

4. Head movements in the dimension of depth in FinSL

Four types of head movement produced in the dimension of depth were identified from the data: the nod, nodding, thrust, and pull. A summary of the characteristics of these four head movement types is given in Table 2.

As can be seen from Table 2, the total number of nods, nodding, head thrusts, and head pulls in the data was 98. Of these, 56 movements were produced by Signer A and 42 by Signer B. The most common type of head movement in the data was the nod: the data consisted of altogether 36 nods, 21 in Data 1 and 15 in Data 2. The average duration of nods was 1.3 seconds and the average amplitude of movement in the dimension of depth was 43 millimetres. When comparing the visualizations of the 36 nods, presented in Figure 6, it is clear that there was a

Table 2. Basic information about head movement types: their overall number, duration, amplitude, shape of visualization, and simultaneous head movements.

	N (Data 1 + Data 2)	Average duration (sec)	Average amplitude (mm)	Shape of the average movement	Variation in amplitude min-max (mm)	Most common simultaneous head movements
Nod	36 (21+15)	1.3	43	V	15–55	tilt
Thrust	19 (15+4)	1.5	50	U	35–60	tilt
Nodding	34 (18+16)	2.1	n/a	Wavy	n/a	tilt, thrust
Pull	9 (5+4)	1.6	56	Upside down J	40–65	turn

lot of variation between different nods in the data. Typical variation between the movement amplitude of different nods was from 15 to 55 millimetres. The differences between the phonetic forms of different nods may be explained by differences in both the preceding and following context in signing and in the functions of the nods. The highest amplitudes of movement produced in nods occurred with Signer B in Data 2, which might also indicate signer-specific (idiolectic) variation. On average, nods formed a relatively symmetrical V-shape in the visualizations of head nods (calculated in Excel on the basis of the mocap data; red line in Figure 6).

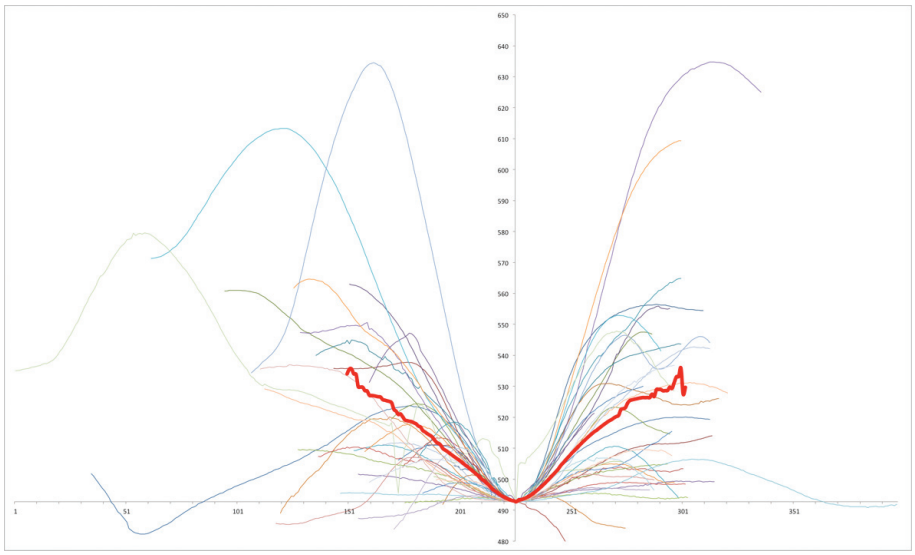


Figure 6. Visualization of the movement amplitudes of different nods on the basis of the mocap data. The average nod is calculated from motion during the strokes and recovery phases of different nods, and it is marked in the figure with a red line. The axes present the amplitude of the movements (y) in the function of time (x).

This indicates that the change of direction between the first and second movement phases in nods is quite abrupt.

Turning to head thrusts, the data included altogether 19 instances, of which 15 were found in Data 1 and 4 in Data 2. The total number of thrusts was therefore considerably smaller than that of nods. The average duration of head thrusts was 1.5 seconds, which makes them slightly longer in duration than nods. The average movement amplitude in thrusts was 50 millimetres, indicating that thrusts are larger movements than nods in terms of depth; a fact which is somewhat self-evident, considering that nods are produced with an axial tilt forward resulting in the lowering of the chin towards the chest, whereas in thrusts the chin and the whole head move forward (although some of the thrusts in the data were accompanied by a slight chin-down and/or a head tilt). As with nods, there was a lot of variation between different head thrusts in the data. However, the range of typical variation between the movement amplitude in thrusts is somewhat smaller than in nods, varying from 35 to 60 mm. The average thrust (red line in Figure 7) forms a relatively symmetrical U-shape, which indicates that the change of direction in thrusts is relatively smooth (longer in duration) when compared to that of nods.

Just like nods, also nodding movements were one of the most common head movements in the dimension of depth in the data. Altogether 34 nodding movements appeared in the data, 18 in Data 1 and 16 in Data 2. Nodding movements involved repetition and they were longest in duration, the average nodding lasting

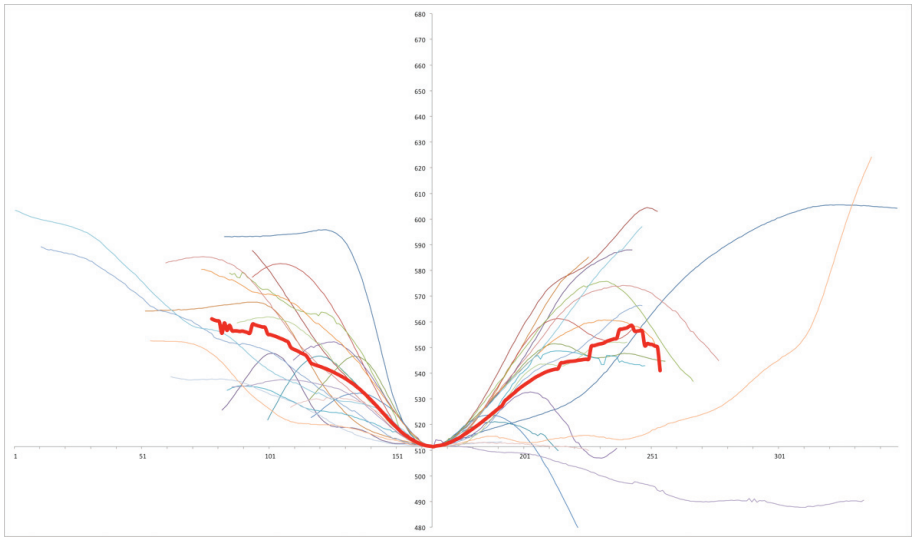


Figure 7. Visualization of the movement amplitudes of different head thrusts on the basis of the mocap data. The average thrust is marked with a red line. The axes present the amplitude of the movements (y) in the function of time (x).

for approximately 2.1 seconds. As with nods and thrusts, there was also a lot of variation between the forms of different instances of nodding in the data (see Figure 8). Noddings consisted of four forward-directed movement phases on average, of which the first forward movement was largest, with an average amplitude of 13 mm. On average, the amplitude of the second movement phase in nodding was much smaller (ca. 5 mm) than the first movement phase, as were subsequent movement phases (5–10 mm). However, as can be seen in Figure 8, there were differences in the amplitude of the movement phases during the repetition on different occasions. This may be a result of several different factors, such as the motion of the head copying the manual articulation of the signer (see Section 5.4). This connection can be found in situations where the head emphasizes something signed by the person producing the nodding, as well as in situations where the nodding is produced by the addressee, and the emphatic (stress) features are produced in connection with the signing of the other party.

Head pulls were the most infrequent head movements in the dimension of depth in the data. The total number of head pulls in the data was nine, five of which were found in Data 1 and four in Data 2. The average duration of different pulls in the data was 1.6 seconds, which makes them slightly longer in duration than thrusts. Also head pulls exhibited variation, typical variation ranging from 40 to 65 millimetres in amplitude. The average pull was approximately 56 millimetres in amplitude and it formed an upside-down J-shape (see Figure 9). This indicates

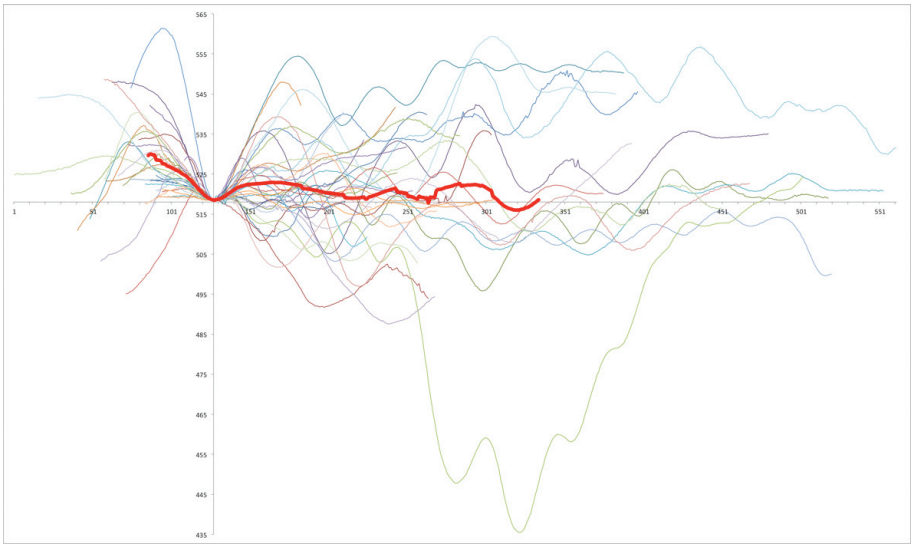


Figure 8. Visualization of the movement amplitudes of different nodding events on the basis of the mocap data. The average nodding is marked with a red line. The axes present the amplitude of the movements (y) in the function of time (x).

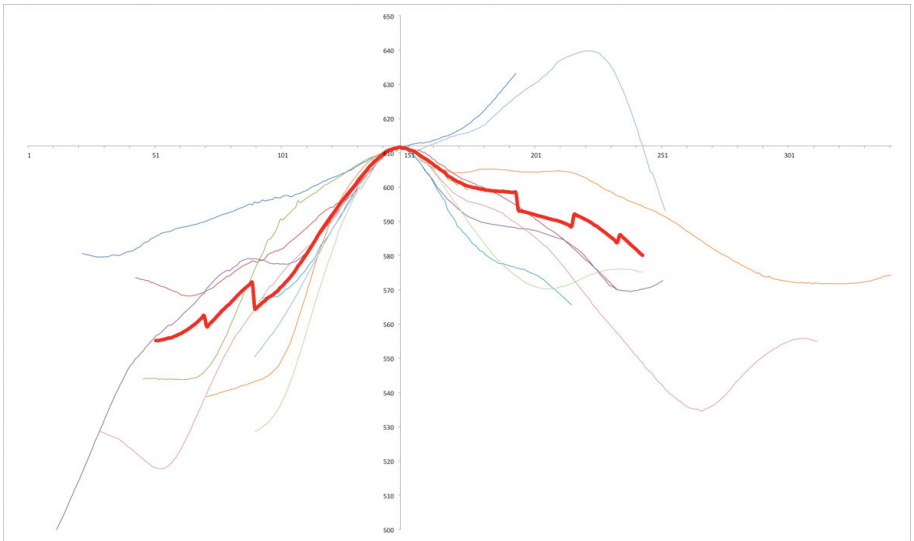


Figure 9. Visualization of the movement amplitudes of different head pulls on the basis of the mocap data. The average pull is marked with a red line. The axes present the amplitude of the movements (y) in the function of time (x).

that the change in the direction of the movement in head pulls resembles that in head thrusts: the transition is smooth and less abrupt than in, for example, head nods. Finally, as can be seen in Figure 9, the first movement phase in pulls is larger in amplitude than the second one. That is, in head pulls the movement is larger at the beginning and it diminishes towards the end.

In conclusion, four different types of head movements were found in the data in the dimension of depth. Of these, the nod was the most frequent and the pull the most infrequent. All of the different types of head movements exhibited a lot of variation, and this was particularly the case with nods. As is shown in Table 2, on average the pull was the largest movement and the longest in duration of the three non-repetitive movement types. The first movement phase of nodding was generally smaller than the other movements (including nods), but in duration nodding was, due to its repetitive nature, longer than the other three movements. The simultaneous production of two different head movements was very common in our data. A common combination of two simultaneous head movements was a head nod or a head thrust with a sideways tilt movement of the head.

Comparison of the forms of head pulls and nodding with the motion of nods and thrusts does not provide us with any useful information, as the direction of movement in pulls and the repetitiveness of nodding differ substantially from the movement patterns in the other two head movement types. However, when comparing the characteristics of nods and thrusts, we found a very strong correlation

between the average nod and average thrust (correlation coefficient 0.9743324). Nevertheless, when examining the whole group of instances of nod and thrust movements, statistical analysis signals very significant difference (p=0.0002). This result indicates that while the average nod and thrust are similar in form, the instances of nods and thrusts include more movements that are notably different in form than those which are similar.

5. Functions of nods, thrusts, nodding, and pulls in FinSL

The head nods, head thrusts, nodding, and head pulls in our data had several different functions on different levels of language structure and use. In the examination, we categorized these functions into groups according to their syntactic, semantic, pragmatic, and prosodic features. The categorization of the head movements was done inductively from the annotations that were based on the observations of native FinSL signers. We distinguished the following seven functions.

E-function	Emphasis: the signer produces prosodic stress giving emphasis to signs articulated by the hands, produces contrastive stress between elements in an utterance, or moves the head to separate members of a list or "textual catalogues", e.g. 'either-or' (Section 5.1);
B-function	Boundary marking: a head movement marks or emphasizes a syntactic and/or prosodic boundary (Section 5.2);
D-function	Domain marking: a head movement marks a prosodic and/or a syntactic domain, such as a topic (Section 5.3.1);
A-function	Affirmation: the signer declares his or her positive attitude towards the truth value of the proposition or aims to convince the addressee of the truth value of the proposition. The addressee reacts positively or gives positive feedback to the proposition produced by the other signer (Section 5.3.2);
Q-function	Interrogative: the signer produces a polar question, a content question, or a 'declarative question' (Section 5.3.3);
C-function	Copying: the signer's head copies the manual movement (Section 5.4);
X-function	Indicating: pointing with the head (Section 5.4).

As can be seen from the list above, head movements in our data have functions related to prosodic stress, contrastive stress and listing (E), boundary marking (B), domain marking (D), affirmation (A), and interrogatives (Q). Other functions found in the data were copying head movements (C) and indicating head movements (X), to which we did not find any reference in the literature. It is not

uncommon for head movements to function as a part of prosody as well as to perform other functions. Some, even many of these head movements are also common in the context of speech, while others are more specific to sign language communication. All in all, these functional categories or types can be seen as forming a series of different continuums, depending on the point of view and on aspects of the functions that are emphasized.

5.1 Emphasis: prosodic stress, contrastive stress & listing

Sagittal head movements in the data include emphatic head movements, which are markers of prosodic stress (Section 5.1.1), contrastive and/or exclusive movements marking contrast between manually signed elements or conveying meanings of exclusion (Section 5.1.2), as well as listing movements separating conjunctively or disjunctively co-ordinated elements that may include ellipsis (Section 5.1.3; see also Jantunen submitted).

5.1.1 *Prosodic stress*

Some head movements in the data are produced as prosodic cues giving emphasis to signs articulated by the hands, that is, they are involved in making a specific sign prominent in an utterance. This type of movement, a head thrust, is presented in the utterance in Figure 10.[7] The utterance also includes a boundary-marking head pull (see Section 5.2) and an affirmative sentence-final head nod (see Section 5.3.2).

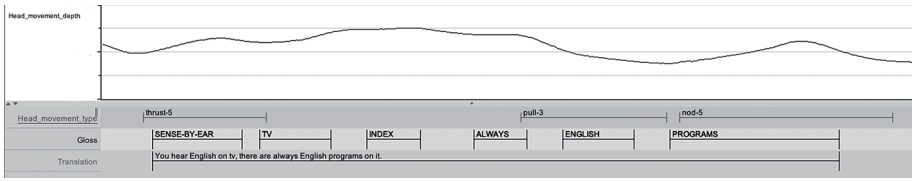


Figure 10. An utterance with an emphatic head thrust, a boundary-marking head pull and an affirmative, sentence-final nod. [Data 1, Signer B, Thrust-5, Pull-3 & Nod-5]

The head thrust in Figure 10 puts emphasis on the sentence-initial sign SENSE-BY-EAR. The head thrust marks focus in the information structure of the sentence (and potentially the beginning of a new syntactic unit).

7. In Figure 10 and in the following figures, we demonstrate example utterances with screenshots from ELAN that include annotations for head movements, manual signs, and a translation. The graphs above the annotation tiers show the visualised mocap data of the movement amplitude of the signer's head in the dimension of depth (mm/Hz; recording speed of 120 Hz).

The sign demonstrated in Figure 11 is an example of an expression in which a head pull together with a facial expression emphasizes the manual articulation of the sign DURING-ONE-DAY with which it co-occurs. The whole utterance in which the expression occurs is demonstrated in Figure 27 in Section 5.3.3.

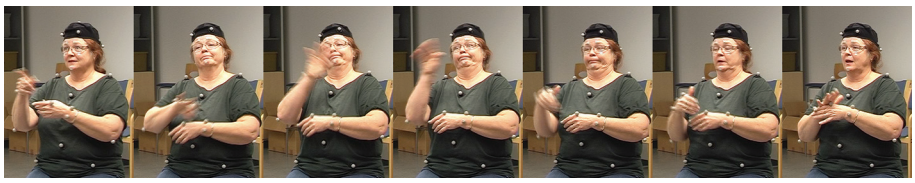


Figure 11. The sign DURING-ONE-DAY together with an emphatic head pull

In addition to emphasizing manual articulation, head movements may give emphasis to other head movements. The example in Figure 12 demonstrates an utterance where the signer produces a combination of a head thrust and nodding together with specific articulation of the lower face (the corners of the mouth lowered and the lower lip protruded) at the end of the sentence. The utterance also includes an affirmative head nod, discussed in Section 5.3.2.

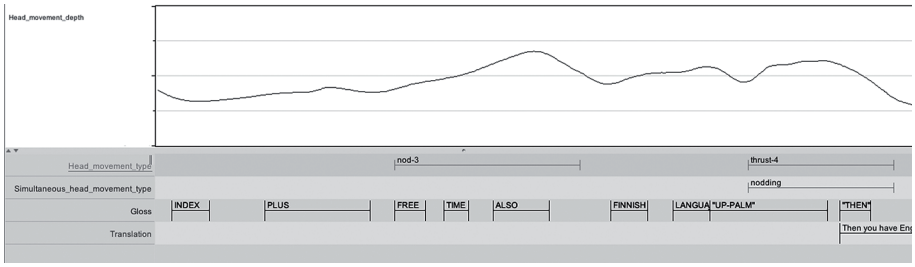


Figure 12. An utterance with an affirmative nod marking existence and a head thrust emphasizing the simultaneously produced nodding. [Data 1, Signer B, Nod-3 & Thrust-4]

The head thrust in the utterance in Figure 12 puts emphasis on the articulation of the strongly affirmative nodding movement produced during the thrust. The head thrust, nodding, and the mouth gesture are produced without the presence of a manual sign and together they construct a gestural predicate with the meaning of 'yes, sure [I use Finnish]'. When highlighting the articulation of the nodding and the mouth action, the head thrust marks the domain of a comment ('yes') on a topic ('Finnish').

5.1.2 *Contrastive stress and exclusion*

In the data, we also found head movements which either mark contrastive stress between elements in an utterance (Figure 13) or convey meanings of exclusion (Figure 14).

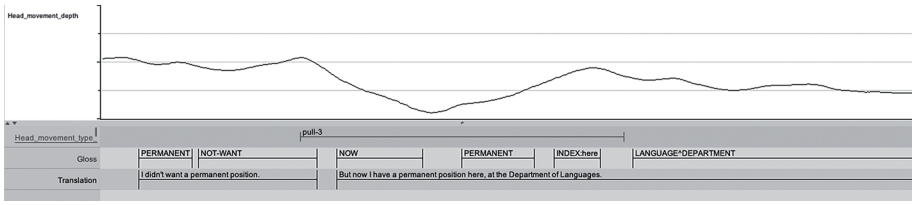


Figure 13. A head pull marking contrastive stress. [Data 2, Signer B, Pull-3]

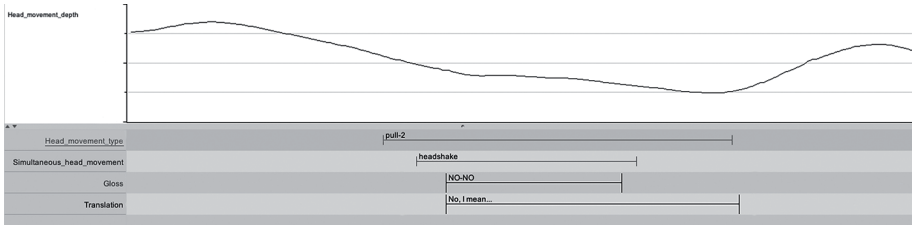


Figure 14. A head pull conveying meanings of exclusion. [Data2, Signer B, Pull-2 & Headshake]

The head pull in Figure 13 emphasizes the contrast between elements which are semantically associated within a time frame. The head pull occurs at the border of two sentences: a negative declarative sentence and an affirmative declarative sentence. The head pull marks the transition between the sentences and emphasizes the contrast between the contents of the two sentences: something that is declared as a fact in an earlier time *(I didn't want a permanent position*) and something that is declared as a fact in the present time (*now I have a permanent position*). The head pull is produced together with a backward body lean, and it is an example of the non-manual marking of contrastive focus in FinSL.

In the utterance in Figure 14, the head pull marks semantic exclusion in a negative expression. The utterance is an incomplete negative sentence, with which the signer rejects any potential misinterpretation of her previous statement by the addressee. After the utterance, the signer continues with amplifying statements. The head pull is produced with a backward body lean, with which it conveys the semantics of exclusion, and they are both produced simultaneously with a headshake. The headshake, negative manual sign, head pull, and backward body lean altogether result in a negative construction, which functions as a corrective element in the discourse.

5.1.3 *Listing*

Emphatic head movements in the data include head movements which (i) appear in co-ordinated structures in which the head and body movements mark contrastive parallel focus in an 'either-or' structure (disjunctive co-ordination),

or (ii) separate parts of manually produced elements that form a list (multiple co-ordination) (cf. Wilbur & Patschke 1998). Like the movements discussed in Section 5.1.2, listing movements are one way of producing contrast between units of information in signing. The most common form of listing movement was a head thrust and the co-ordination was produced either sentence-internally or in larger discourse episodes.

In the 'either-or' structure in Figure 15, a head movement emphasizes the disjunctive co-ordination expressed syndetically, that is, with a manual co-ordinator sign (see Jantunen, submitted).

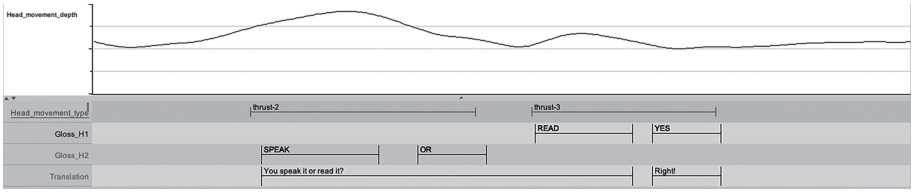


Figure 15. Interrogative head thrusts in a content question consisting of a co-ordinated 'either-or' structure. [Data 1, Signer B, Thrust-2 & Thrust-3]

The example in Figure 15 consists of two parts, an interrogative sentence with co-ordinated elements and a positive response to the interlocutor's answer ('Right'). The two head thrusts in the utterance mark the interrogative (see Section 5.3.3) and, together with movements of the body, emphasize the contrast between the co-ordinated clauses ('speaking' and 'reading'), which are in disjunction. The disjunctive co-ordination is performed by the manual sign OR (see Jantunen, submitted). The second thrust continues after the interrogative sentence and spreads over the subsequent affirmation. The manual and non-manual articulation results in a parallel focus structure in FinSL.

In the several utterances with multiple co-ordination found in the data, the movements of the head, together with temporal features in, and breaks between, the manually produced signing sequences, separate the different parts of the list (Figures 16 and 17). The list structures did not include list buoys.

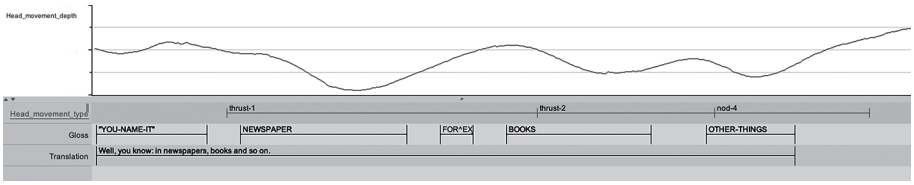


Figure 16. Three head movements separating parts of a list in a sentence with multiple co-ordination. [Data 1, Signer A, Thrust-1, Thrust-2, Nod-4]

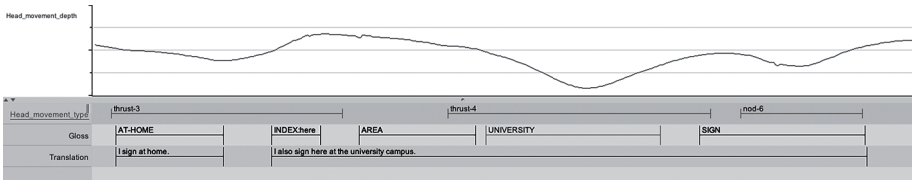


Figure 17. Two head thrusts with a listing function with a sentence-final assertive nod. [Data 1, Signer A, Thrust-3, Thrust-4, Nod-6]

In the sentence in Figure 16, the signer produces head movements — two thrusts and one nod — during co-ordinated nominal signs (NEWSPAPER, BOOKS, OTHER-THINGS). The head movements mark parallel contrastive focus in the utterance: they separate parts of the list, making the contents of the utterance clear and understandable. This type of articulation is closely related to the emphatic marking of prominence. In the example in Figure 17, the signer produces two sentences consisting of two listing head thrusts and a sentence-final assertive nod. The head thrusts separate the co-ordinated elements ('at home', 'at the university'). The first head thrust in the example does not align with the syntactic structure and spreads over the transition between the two sentences. The sentence-final assertive nod is shorter in duration and the movement is smaller in amplitude than the two head thrusts.

5.2 Boundary marking

Head movements with boundary-marking functions occurred in the data at the borders between syntactic, prosodic, or textual sequences, for example at the beginning or end of a clause, utterance, or larger text episode. Boundary-marking head movements were produced either with manual discourse markers (Figure 18) or without them.

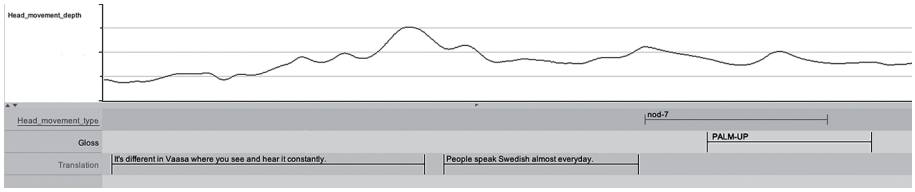


Figure 18. A boundary-marking head nod. [Data 1, Signer B, Nod-7]

In the utterance in Figure 18, the signer produces a head nod, which emphasizes the prominence of the manual sign PALM-UP, which functions as an indicator of transition from one subject to another in the discourse. The preparation of the nod is long in duration, and the stroke is produced simultaneously with the stroke of the manual sign. In addition to boundary marking, the nod may therefore also be an example of a copying head movement (see Section 5.4).

In the data, head nods often occurred at the boundaries of syntactic units, as has also been observed for nods in, for example, ASL (see Section 2.2). However, in the current data, nods did not occur after sentence-final signs but instead were produced together with them. Of the head nods produced by the active signer (not by the addressee), 37.04% were produced sentence-finally (46.15% in Data 1; 28.27% in Data 2). Although the sentence-final nods in the data may be interpreted as boundary markers, the syntactic placement alone does not automatically allow us to classify them as such. Some of these nods were not punctual but spread across several manual signs at the ends of sentences. Moreover, some of the sentence-final head nods also performed other functions, such as affirmation (see Section 5.3.2), or they were movements copying manual path movements (see Section 5.4).

All in all, the difference between punctual boundary markers and more deliberate head movements was not always clear in our data. The utterance in Figure 19 is a sentence consisting of two co-ordinated clauses. In the sentence, a head pull marks prosodically the transition between the first and second clause as well as the contrast between these two co-ordinated elements in the sentence.

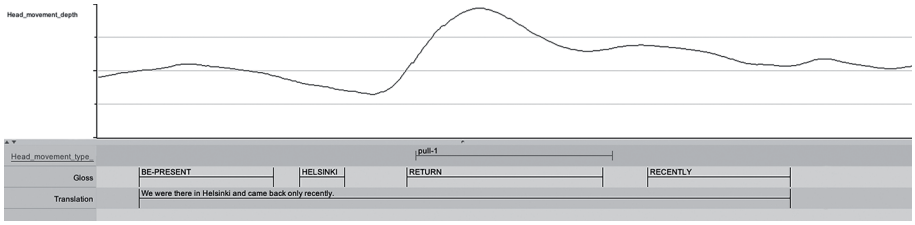


Figure 19. A head pull marking a boundary and giving emphasis on the sign RETURN. [Data 2, Signer A, Pull-1]

The head pull in Figure 19 is clause-initial and marks the beginning of a new syntactic unit. As well as performing as a boundary marker, it can be seen as an emphatic marker which increases the visibility of the sign RETURN with which it is produced. Moreover, in addition to marking boundary or emphasis, the head pull in Figure 19 may also be a result of the articulation of the hands. The head pull is a countermovement (i.e. it is produced in opposite direction) to the manual movement in the sign RETURN: it may be a result of physical phenomena, the neck muscles reacting to the movement of the hands. However, the head pull is relatively large in amplitude, which indicates that it is more deliberate than a physically driven 'recoil movement' occurring as a by-product of the manual movement. This strengthens the interpretation that the movement emphasizes a transition between elements in the utterance, and by doing so performs as a stress-for-focus marker for the sign RETURN.

It should be noted that in our data, we also found cases where the prosodic and syntactic structures were not isomorphic in an utterance. In the example in Figure 10, in Section 5.1.1, a transition between a head thrust and a head pull marks a prosodic boundary which is not at the edge of a syntactic unit but rather occurs in the middle of a clause.

5.3 Prosodic, syntactic, and/or communicative domain marking

Sagittal head movements in the data also included movements which marked prosodic, syntactic, or communicative domains in signing. Head movements with a domain-marking function either marked prosodic contours or syntactic domains without performing, for instance, interrogative or affirmative functions, or they had a contour-like 'element-binding' effect in signing in addition to other (syntactic) functions. Domain marking of topics, affirmation, and interrogatives is discussed in Sections 5.3.1–5.3.3.

5.3.1 *Topics*

In the data, we found head movements which marked the domain of syntactic units that formed a topic. The example in Figure 20 demonstrates two different types of domain marking produced with head movements: marking the domain of a topic and binding together manually produced signs into a contour, which forms a comment on the topic.

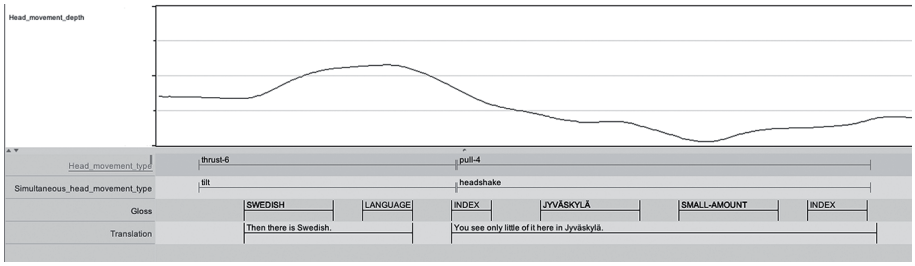


Figure 20. Domain-marking thrust and head pull. [Data 1, Signer B, Thrust-6 & Pull-4]

In the example in Figure 20, the signer produces two head movements: a head thrust together with facial articulation (eyes widened, eyebrows raised), and a head pull produced together with a backward body lean and a horizontal headshake. The sentence-initial head thrust together with the facial articulation produces stress on the signs SWEDISH and LANGUAGE, which form the topic ('Swedish') in the example. In doing this, it also prosodically marks the domain of the topic. The head pull is long in duration and it is in alignment with the manually produced signed sentence with which it co-occurs. The head pull is a recovery movement

from the position of the head after the thrust movement. The pull is, however, large in amplitude and longer than the thrust movement, and it differs from the head thrust also in that the upper body participates in the backward movement. These phonetic features indicate that the head pull is deliberate and that it functions as an emphatic marker for the prominence of the manually signed sequence, which comments on the topic produced at the beginning of the utterance. Therefore the head pull is not merely a recovery movement, but it also performs a prosodic domain-marking function. The headshake produced with the head pull conveys meanings of disbelief or diminishing; the polarity of the sentence does not become negative by the headshake.

5.3.2 *Affirmation*

Most of the sagittal head movements in the data had functions relating to affirmative declaratives and positive responses in discourse. By 'affirmative declaratives', we mean sentence types that are "used for speech acts, such as asserting, describing, complaining, bragging about, predicting or promising something etc." (Velupillai 2012: 346). Head movements were present in speech acts such as agreement or as an indication of engagement in the discourse, and they also conveyed meanings related to propositional modality,[8] i.e. "the speaker's attitudes towards the truth value of the information given in the proposition" (Velupillai 2012: 217). The affirmative function was the most common function of sagittal head movements in our data, and the head movements conveying meanings of affirmation were most frequently head nods and nodding movements.

We propose that there are at least three sorts of affirmation related to the head movements in the data: neutral affirmation, strong affirmation, and affirmation as feedback. The relationship between the three functional subtypes is gradual as they all represent different types of affirmation. Neutrally affirmative movements convey the meaning of a positive attitude, and they may also mark existence, which is also done with strongly affirmative movements — only more strongly. Strongly affirmative movements also convey the signer's strong belief in, or commitment towards, the truth of the signed information. Feedback movements can convey both kinds of affirmative meaning, but they are produced by the addressee and they signal participation and engagement in the conversation. Many of these affirmative head movements are generally known and are also common communicative gestures in different spoken languages (see e.g. McClave 2000; Aoki 2014).

Head movements with neutral affirmation convey meanings connected to the signer's positive attitude towards a proposition or towards the truth value of a

8. With *modality*, we refer to what Velupillai (2012) defines as "semantic labels of attitudes towards events", not the verbal category of *mood*.

proposition in an utterance. In the example in Figure 21, a neutrally affirmative nod is produced as a positive response to an utterance on the part of the interlocutor.

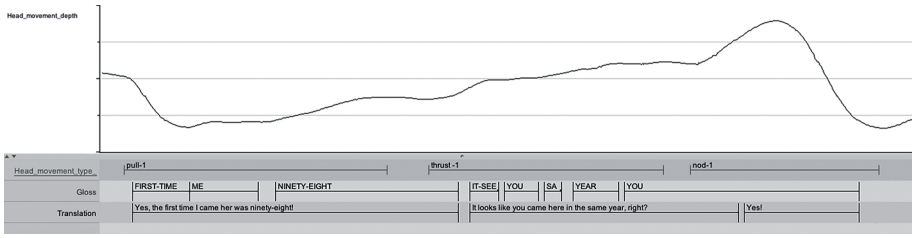


Figure 21. A neutrally affirmative nod produced as a positive response. [Data 2, Signer B, Pull-1, Thrust-1 & Nod-1]

The example in Figure 21 shows three sentences: an affirmative declarative sentence, an interrogative sentence, and a non-manual predicate which forms an affirmative declarative sentence. In the non-manual predicate, the signer produces a neutrally affirmative head nod during a (relatively long) hold in the sign YOU. This affirmative non-manual utterance is produced partly simultaneously with the last sign of the second sentence and it forms an affirmative declarative statement ('yes') in itself. The emphatic head-pull in the first sentence is discussed in Section 5.4 and the interrogative head thrust in Section 5.3.3.

In the current data, neutrally affirmative head movements were also found in situations where the signer declared the existence of something. In addition, head movements with neutrally affirmative functions often performed overlapping functions, such as boundary marking (see Section 5.2). The examples in Figures 10 and 12, presented earlier in Section 5.1, include neutrally affirmative head nods. In the assertive utterance in Figure 10, the sentence-final nod and the sign ALWAYS connect the second clause of the utterance with positive polarity. The head nod may also be a marker of existence and perform as a predicate in the existential clause. Together with a pause in the manual articulation, it also performs a prosodic boundary-marking function (see Section 5.2). In the utterance in Figure 12, the head produces a slow and deliberate neutrally affirmative head nod at the beginning of the sentence, which may also function as a marker of existence. The head nod is produced with a slow stroke phase and it is rhythmically in line with the manually articulated signed phrase during which it occurs. The nod marks prosodically the domain of the phrase, after which the signer produces new information.

Head movements with strong affirmation expressed the signer's firm commitment to the truth value of the proposition (Figure 22) or her strong support for or commitment towards something (Figure 23). With a 'strongly affirmative statement', we refer to what is called in the investigation of propositional modalities

deductive epistemic judgement: a firm statement in which the signer is "quite convinced of the truth of the proposition" (Velupillai 2012: 219). Expressing 'firm commitment' to a future action is an example of what we call deontic event modality, more specifically a commissive, in which the signer is "certifying that the action will take place" (Velupillai 2012: 223). The most common head movement type with a strongly affirmative function was nodding, although in the data, single head nods also performed strongly affirmative functions.

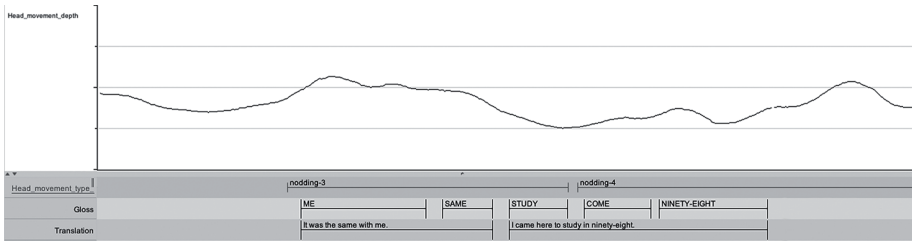


Figure 22. An example of strongly affirmative nodding related to deductive epistemic judgement. [Data 2, Signer A, Nodding-3]

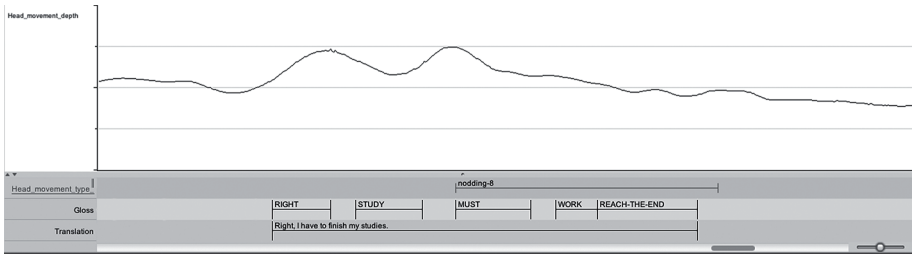


Figure 23. An example of strongly affirmative nodding related to deontic event modality. [Data 2, Signer A, Nodding-8]

The example in Figure 22 consists of two sentences, the first of which is a characterizing sentence. During the first sentence, the head produces a small nodding movement, which functions as a strongly affirmative element: it conveys the signer's firm commitment towards the truth of her utterance. In the example in Figure 23, the signer produces an assertion which conveys the meaning of following an activity ('studies') in the future. With the nodding, the signer expresses her commitment to the future task.

Affirmation as feedback was the most frequent type of affirmation in the data, and over two thirds of such cases were instances of nodding. In continuous dialogue, the participants showed each other that they were paying attention and potentially that they were in agreement about what the signer was saying. Figure 24 gives an example, in which Signer B, in the role of the addressee, produces a feedback nodding movement while Signer A is signing.

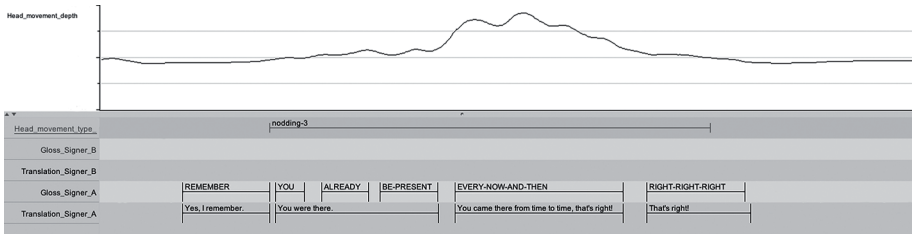


Figure 24. An example of head nodding with a feedback function. [Data 2, Signer B, Nodding-3]

Half way through the nodding in Figure 24, the head movement becomes more pronounced and the affirmation becomes stronger: the interlocutor is responding to the signer's utterance by showing agreement. Signer B does not produce any manual signs with the nodding. The example illustrates a feedback movement in which the interlocutor is first merely showing participation or attention and then shows strong agreement in response to the signer's statement. The difference between the two situations is that in strong agreement, the interlocutor has a more active role and the head movement functions as a statement rather than merely indicating participation.

The forms of affirmative head movements were in some cases 'hybrids' of nods and short rapid stretches of nodding. In the example in Figure 25, the signer produces a small rapid nodding movement, which is produced during a larger movement in which the signer's chin moves towards her chest.

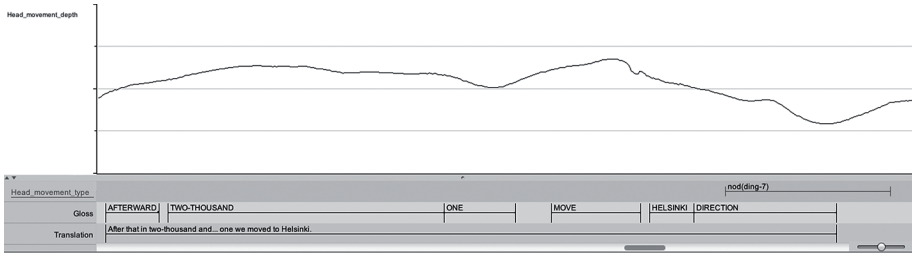


Figure 25. A sentence-final hybrid form of a nod and nodding. [Data 2, Signer A, Nodding-7]

The nod-nodding hybrid in Figure 25 is clearly affirmative, but it is difficult to define whether it is particularly strong or whether it merely marks the signer's positive attitude towards the information in the assertion. The hybrid is sentence-final, which indicates that it functions also as a prosodic boundary marker. It should be noted that no other nodding movement in the data functioned as a boundary marker, which reinforces the interpretation of a nod-nodding hybrid in this case.

5.3.3 *Interrogatives*

In the data, signers also produced head movements in questions. Head movements together with facial articulation, and optionally with manual interrogative signs, made the utterances interrogative. Two of the total of nine interrogative head movements in the data were produced in content questions (Figures 26 and 27) and nine in polar questions (Figure 28). The most common head movement with interrogative (Q) function was a head thrust.

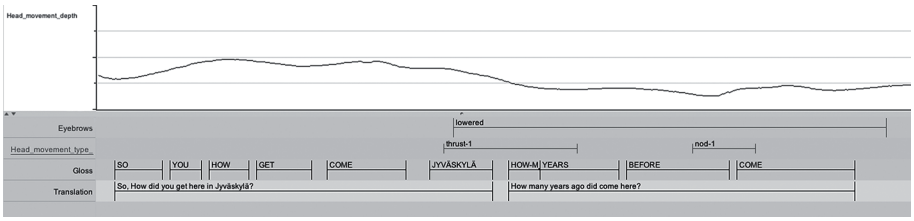


Figure 26. An interrogative head thrust between two content questions. [Data 2, Signer A, Thrust-1 & Nod-1]

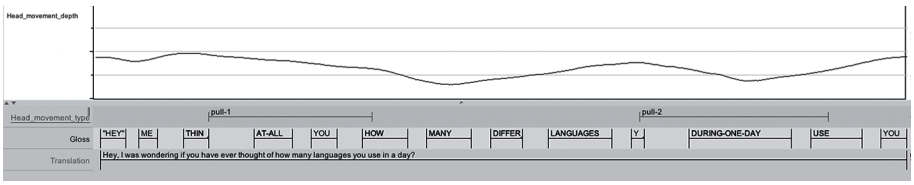


Figure 27. An interrogative head pull (pull-1) in an embedded content question, which forms a complex interrogative sentence. [Data 1, Signer B, Pull-1 & Pull-2]

In the example in Figure 26, the signer produces two interrogative sentences, both of which are content questions. The interrogative head thrust begins towards the end of the first sentence and spreads over the transition between the two sentences. The thrust is considerably shorter in duration than the raised brows with which it co-occurs. The head nod produced subsequently in the same sentence functions as an indexical element (see Section 5.4). The example in Figure 27, on the other hand, contains a complex interrogative sentence. The first part of the sentence forms an introductory polar question ('have you ever thought?') and is followed by an interrogative transitive clause, which is an embedded content question ('how many languages you use in a day?'). The interrogative head pull occurs before the question sign HOW in the transition between the polar and content question. It is accompanied by a chin-down position and a brow raise. Later the addressee answers to both of the questions: "*Yes, I have thought about it several times. If you start to count them you're surprised how many there are: two, three, even four lan-*

guages every day." The second head pull produced in the utterance is emphatic and was presented earlier in Figure 11 in Section 5.1.

In polar questions, the interrogative tone of the structures was conveyed solely by the articulation of the head and face. The example in Figure 21 presented earlier in Section 5.3.2, included an interrogative sentence (IT-SEEMS YOU SAME YEAR YOU), which is a polar question. During the interrogative head thrust, the signer also raises her eyebrows. An interrogative head thrust occurred also in the polar question described in Figure 28, this time with a brow lowering.

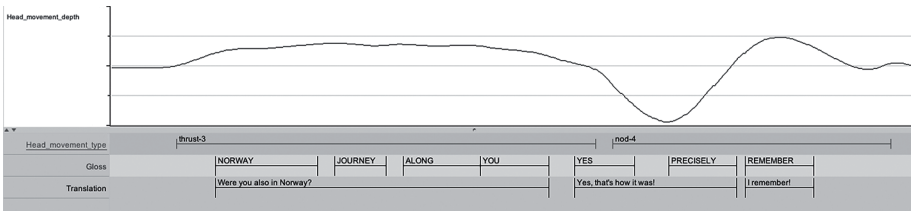


Figure 28. An interrogative head thrust in a polar question. [Data 2, Signer B, Thrust-3 & Nod-4]

The utterance in Figure 28 consists of a polar question followed by two affirmative declarative sentences. The interrogative head thrust begins before the start of the question and ends at the beginning of the subsequent declarative sentence. The head thrust is followed by a nod with a positive (affirmative) function.

There was also one polar question in the data with a co-ordinated (disjunctive) 'either-or' structure, which was presented in Figure 15 in Section 5.1.3. Two head thrusts produced in the utterance function as interrogative markers while at the same time, they are involved in the separation of the two co-ordinated elements. The question in the utterances described in Figure 15 forms an interrogative structure in which the head thrusts mark contrastive focus.

5.4 Other functions: Copying, indicating, and time-reference

Sagittal head movements in the data also included copying and indicating head movements as well as head movements with possible reference to past or future time. Copying head movements were usually instances of head nods or nodding in which the motion of the head copied the temporal pattern of global manual (path) movements. In copying head movements, the stroke in the head movement was produced simultaneously with a stroke in the manual movement. Copying can be a form of emphasis in which the movement of the head increases the visibility of the manual sign. On the other hand, copying may also be a result of non-deliberate co-articulation. Examples of head movements with features that may be seen as copying are given in Figure 18 and Figure 29.

In the data, we found three cases in which the head was used in referential pointing (X function). In the interrogative sentence introduced in Figure 26 in Section 5.3.3, the signer produced an indicating head nod, which functions as a reference towards the addressee ('you'). No manual indexical signs were produced to refer to the 2nd person. The utterance is an intransitive sentence, in which the head nod performs as the S argument (cf. Velupillai 2012). An indicating head nod occurred also in the utterance presented in Figure 29.

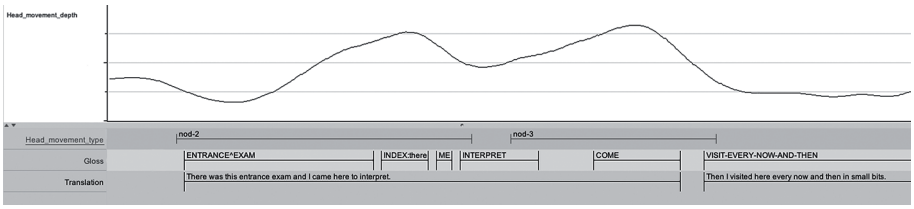


Figure 29. An utterance with an indicating head nod. [Data 2, Signer B, Nod-2 & Nod-3]

In the utterance in Figure 29, the signer's head points and nods towards the location where the signer had previously placed a manual (indexical) sign. In the example, the head first nods during the existential clause in the beginning of the sentence, binding together the signs ENTRANCE^EXAM and INDEX. The first nod is then followed by an indicating head nod during the last two signs of the sentence. In the second nod, the position of the signer's head is different: the chin is closer to the chest and the orientation of the face (and later the forehead) is directed towards the end location of the sign COME. This indicates that the second head nod is indexical and points towards the location which refers to the meaning 'here'. The nod can also be seen as copying the movement of the hands in the sign COME.

In one occasion in the data, a head pull was produced in an utterance with reference to an event in a specific time frame. A head pull in the example in Figure 21, in Section 5.3.2 was produced when referring to past time. When signing the utterance "*The first time I came here was ninety-eight*", the head pull together with the facial articulation (eyes wide & eyebrows raised) functions as an emphatic marker: it emphasizes the prominence of the signs FIRST-TIME, ME, and NINETY-EIGHT during which it occurs. The head pull is produced without any noticeable movement of the upper body, and the combination of the head pull and facial articulation emphasizes that the signer is referring to a situation which is the very first of its kind.

However, it would be a rather strong claim to say that the non-manual articulation in itself functions as a marker of past time in this instance. In the example in Figure 21, the articulation of the signer's head and face emphasizes the manually produced sign FIRST-TIME, which already (taken in context) expresses that

the event is situated in past time. Moreover, the data also includes an utterance in which a head pull occurs in an utterance with a quite different meaning: in Figure 13 in Section 5.1.2, a head pull gives emphasis to something that is declared about the present time, in contrast to something that has been stated earlier about past time. Taken together, according to our data, the head movement can emphasize or mark contrast between elements in signing which already have a reference to past, present, or future time. Whether the direction of a head movement can refer to time, or the order of events, by reference to a visual "timeline" in the signing space, is an issue for future research.

5.5 Summary

An overview of the form-function combinations of head movements in our data is presented in Table 3. The numbers in the table are based on those functions, which have been analyzed as primary functions for the head movements.

The most frequent function in the data was the affirmative (A) function. Different emphatic (E) functions, such as listing and putting prosodic stress to manually produced signs, were also common. All functions except indicating (X) were expressed with more than one type of head movement, especially emphasis, which occurred with all four head movement types. The prosodic/syntactic domain marking (D) and the copying (C) functions were the most infrequent functions in the data, but also the indicating and the boundary marking (B) functions were rare. However, several head movements were analyzed as, for example, copying or boundary-marking movements in addition to other functions (i.e. boundary-marking or copying as a secondary function).

In Table 4, we present again the form-function combinations of different head movements but this time, the numbers include both the instances in which a function has been analyzed as primary and the instances in which a function has been analyzed as secondary (i.e. occurring in addition to other functions). Due to the overlapping of several functions for single head movements, the total numbers of

Table 3. Form-function combinations of head movements in the data

	E	B	D	A	Q	C	X
Nod	4	1	0	26	2	0	3
Thrust	11	0	1	1	6	0	0
Nodding	1	0	0	31	0	2	0
Pull	5	2	1	0	1	0	0
Total	**21**	**3**	**2**	**58**	**9**	**2**	**3**

Table 4. Form-function combinations of head movements in the data including primary and secondary functions

	E	B	D	A	Q	C	X
Nod	6	12	6	29	2	3	3
Thrust	13	0	2	1	6	0	0
Nodding	3	1	0	32	0	4	0
Pull	6	3	1	0	1	1	0
Total	**28**	**16**	**9**	**62**	**9**	**8**	**3**

the form-function combinations in Table 4 do not represent the actual amount of head movements in the data (cf. Table 3).

A summary of the central functions of nods, nodding, head thrusts, and head pulls is presented below:

- Nods — Their central function is neutral affirmation and giving positive feedback (A). Tend to occur sentence-finally.
- Thrusts — They tend to be used in questions (Q). Also emphatic functions of listing and prosodic stress (E) are central.
- Pulls — Most mark emphasis (E), including contrast and semantic exclusion.
- Nodding — Its central function is to signal positive feedback (A); often occurs during the receptive phase of the discourse. Nodding can also copy the manual motion (C).

6. Discussion

6.1 The relation between form and function

Layering and overlapping of the forms and functions of head movements and other manual and non-manual articulations was common in the data. Firstly, the overlapping of independent manual and non-manual articulations occurred in the data. This can be seen, for instance, in Figure 21, in Section 5.3.2, in which a non-manual predicate (a head nod) is produced during a hold in the co-occurring manual sign. Secondly, the overlapping of several head movements also occurred in the data. This is demonstrated, for example, in the utterance in Figure 12 (Section 5.1.1), where a simultaneous head thrust and nodding movement form a unit in which the head thrust emphasizes the strongly affirmative nodding. The same example also illustrates the overlapping of several non-manual articulations, and the difficulties in separating their functions. The head thrust and nodding are

produced with a specific mouth gesture, and together these three elements form a gestural unit in which the meanings conveyed by the mouth gesture can easily be confused with the functions of the action of the head. Separating the meaning of a head movement (if there is one) from the meaning of a whole utterance is a problem which needs to be explored by a detailed annotation of the activities of different non-manual articulators. The individual annotations can then be compared and the similarities and differences between the functions evaluated.

We also frequently observed overlapping of several functions for a single head articulation. If one head movement is seen to perform several functions, we need to consider whether any function can be seen as more or as less central than any other. The questions that follow are how this is defined and, at a later stage, how it is incorporated into the annotation and analysis of head movements and their functions. In the analysis of the functions of single head movements, it is also necessary to observe the preceding and following context of the non-manual and manual elements produced in the signing.

The form of head movement is not always the same for each function. For example, nods, thrusts, pulls, or nodding can all mark prosodic or syntactic domains. The form of the movement may also vary even though the function is the same. For instance, head thrusts and head nods both perform as markers of lists, sometimes even in the same utterance (see the example in Figure 16 in Section 5.1.3). The fact that one sentence can include both thrusts and a nod as listing movements raises two questions. Firstly, is it necessary to differentiate between a nod and a thrust in list structures? It might be that the distinction between them is merely coincidental: a position of the jaw which is the result, perhaps, of the previous or following context in the signing. Or it might be that the idiolectic characteristics of individual signers influence the articulation. Secondly, is it even possible in every case to differentiate between forms such as nods and thrusts? The head can move forward in the dimension of depth with or without lowering the jaw, and the characteristics of the movement may be very subtle. It is sometimes difficult to determine whether the movement is a thrust or a nod, especially when observing video material only with the naked eye. The same applies in some instances also with nods and nodding: in the data, nods and nodding formed hybrid forms (see Figure 25 in Section 5.3.2). Linguistically, the difference between the form of the movements is in some cases insignificant; it may be enough that something is happening (changing) in the action of the head, whatever the specific form of the head movement is. However, there are also situations in which the difference in the form of the head movement is significant. For example, nodding is different from nods in that it does not mark boundaries or lists, as nods do.

The functional types presented in Section 5 are not mutually exclusive but they overlap. For example, a head nod signalling affirmation can also function as a boundary marker. Another example of a gradual relationship between two function types is boundary and domain marking. According to the traditional view, boundary and domain marking are distinguished on the basis that boundary markers are punctual and do not spread (see Section 2.1). However, the difference between a boundary and domain marker is often more obscure. The head pull in the complex sentence presented in Figure 19 in Section 5.2 clearly marks a sentence-internal transition between two elements. However, it is not punctual but gives emphasis to the sign with which it is produced. If the sign in question would be a depicting verbal, would the head movement still be classified as a boundary marker instead of a domain marker? Also, in cases in which a single sign constitutes a "domain" (e.g. a topic), a head movement expressing emphasis at the same time is marking the domain. It has also been stated for ASL that boundary markers (all except head thrusts) occur after the last sign of a syntactic unit. In our data, however, head movements such as nods and pulls appeared as boundary markers before, during, and after the transition between phrases, clauses, or utterances. In other words, on the basis of our data, head movements in FinSL are not always simply *either* boundary *or* domain markers. The difference between the two prosodic functions is not so clear cut; in the end, the significant factor is that different units are separated, or that the elements inside different units are bound together into contours.

There were also situations in the data in which the head movement marked a larger prosodic contour which was not aligned with the syntactic structure of the utterance. In this way, the results in our data support the observation that prosodic and syntactic structures in sign languages are closely related but not isomorphic (cf. Nespor & Vogel 1986; Wilbur 2000; Pfau & Quer 2010; Sandler 2012). All in all, the division of linguistic non-manuals into 'prosodic' and 'grammatical' proves to be somewhat controversial in the light of the head movements in our data. For instance, listing is an example of both prosody and grammar: a list structure can simultaneously be syntactic, happen on a larger textual scale (themes/episodes), and be an example of producing prosodic stress for creating contrast (separation, parallel focus) between elements that are in multiple co-ordination. Also, boundary marking can involve smaller syntactic borders or larger textual episodes. For example, assertive head nods appear when moving from one textual subcategory to another, in changes, or in transitions between larger episodes.

The concept of a continuum may be beneficial to an understanding of the different forms and functions of head movements. As is evident from Figures 6 and 7 in Section 4, nods and thrusts are generally phonetically similar but not identical. There are forms of nods and thrusts that clearly differ from each other,

and on the other hand, there are head movements which are difficult to classify with certainty as one or the other. It may thus be useful to view the relationship between, for example, nods and thrusts or border marking and domain marking as a continuum. At one end of the continuum, there is a clear case of a head nod or a border-marking function and at the other end a clearly formed thrust or a clear case of domain marking. In between the polar extremes of the continuum are several forms and functions with characteristics of both extremes. The functions of head movements form overlapping continuums, such as gestural-grammatical, communicative-syntactic, textual-syntactic, prosodic-communicative, prosodic-grammatical, and so on.

6.2 Comparison with previous theoretical observations

The results of the present study are partly in line with, and partly differ from, observations made regarding head movements and their functions in other sign languages. The most frequent head movements in the data, head nods, were used for all seven functions. Just like nods in other sign languages, the nods in our data, too, fulfilled affirmative functions and they appeared in lists and verbless utterances, comparable to examples (1) and (2) in Section 2. Head nods in the data could also form a domain when occurring as positive responses ('yes'). As has been stated for nods in ASL (see Section 2.2), some of the nods in our data occurred close to the boundaries of syntactic units: 37.04% of the head nods, produced by the active signer, were sentence-final. The status of head nods as boundary markers should be investigated further based on a larger corpus of FinSL. In addition, we found one function for head nods in FinSL which has not been mentioned in relation to other sign languages: in the data, nods were used to point towards referents in signing.

Compared to nods, head thrusts in our data had fewer different functions. Predictably, thrusts occurred in content and polar questions, as has been stated for several sign languages, including FinSL (see example (6) in Section 2.3). However, contrary to what has been stated of questions in FinSL so far, thrusts in our data did not occur in all of the interrogative clauses in the data, which indicates that head thrusts are not obligatory for the production of FinSL questions (cf. Savolainen 2006). As has been observed for ASL (Wilbur & Patschke 1998) and NGT (van der Kooij et al. 2006), head thrusts in our data also marked list structures (parallel contrastive focus) and performed emphatic functions of putting prosodic stress on the articulation of the hands — either together with body leans or independently. In addition to emphasizing manual articulation, the head thrusts in our data could also emphasize other head movements. Head thrusts in our data did not perform boundary-marking functions (cf. Wilbur 2000), but they did produce emphasis on sentence-initial signs.

Like nods, also nodding in the data had affirmative functions, as has been noted for other sign (and spoken) languages. Nodding was, however, more restricted in the distribution of its different functions than nods. Nodding occurred when strongly affirming something, as has been described for several sign languages such as Italian Sign Language (see example (5) in Section 2.2), and giving positive feedback in the conversation. The examples of strongly affirmative nodding found in the data expressed either epistemic (deductive) propositional modality or deontic (commissive) event modality. In our data, we did not find any instances of nodding which marked boundaries (except for one hybrid form between a nod and nodding), cautiousness, or vagueness (cf. Wilbur 2000). Nodding in our data did, however, include movements in which the motion of the head copied the movement of the hands.

The last of the four movement types, the head pull, was the most infrequent head movement in the data and had a limited number of functions. Head pulls in the data performed emphatic functions of marking contrastive stress and exclusion, as has been noted, for example, for ASL and NGT (cf. Wilbur & Patschke 1998; van der Kooij et al. 2006). These emphatic head pulls were produced either together with backward body leans or independently. In addition, head pulls in the data gave prosodic stress to manually produced signs. One head pull in the data had an interrogative function and occurred in a content question (see Figure 27 in Section 5.3.3), although head pulls have not been mentioned in previous studies of FinSL questions (see Savolainen 2006). However, head pulls have been found to occur, for example, in ASL content questions (see Liddell 1980; Pfau & Quer 2010). Head pulls in the data did not function as topic markers, as in ASL (cf. Aarons 1994), or mark other question types such as polar questions, as noted for BSL (cf. Sutton-Spence & Woll 1999).

6.3 On the linguistic vs. gestural status of head movements

The observations concerning the overlapping and gradual relationship between the forms and functions of different head movements in the data are interesting when viewed against, for example, Okrent's (2002) definition of gestures. According to Okrent, gestures are non-conventional in form and the relationships between the forms and functions of gestures are gradient and non-categorical in nature. In addition, Emmorey (1999) has stated that some movements and positions produced by different parts of the body while signing are to be considered gestures rather than signals that are conventionalized in the language system. Moreover, the division of non-manuals into affective or linguistically significant has been based on the level of sharpness in their on- and offsets. Should we therefore conclude that all head movements in FinSL are gestures?

According to our data, the prosodic, syntactic, and/or gestural head movements show no noticeable differences in form and production. If anything, they seem to be fairly free in combining and layering different functions to apparently uniform movements. The results of this study show that the functions of different head movements are various but not random, as can be seen from the overall regularities of the functions of nods, thrusts, nodding, and pulls listed in Section 5.5. These results suggest that many functions of FinSL head movements are gestural (e.g. affirmative nods and nodding produced along with the discourse, deictic indicating head nods, head pulls conveying meanings of semantic exclusion). Head movements can be situated in different locations on a gestural-grammatical continuum according to their features, such as level of conventionality, iconicity, or idiosyncrasy.

However, on the basis of this study, it would be premature to decide whether head movements are always to be considered gestures. The suggestions made here concerning the nature of FinSL head movements are put forward on the basis of data from two native FinSL signers. Many, if not all, of the results of the study should be tested with a larger corpus of FinSL consisting of data from several different signers and different types of situations of language use. What we can state, though, is that, according to our analysis of head movements, the difference between affective/gestural and linguistically significant non-manuals in FinSL is not clear-cut. Head movements with syntactic or grammatical relevance are not clearly more systematic than, or significantly different in their on- and off-sets from, the head movements which can easily be classified as primarily gestural. The more or less gestural and context-specific nature of head movements does not change the fact that they should be taken into account when examining the structure and use of FinSL. Gestural and gradient features in signing are significant characteristics that, if one takes a non-modular point of view on language, are an inherent part of the language system. The results of the current study serve as a first step towards an in-depth investigation of head movements and the grammatical-gestural role of non-manuality in FinSL.

7. Conclusion

Our examination of head movements has revealed that the actions of the head have several roles when organizing FinSL utterances in discourse. The head moves a lot during signing (see Figure 5, Section 3.2); some of the articulations have syntactic, prosodic, or discourse level functions, while others do not have a specific linguistically significant function. The most common sagittal head movements in the data were nods and nodding, which had affirmative functions that were either

neutral or strong or gave positive feedback in the discourse. Other movements were thrusts and pulls, which performed, for example, interrogative, emphatic, and boundary-marking functions.

In our data, consisting of continuous dialogue, the movements of the head and changes in head positions were not predetermined or regular. The results suggest that differentiating between different head movements by simply observing video data may in some cases be very difficult. It can be hard, for example, to distinguish between nods and thrusts with small movement amplitude when relying only on the traditional observation of two-dimensional video material. For this reason, among others, the motion tracking data was found to be especially useful. The benefits of the quantitative data imply that in the phonetic analysis of non-manuals such as head movements, motion capture and/or automated video analysis is essential.

Another overall conclusion of our study is that the form-function relationship of different head movements is not one-to-one, even though there are clear regularities in the functions of nods, head thrusts, nodding, and head pulls. The data analysis showed that one function (e.g. emphasis) may be expressed by different types of head movements and, conversely, that one type of head movement may have several different functions, depending on the context in which it occurs. These observations are supported by earlier researchers' general observations about non-manual activity in sign languages (see Herrmann & Steinbach 2011). The forms and functions of head movements overlapped with each other, forming gradient continuums between clear cases. In some cases, the forms and functions of head movements in the data also overlapped with the forms and functions of other manual and non-manual articulations.

The non-categorical nature of the form-function combinations of head movements in the data, as well as the lack of consistency and spreading behaviour of specific head movements, suggest that the general division of non-manuals in sign languages into affective or grammatical is not directly applicable in the interpretation of the functions of head movements in FinSL. A more detailed investigation of the kinematic differences between specific head movements with different functions is needed. Finally, a comparison of the head movements produced by native FinSL signers, L2 learners of FinSL, and speakers of Finnish might offer useful information that would help us to understand the part played by head movements in non-manual articulation and overall communication in FinSL.

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II

THE ALIGNMENT OF HEAD NODS WITH SYNTACTIC UNITS IN FINNISH SIGN LANGUAGE AND SWEDISH SIGN LANGUAGE

by

Puupponen, A., Jantunen, T. & Mesch, J. 2016

Proceedings of Speech Prosody 2016, 168–172

The alignment of head nods with syntactic units in Finnish Sign Language and Swedish Sign Language

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Abstract

In this paper we examine the relationship between specific head movement events – head nods, often treated as prosodic boundary markers – and syntactic units in Finnish (FinSL) and Swedish Sign Language (SSL). In the study we investigated the alignment of head nods with syntactic units on the basis of a total of 20 (10+10) FinSL and SSL narratives. The results of the study show that in both languages head nods appeared similarly on syntactic boundaries and that the tendency was to align nods sentence-finally. However, not all head nods behaved this way: for example, a relatively large number of head nods were also found to occur sentence-initially or elsewhere in the sentence. Furthermore, head nods occurring on syntactic boundaries also had non-boundary marking functions, and not all syntactic boundaries occurred with head nods.

Index Terms: boundary marker, head movement, syntactic unit, Finnish Sign Language, Swedish Sign Language

1. Introduction

In this paper we discuss the relationship between head nods and syntactic units in two historically related sign languages, Finnish Sign Language (FinSL) and Swedish Sign Language (SSL). Single head nods have been claimed to occur at prosodic and/or syntactic boundaries in different spoken and signed languages (see e.g. [1], [2]). In sign language literature, these *on-boundary* movements of the head are referred to as "prosodic boundary-markers": It is often argued, at least implicitly, that they occur at the end of sentences ([2], [3]) and are punctual cues that do not spread across entire syntactic domains (e.g. [3]).

However, some studies (e.g. [2], [4]) have suggested that not all nods in signed texts and conversations are produced on a syntactic boundary: nods have also been identified as occurring elsewhere, and they have also been shown to cover whole clauses/sentences if these clauses/sentences are of short duration [4]. Indeed, head nods seem to be frequent elements in signed and spoken discourse, signaling, for example, affirmation, a positive response, or the signers'/speakers' engagement in the discourse (e.g. [6], [7]). Having said that, in order to define single head nods simply as "boundary-markers" in different sign languages we need to first examine the frequency and distribution of head nods performing different functions in different sign languages. This also includes finding out exactly how head nods are positioned in relation to syntactic units.

As in other sign languages, head nods have also been found to occur on syntactic boundaries in FinSL and SSL (see [4], [5]). It is, however, still unclear how nods and syntactic units are aligned in the two languages; how frequently and how exactly nods and syntactic boundaries coincide, and whether the two languages show similarities or differences in this respect. In the current study we examine the use of head nods and their relation to syntactic units by observing annotated data of FinSL and SSL. The goal of the research is to find out whether head nods appear in similar or different ways in FinSL and SSL texts. Our research questions are as follows: (i) How are nods distributed with respect to syntactic units in FinSL and SSL? And (ii), How are on-boundary head nods *exactly* positioned in relation to the syntactic boundaries with which they occur, and how frequent are the nods occurring in these positions? The answers to these questions will lead us to a discussion of whether head nods can be treated as prosodic boundary markers in FinSL and SSL.

2. Data and method

The analysis of head nods in FinSL and SSL was carried out on the basis of a total of 20 (10+10) signed narratives from native FinSL and SSL signers between the ages of 20 and 59 years. For the data collection, both the FinSL and SSL signers were asked to tell a story from one of two picture books: *Snowman* and *Frog, where are you?*. The tasks were carried out in pairs in a dialogue setting in which the recording set-up consisted of cameras directed toward the informants from 4 to 6 different angles (see Figure 1). The material consists of approximately 30 minutes of video data per language.

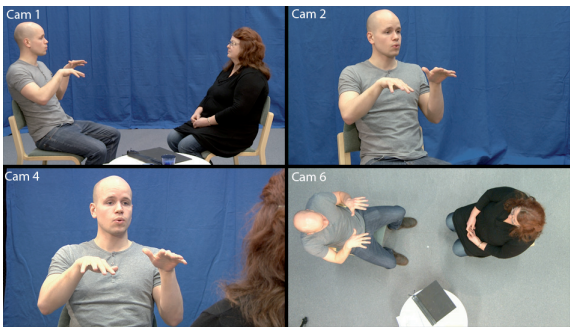


Figure 1: *Screenshots of one frame in the FinSL video material from four different camera angles* [8].

From the data, annotations were created in ELAN [9] on the levels of manual signs, sentences, translation and head movements. The annotation work on the movements of the head was carried out by a native FinSL signer who was also familiar with SSL and experienced in annotation procedures. Different head movement events were identified from the data through a detailed process of observing the motion of the head in different dimensions in all the narratives in the data. This annotation work benefited greatly from the possibility of viewing several videos, recorded from multiple camera-angles, simultaneously in ELAN. It should also be noted that, in addition to the traditional video material, the data of the current study also included computer-vision based analysis of the movement of the head, obtained with SLMotion software (see [10] and [11]). The detection of the movement of the signer's head resulted in numerical data which was then imported into ELAN and viewed as graphic visualizations. These detailed measurements provided support for the re-examination of particular annotations, as well as for the detailed analysis of the alignment of single head nods with syntactic units.

On the basis of the annotations, the nods in the data were classified as either i) nods occurring on syntactic boundaries (i.e. on-boundary nods) or ii) other sentence/clause-internal nods. On-boundary nods were then divided, according to their timing with syntactic units, into 6 subtypes (see Table 1).

Table 1. *The classification of different head nods occurring on syntactic boundaries in the data.*

On-boundary nods	Explanation
Sentence-final	During or after the last sign(s) of a sentence
Sentence-initial	During the first sign(s) of a sentence
Sentence border	On the border between two sentences
Inter-sentential	During a pause between two sentences
Sentence-internal boundary	During a clause or phrase boundary
Sentence-internal listing	Separating elements in multiple co-ordination

Table 2. *The classification of different sentence/clause-inner head nods in the data.*

Other sentence/clause-internal nods	Explanation
Sentence-internal other	Functions such as emphasis or affirmation
Whole sentence	During a whole sentence
Sentence-internal X	Unclear cases

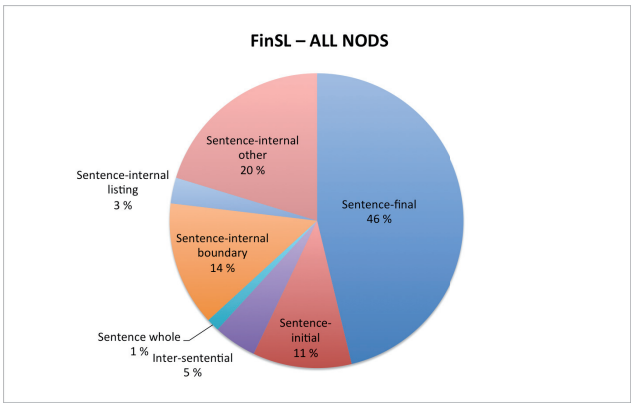
When a nod was produced during a transition from one sentence to another, it was defined as *sentence-final* or *sentence-initial*, depending on which "side" of the sentence boundary the stroke of the nod movement was produced. If this could not be distinguished, the nod was labeled as *sentence-border*. If a nod was produced during a pause between two sentences it was labeled as *inter-sentential.* Nods that occurred on boundaries of smaller syntactic units were defined as *sentence-internal boundary* nods, which marked clausal or phrasal boundaries, and *sentence-internal listing* nods, which marked coordinative lists. Sentence/clause-internal nods, on the other hand, were divided into three groups: *sentence-internal other*, nods which were not aligned with syntactic boundaries but had other functions such as affirmation or emphasis, nods with whole utterances labeled as *whole sentence*, and unclear cases labeled as *sentence-internal X* (see Table 2).

3. Results

When examining the overall distribution of head nods in the data, it was found that the average number of nods per narrative was higher in FinSL than in SSL. The average story in FinSL included over twenty head nods whereas in SSL there were only half that number in the average story. Altogether the FinSL data consisted of 212 and the SSL data of 107 instances of head nods. The difference in the number of head nods between FinSL and SSL narratives may be explained either by the fact that FinSL narratives were longer in duration than SSL narratives, or by the fact that the number of sentences in FinSL was higher than in SSL (see Table 3). In addition, in both FinSL and SSL narratives the number of head nods per narrative showed a lot of variation between individual signers (see Table 3). This may be a result of several factors, such as differences in the age and background of the signers.

Signer	Duration (min:sec)	Nr Nods	Nr Sentences
FinSL			
S1	1:56	21	42
S2	2:20	28	55
S3	4:15	15	104
S4	4:40	11	112
S5	5:54	17	90
S6	1:34	33	42
S7	1:47	30	62
S8	4:34	32	63
S9	2:56	13	76
S10	2:35	12	55
Total	**32:31**	**212**	**701**
SSL			
S11	2:07	13	36
S12	3:37	19	55
S13	4:49	11	54
S14	3:19	7	41
S15	2:38	19	36
S16	1:25	12	27
S17	2:24	6	34
S18	2:53	4	39
S19	2:00	12	25
S20	2:38	4	40
Total	**27:50**	**107**	**387**

Table 3. *The overall duration, number of nods, and number of sentences in each narrative in the data.*



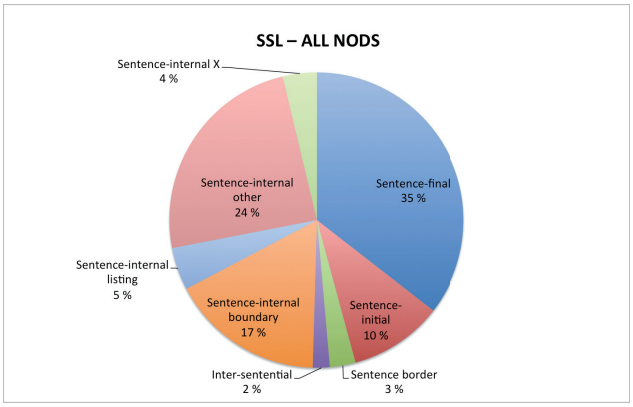


Figure 2: *The distribution of different types of head nods in the data in FinSL* (n=212) and SSL (n=107).

Despite the differences in the total number of head nods between FinSL and SSL, the distribution of different head nods in both languages was relatively similar (see Figure 2). We found that in both FinSL and SSL narratives, there was a strong tendency to produce a head nod sentence-finally. In both languages, the largest groups of head nods in the data, in order of frequency, were sentence-final nods (35–46%), sentence-internal other nods (20–24%), sentence-internal boundary nods (14–17%) and sentence-initial nods (10–11 %). These groups constituted 91 percent of all nods in FinSL and 86 percent of all nods in SSL. The most infrequent nods were nods during whole sentences (0–1%), nods on the borders of two sentences (0–3%), and nods between two sentences (2–5%). All in all, in FinSL narratives 80 percent and in SSL narratives 73 percent of all nods were produced on syntactic boundaries (i.e. on sentence-final, sentence-initial or sentence-internal clausal boundaries). Some of these nods co-occurring with syntactic boundaries performed also other simultaneous functions, such as affirmation.

When examining the distribution of different subtypes of on-boundary head nods (see Figure 3), we found that in both languages sentence-final nods were clearly more common than, for example, sentence-initial nods or nods which occurred at sentence-internal clausal boundaries. However, although sentence-final nods were the most frequent on-boundary nods in both languages, the percentage of sentence-final nods in all boundary-marking nods was larger in FinSL (59%) than in SSL (49%).

4. Discussion

Concerning research question (i), the results of the current study show that although the overall number of head nods differs significantly in FinSL and SSL narratives, the patterns in which head nods align with syntactic units are very similar in both languages. The majority of head nods produced in the narrative texts in FinSL (80 %) and SSL (73 %) were on-boundary, and the remaining head nods were mostly nods not occurring on syntactic boundaries but performing functions such as emphasis or affirmation (FinSL 20 %, SSL 24%) These head nods emphasized, for example, the form or meaning of single manual signs, or conveyed meanings of strong or neutral affirmation (such as 'indeed' or 'yes') independently or together with manual signs (see e.g. [4]).

Concerning research question (ii), when examining how exactly on-boundary head nods occur in relation to syntactic boundaries, we found that, in both SSL and FinSL, nods were especially common in sentence-final positions, on sentence-internal clausal or phrasal boundaries, and sentence-initially. Although both languages had a strong tendency to produce on-boundary head nods sentence-finally, also sentence-initial head nods were surprisingly frequent. In this respect our results differ from previous observations made of other sign languages (see [2], [3]).

However, the data also showed differences in the distribution of different on-boundary nods between the two languages: sentence-final nods were more frequent in FinSL (59 %) than in SSL (49 %). Besides possible differences in translation strategies, also different ways of constructing the narratives in the two languages can be seen as causing the difference between them in the alignment of nods with syntactic units. It has been argued that the use of gestural elements and constructed action may influence the grammatical structure of signing in different ways (see e.g. [12], [13]). In the current study, *showing* an event (gestural enactment) was a more common strategy in SSL narratives and *telling about* an event more common in FinSL narratives. If constructed action can function as predicates and arguments in clauses and therefore result in the lower use of conventionalized signs in narratives (see [12]), the results of this study raise the interesting question of whether gestural enactment also influences the frequency and use of prosodic cues in discourse. Finally, as these observations are based on the analysis of narrative texts, comparison of the results with the use of nods in turn-final and turn-internal boundary marking in spoken and signed dialogues would be an interesting topic for future work.

All on-boundary head movements cannot be directly interpreted as prosodic boundary markers. For example, not all the sentence-final or sentence-initial head nods in our data were punctual, but they spread over several manually produced signs. In addition, it should be noted that on-boundary head nods were not compulsory for the marking of syntactic boundaries, nor were they the only possible markers separating syntactic and/or prosodic domains in either of the languages. When we compare the overall numbers of head nods and sentences given in Table 3, we see that head nods *may* occur on syntactic boundaries but they are by no means compulsory. Other properties in the articulation of the hands and other parts of the body, such as velocity differences, pauses, and durational features, are involved in the organization of manual and non-manual movement patterns into understandable chunks of discourse.

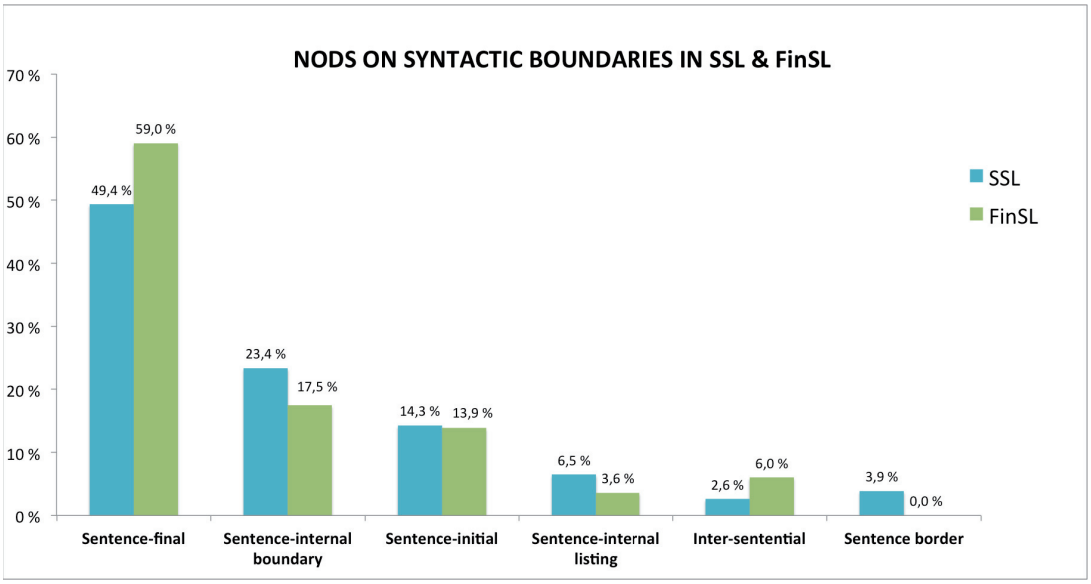


Figure 3: *The distribution of different types of nods occurring on syntactic boundaries in FinSL (n=166) and SSL (n=77).*

However, according to the results of the current study, the distribution of nods in the data was consistent and similar in both languages: most of the head nods produced in narrative texts in both FinSL and SSL were punctual head movements which occurred immediately before or after a syntactic boundary. These observations indicate that head nods in FinSL and SLL show characteristics of prosodic boundary-marking and, moreover, that the use of nods as boundary markers is similar in FinSL and SSL. Some of these nods did not only occur with syntactic boundaries but also had other, overlapping functions. For example, some sentence-final nods in the data conveyed meanings of neutral or strong affirmation, described earlier in this section. The separation of prosodic domains cannot therefore be seen as their only function.

5. Conclusion

In this paper we presented a study of the relationship between head nods and syntactic units in FinSL and SSL. According to the results, head nods in FinSL and SSL are aligned similarly and rather systematically with syntactic boundaries in narrative texts. The majority of nods occurred immediately before or after a sentence boundary, or at sentence-internal clausal boundaries. The observations presented here lead us to the conclusion that, in both FinSL and SSL, head nods perform a prosodic boundary-marking function in addition to, or simultaneously with, other functions. This further implicates that, when it comes to single and more or less punctual head movement events, the prosody and syntax are connected and "co-operating" in the construction of understandable signed texts in FinSL and SSL. In addition, the tendency for the sentence-final alignment of head nods in both FinSL and SSL indicates that the way in which nods participate in the rhythmic patterning of signing is similar in the two languages. However, when consulted on issues related to rhythmic features in FinSL and SSL, native signers have reported an intuitive sense of rhythmic difference between the two languages [14]. In our future work we plan to investigate further how single head nods contribute to the rhythm of signing, and whether the similar patterns found in the distribution of nods in FinSL and SSL can also be found in other sign languages.

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III

THE RELATIONSHIP BETWEEN THE MOVEMENTS AND POSITIONS OF THE HEAD AND THE TORSO IN FINNISH SIGN LANGUAGE

by

Puupponen, A. 2018

Sign Language Studies 18(2), 175–214

ANNA PUUPPONEN

The Relationship between Movements and Positions of the Head and the Torso in Finnish Sign Language

Abstract

This article discusses a study of the relationship between movements of the head and the torso in Finnish Sign Language (FinSL). It describes the differences and similarities in the articulation of these two body parts in FinSL narratives, and discusses the status and relationship of the head and the torso as articulators in sign languages. The study reveals that, in FinSL narratives, the head is clearly more active than the torso. When both the torso and the head moved, almost half of the co-occurrences were found to be simple combinations of codirectional movements, while slightly more than half of the co-occurrences were semicomplex or complex combinations with differences in the direction of the movements. Most of the co-occurring torso and head movements shared the same function, regardless of the degree of complexity of the combination. However, differences in the functions of torso and head movements were found to increase as the complexity of the combined movements grew.

Nonmanuals (i.e., movements and positions of the torso, head, and upper and lower face) are considered to be an integral part of sign languages. In order to form a theory of nonmanuals and the role of nonmanuality in a sign language, one must investigate the forms and

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functions of articulations of the torso, the head, and the face separately, as well as in relation to each other and to the articulation of the hands. Research on various sign languages has provided much information on facial articulation (see, e.g., Wilbur and Patschke 1999; Boyes Braem and Sutton-Spence 2001). For example, studies have been done on the articulation of the lower and upper face (e.g., mouth actions, eye aperture, eyebrow position) in relation to lexical signs or the informational structure of utterances in several sign languages (ibid.). However, studies that focus specifically on the forms and functions of torso and head movements are not so common (see, e.g., Liddell 1986; Schalber 2006; Lackner 2013). Movements of the head have been observed in negations, affirmations, and interrogatives (e.g., Zeshan 2006; Wilbur 2000; Lackner 2013; Puupponen et al. 2015) and in the marking of prosodic units or their boundaries (e.g., Wilbur 2000; Sandler 2012). Body movements have been found to play a part in constructed action (CA), to contribute to the meaningful use of space in signed discourse, and to coincide with different discourse-level units (Engberg-Pedersen 1993; Wilbur and Patschke 1998; Boyes Braem 1999; Crasborn and van der Kooij 2013; Hodge and Ferrara 2013).

In FinSL, research on nonmanuality has investigated mouthings and mouth gestures (Pimiä 1987; Rainò 2001; Rauhansalo 2015). Observations of head movements and facial articulation in interrogatives and negatives have been noted (Savolainen 2006), while more recent phonetic research has concentrated on the forms and functions of head movements (Puupponen 2012; Puupponen et al. 2015). As in the linguistics literature on other sign languages, studies of torso movements and positions in FinSL are far fewer in number, apart from individual references to body movements in constructed action (Rissanen 1992; Luckasczyk 2008; Jantunen 2007), syntactic boundaries in equative sentences (Jantunen 2007), and coordination (Jantunen 2016). Consequently, the relationship between the torso and the head in the articulation of FinSL also remains unexplored. An exception is Jantunen et al. (2012), who found that, according to motion-capture location data on continuous signing, the correlation between movements of the torso and the head is very strong.

Our knowledge of the relationship between the articulations of the torso and the head is still quite limited. Movements of the head and

the torso have been addressed in sign language literature in various ways. Some studies have dealt with the actions of the torso and the head as a single unit, whereas others have emphasized the independence of different nonmanual channels. Wilbur and Patschke (1998) discuss contrastive stress in American Sign Language (ASL) and, when referring to a body lean, take into account the various movements "of the body, shoulders or head" (ibid., 279). In addition, a study of contrastive focus structures in the Sign Language of the Netherlands finds that movements of the body vary according to whether they are produced with only the head or with the head and the torso together (Crasborn and van der Kooij 2013, following Wilbur and Patschke 1998 and van der Kooij, Crasborn, and Emmerik 2006).

On the other hand, when addressing the simultaneous layering of nonmanuals in ASL, Wilbur (2000) underlines the independence of different nonmanual channels, such as head position, body position, and the activities of different parts of the face. In this context Wilbur implies that one nonmanual marker may be produced with different nonmanual articulators. However, it remains unclear whether a single nonmanual element tends to be a combination of the activities of several nonmanual articulators (such as the torso and the head) or whether these separate channels alone are commonly used to produce individual nonmanual elements.

Discussing the criteria for identifying CA in sign language discourse, Cormier, Smith, and Sevcikova (2015) recommend the use of several articulation tiers when annotating data. In this approach, the articulations of a signer's head and torso (as well as face, eyegaze, dominant hand, and nondominant hand) are annotated in separate tiers, as they represent different characteristics of a referent. Cormier and colleagues conclude that the multitier annotation of CA sequences makes it possible to identify different levels of constructed action on the basis of the active articulators and the degree of activation (ibid., 9). This method shows that annotating and analyzing torso and head movements separately may be necessary in order to understand the roles they play (together or separately) in linguistic strategies emerging in signed discourse.

The aforementioned references demonstrate that the torso and the head may be seen either as independent channels of articulation or

as two closely connected sources of movement. By implication, torso and head movements can occur together to perform a shared function; only head movements may be used; or torso and head movements may overlap and have independent functions. However, it is unclear when, how, and why the torso and the head move together or the head moves independently of the torso, and whether torso and head movements usually perform the same function. In order to understand the significance of nonmanuals in the structure of a sign language and the connections between prosodic, phonological, syntactic, and discourse elements, it is important to comprehend the relationship between the different parts of the body involved in signing. This entails an evaluation of the relationship between the activity of the torso and the head in the articulation of sign languages.

This article presents a study of the relationship between the movements and positions produced with the head and the torso using narrative data from FinSL. The goal of the study is to investigate (a) whether the signer's head moves primarily together with the torso, on its own without the torso, or with the torso but independently of it; and (b) whether co-occurring torso and head movements perform the same function. The objective is to determine the extent to which the actions of these two body parts should be viewed separately. In order to answer these questions, the movements and positions of the head and the torso were annotated and analyzed according to their *activity, timing, direction,* and *function* in data consisting of twelve FinSL narratives.

With regard to activity, the degree of activeness of the two body parts was investigated on the basis of the number of annotation cells given for different types of torso and head movements in the data. With relation to timing and direction, the focus was to examine how torso and head movements overlap. The co-occurrences of torso and head movements were annotated and analyzed in different phases with the help of automatic and manual annotation. The directions of co-occurring torso and head movements were then viewed, and the co-occurring movement combinations were categorized according to their degree of complexity. As a result, the co-occurrences of torso and head movements were defined as simple, semicomplex, or complex combinations, depending on the number of co-occurring codirec-

tional and directionally differing movements. Finally, the functions of torso and head movements in simple, semicomplex, and complex combinations were analyzed in order to learn whether the movements performed a shared or an independent function while co-occurring.

The remainder of this article is organized as follows: I first present observations previously made on head and body movements and their functions in research on FinSL and other sign languages. I then outline the goals and research questions, the data, and the method of the current study. After that, I present an analysis and the results of the study and follow these with a discussion and a conclusion.

Background: Head and Body Movements in Sign Languages

Forms of Head and Torso Movements in the Sign Language Literature

The sign language literature has mentioned a variety of head movements used in grammatical and/or prosodic contexts. These are *head nod,* repeated *nodding, headshake,* sideways *head tilt,* sideways *head turn,* forward *head thrust,* and a backward movement of the head (also called a *head pull*) (e.g., Liddell 1980, 1986; Wilbur 2000; Zeshan 2006; Pfau and Quer 2010; Puupponen et al. 2015). In addition, movements referred to as *chin-up* (also called *raised chin* or backward *head tilt*) and *chin-down* occur in sign language research as well, especially in questions and conditionals (e.g., Zeshan 2006; Schalber 2006; Pfau and Quer 2010). However, studies do not always explicate whether the movement of the chin is accompanied by a movement of the whole head forward or backward or neither of the two.

With regard to the movements of the torso, body leans have been observed in prosodic units and discourse strategies (e.g., Wilbur and Patschke 1998; van der Kooij, Crasborn, and Emmerik 2006; Hodge and Ferrara 2013). In addition, movements of the torso are mentioned in the corpus annotation guidelines of Swedish Sign Language (Wallin and Mesch 2014). These torso movements—*lean forward, lean backward, lean right, lean left, turn right, turn left, shoulders up,* and *shoulders shrugged*—form the basis of the annotation work on torso movements in the current study.

The aforementioned types of torso and head movements are psychological concepts of the motion of the body, the anatomical

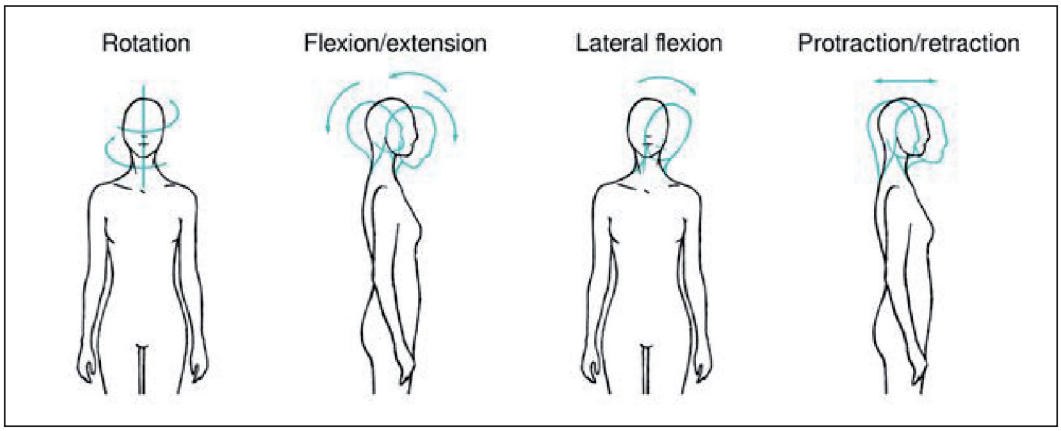

Figure 1. Anatomy of head movements according to the cardinal planes.

characteristics of which are not specified. For example, sideways tilts of the head are often referred to merely as head tilts, without explicating the direction of the movements. According to the anatomical features of the head and the torso, movements of these two body parts emerge as rotations in the horizontal plane, flexions in the sagittal plane, or flexions in the frontal plane (figures 1 and 2). In addition, forward and backward movements of the head may emerge as protractions and retractions in the sagittal plane (figure 1).

Although the overall movement trajectories of the head and the torso seem similar in figures 1 and 2, the muscles and joints produc-

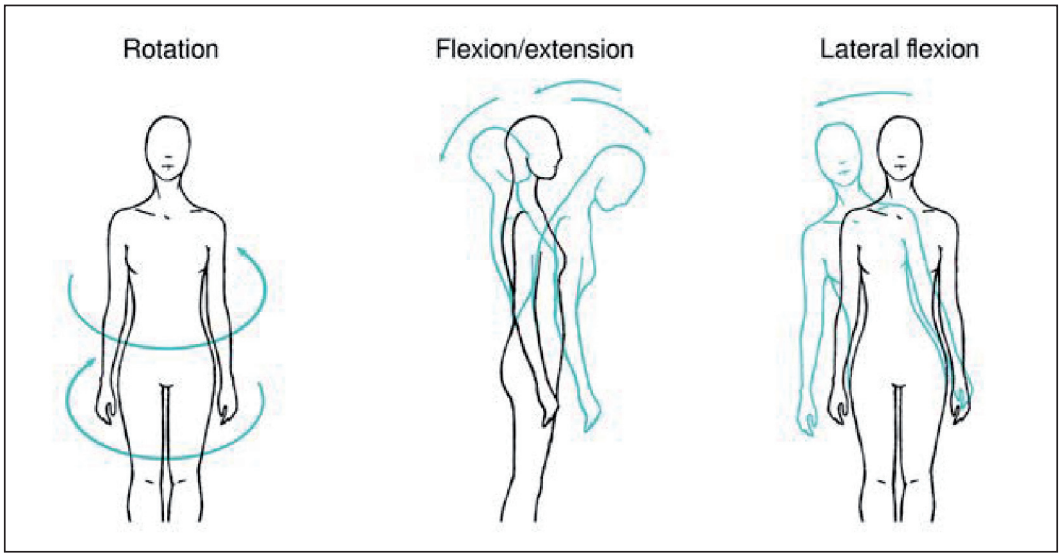

Figure 2. Anatomy of torso movements according to the cardinal planes.

ing the movements differ. Movements of the torso and movements of the head both involve the vertebral column. However, movements of the torso activate the thoracic and lumbar vertebrae, whereas movements of the head activate the cervical vertebrae (DeStefano 2011). Moreover, due to the vertebral anatomy and spine kinematics, spinal movements often include a coupling of rotation and side bending of the torso, which is controlled by different physiological mechanics (ibid.). Nevertheless, one of the objectives of the current study is to investigate how often the torso and the head move together in a similar way. Because an in-depth discussion of human anatomy and motion are beyond the scope of this article, the movement types found in the sign language literature (and listed on p. 179) were first viewed against the anatomical features of the motions presented in figures 1 and 2 (see table 1) and were then simplified into categories based on the direction of the motion. As described here, this process of simplification facilitated the annotation and analysis of the timing and direction of co-occurring torso and head movements.

In order to study the frequency of formally similar and co-occurring torso and head movements, the anatomical categorization of torso and head movements (see table 1) was simplified in the following ways. First, upward movements of the shoulders and shoulders shrugged were excluded from the investigation of codirectional torso and head movements due to the absence of parallel head movements. In addition, repetitive head movements (e.g., headshakes, nodding) were excluded from the investigation of codirectional tor-

Table 1. Types of Head and Torso Movements in the SL Literature according to the Anatomical Terms of Movement

Anatomy of Movements	Types of Head Movements	Types of Torso Movements
rotation	turn right, turn left, headshake	turn right, turn left
flexion/extension	nod, nodding, chin-up, chin-down	lean forward, lean backward
lateral flexion	tilt right, tilt left	lean right, lean left
protraction/retraction	thrust, pull	—
elevation/depression	—	shoulders up, shoulders shrugged

Table 2. Torso and Head Movements: Right, Left, Forward, Backward

Direction	Types of Head Movements	Types of Torso Movements
right	turn right, tilt right	turn right, lean right
left	turn left, tilt left	turn left, lean left
forward	chin-down, thrust	lean forward
backward	chin-up, pull	lean backward

so and head movements but included in the analysis of more complex combinations of co-occurring torso and head movements (pp. 186–88). Second, movements involving rotation (e.g., sideways turns of the torso or head) were combined with sideways leans/tilts and were examined as movements to the right or left. Finally, chin-up and chin-down movements, head thrusts, and head pulls were examined as movements forward and backward, and the co-occurrence of head nods with torso movements was examined separately. This process resulted in four directional categories of head and torso movements: right, left, forward, and backward. These directional groups (see table 2) for both head and torso movements served as a starting point for the annotation and analysis of co-occurring codirectional torso and head movements (pp. 186–88).

Functions of Head and Torso Movements in Sign Languages

In the sign language literature, head movements have been associated with various grammatical, prosodic, gestural, and/or discourse-level functions. For example, head movements (e.g., single nods, nodding, headshakes, head thrusts) have been found to differentiate between affirmative, negative, and interrogative sentence functions (e.g., Wilbur 2000; Zeshan 2006; Lackner 2013; Puupponen et al. 2015). In addition, forward- and backward-directed head movements or head nods have been found to align with the boundaries of prosodic, syntactic, and/or discourse sequences (Sandler et al. 2011; Wilbur 2000; Puupponen et al. 2016) and to increase the prominence of single signs (Wilbur 2000; Puupponen et al. 2015). Sideways head tilts, on the other hand, are believed to bind together manually signed sequences (e.g., Sandler et al. 2011; Puupponen 2012; Jantunen et al. 2016a).

Furthermore, combinations of torso and head movements have been found to perform different prosodic and/or discourse functions. Forward-backward and right-left movements of the body have been found to encode information structure and they have been associated with contrastive stress. These same movements may also be used to express meanings of exclusion and inclusion (Wilbur and Patschke 1998; van der Kooij, Crasborn, and Emmerik 2006; Crasborn and van der Kooij 2013.) Sideways torso and head movements have also been found to mark the junctures of coordinated elements in discourse (Jantunen 2016). In addition, as mentioned on p. 176, various movements of the torso and/or head have been shown to contribute to constructed action, a strategy in which signers depict referents in discourse with nonmanual and manual activity (e.g., Hodge and Ferrara 2013; Cormier, Smith, and Sevcikova 2015). According to Cormier, Smith, and Sevcikova (2015), diverse types of constructed action are overt, reduced, or subtle, depending on the number of active articulators, such as eyegaze, torso, and head, as well as the degree to which they are employed. Constructed action constitutes reference tracking in discourse but it is yet unclear how and in what extent torso and head movements are used for reference tracking when signers are not enacting actions of a referent (see, e.g., Schembri, Fenlon, and Cormier 2016). Some observations have been made of such movements in FinSL and Austrian Sign Language (Puupponen 2012; Lackner 2013).

A Study of the Movements of the Head and Torso in FinSL

Goals and Research Questions

The goal of the current study was to examine the relationship between the activity of the torso and that of the head in FinSL narratives. The research aimed to find answers to two questions: Does the head tend to move together with the torso, independently of the torso, or together with—but in a manner that differed from that of—the torso? Do co-occurring torso and head movements perform one and the same function or independent functions? On the basis of the analysis, the study also aimed to discuss whether the torso and the head should be considered as one or two articulators in FinSL.

In order to answer these questions, the movements of the torso and the head were analyzed using data consisting of twelve signed narratives. For Question 1, the study focused on comparing the overall *activity* (i.e., number of movement events) of the torso and the head, as well as the *timing* (i.e., co-occurrence) and the *direction* of torso and head movements in the data. The investigation of the activity was carried out on the whole dataset, whereas the timing according to the direction of movements was analyzed using six narratives (half of the dataset). For Question 2, the *functions* of co-occurring torso and head movements were annotated and analyzed from a subset of four narratives.

Data

In the collected data, twelve native FinSL signers (eight females and four males) between the ages of 20 and 60 retold the stories in the picture books *Snowman* and *Frog, Where Are You?* The overall duration of the material is 45 minutes 12 seconds. The data were collected in 2013 as a part of the collection of a larger corpus of the sign languages of Finland[1] at the Sign Language Centre of the University of Jyväskylä. During the collection of data, the signed stories were among the six or seven communicational assignments given to the signers, who worked in pairs in a dialogue setting (see figure 3a).

The signing of the participants was filmed in a studio by seven HD video cameras, which recorded the participants from different angles (see figure 3b). The setup included one ceiling camera that recorded the participants from above in order to add depth to the

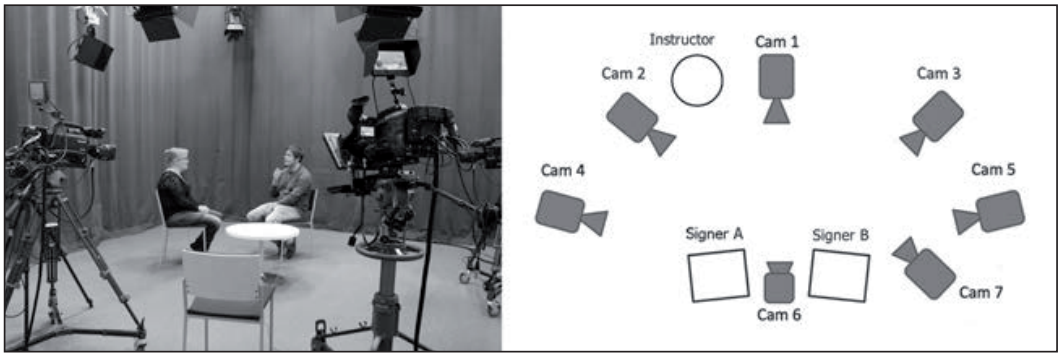

Figure 3. (a) Dialogue setting in the studio; (b) camera setup in the recording studio (Puupponen et al. 2014; Salonen et al. 2016).

motion of each signer's torso, head, and hands. The data-recording process is described in more detail in Puupponen et al. (2014) and Salonen et al. (2016).

Basic Annotation of Torso and Head Movements

The narrative data were processed in the ongoing ProGram project[2] at the University of Jyväskylä. Annotations have been created in ELAN for manual signs and sentences (meaning-based annotations), syntactic structure, head movements, and torso movements (see Jantunen et al. 2016b). The basic annotation of head movements was done in twelve tiers, and that of torso movements in nine tiers in ELAN (see table 3).

As table 3 shows, all of the annotation cells include the type of movement (e.g., *head tilt L*), as well as an ordinal number that indicates the time at which the movement occurred in the discourse (e.g., *head tilt L 01, head tilt L 02*). The groups *other head movements* and *other torso movements* include movements that are not found in the sign language literature and are infrequent and peripheral in the data (e.g., moving the whole head up or down; upward movements of the torso, during which the signer straightens his or her spine).

In the annotation, movements of the torso or the head include continuously dynamic movements in which the head or the whole

Table 3. Schema for Tiers Used in the Annotation of Head and Torso Movements in ELAN

Head-Movement Tiers	Torso-Movement Tiers
head nod	body lean f(orward)
head nodding	body lean b(ackward)
head thrust	body lean r(ight)
head pull	body lean l(eft)
head chin-up	body turn r(ight)
head chin-down	body turn l(eft)
head tilt R(ight)	shoulders up
head tilt L(eft)	shoulders shrugged
head turn R(ight)	body other
head turn L(eft)	
headshake	
head other	

upper body moves from place A to place B and then back to A. This whole sequence was annotated as a single cell. In addition, single events refer to movements that include a static position, in which the torso or the head moves from place A to place B, remains at place B, and then moves back to place A. These movement-hold-movement sequences were also annotated as a single cell, which was relatively long in duration. If the torso/head movement was immediately followed by a subsequent movement, the end of the annotation cell was placed approximately in the middle of the transition between the two movements.

Annotating and Analyzing the Relationship of Torso and Head Movements: Activity, Direction, Timing, and Function

In the analysis of torso and head movements, the degree of *activeness* of the head and the torso was studied in the overall number of annotation cells given for different types of torso and head movements in the basic annotation phase. First, the number of annotation cells for different types of head and torso movements was calculated from all twelve narratives in the data and collected in tables in Excel for further examination. The results of the analysis are presented on pp. 188–91 and they include the number and distribution of the different types of torso and head movements and an overview of the variation in the number of torso and head movements between individual narrators.

With regard to the *timing* and *direction* of torso and head movements, the study focused on analyzing the co-occurrence of torso and head movements directed forward, backward, right, or left in six narratives (see table 2). The objective was to find instances of co-occurring torso and head movements and to investigate their degree of complexity, that is, whether the movements were purely codirectional (i.e., the head and torso moving together) or whether the combinations of torso and head movements were more complex and included movements that were produced simultaneously in different directions. The work included several steps of automatic and manual annotation and analysis of each of the six narratives in ELAN.

First, by using the Merge Tier operation in ELAN, tiers for sideways leans and turns of the torso and for sideways tilts and turns of the head were merged according to the direction of the movement. This resulted in eight tiers: four merged tiers for the head movements

and four for the torso movements (*head/torso forward, backward, right, left*). Second, from the merged tiers of torso and head movements, annotations were created for the co-occurrences of torso and head movements with the Create Annotations from Overlaps operation in ELAN. For example, the tiers *head left* and *torso left* resulted in one tier, *overlap head torso left,* which consisted of annotations of co-occurring torso and head movements directed leftward. Each annotation cell included the individual codes for the co-occurring torso and head movements according to the order in which they emerged in the data.

After automatically creating four annotation tiers for the co-occurrences of codirectional torso and head movements (head and torso forward, backward, right, and left), the annotations were examined manually. During this phase, separate annotations were manually created on dependent tiers for all other torso and head movements produced during these co-occurrences. In addition, misleading or incorrect annotations—due to, for example, the one-to-two-frame overlaps between the ends and the beginnings of annotation cells in different tiers—were deleted and excluded from the analysis. The annotations in the overlap tiers and their dependent tiers were then exported as tab-delimited text and brought together in a table in Excel for further examination.

In Excel, the data were tagged with color codes according to the number and directionality of the co-occurring torso and head movements. If the co-occurring torso and head movements were purely codirectional, the sequence was tagged as *simple.* If the sequence included a codirectional movement of the torso and head, as well as one other head movement, the sequence was tagged as *semicomplex*. Finally, if the sequence included codirectional torso and head movements, as well as several other torso and/or head movements, it was tagged as *complex*. The results of the analysis of the direction and timing of torso and head movements are presented on pp. 192–94 and include examples of the simple, semicomplex, and complex combinations of co-occurring head and torso movements, as well as the frequency of these different combinations in the data in the forward-backward and right-left dimensions.

Finally, in order to reach any conclusions about the status of the head and the torso as articulators operating in tandem or independently, we must examine the functions of both the simple codirectional

combinations and the more complex co-occurrences of torso and head movements. Therefore separate annotations were created for the functions of overlapping torso and head movements in four narratives. Each functional annotation cell included information on whether the co-occurring torso and head movements had the same function or different functions and what, precisely, these functions were. The results of the analysis are presented on pp. 194–206 and include a comparison of consistency in the functions of torso and head movements between simple and complex combinations, examples of the functions of torso and head movements in simple and complex combinations, and a short comparison of the functions of torso and head movements in the data in the forward-backward and the right-left dimensions.

The Overall Activity, Direction, and Timing of Torso and Head Movements

Activity and Direction

The results of the analysis of different types of head and torso movements produced in the twelve narratives show that the head was clearly more active than the torso: The average narrative consisted of 207 head movements but only 50 torso movements (table 4).

The distribution of different types of head and torso movements in the data is shown in figures 4 and 5. The most frequent head movements were head nods and sideways head turns to the right: Nods and right turns each constituted 13 percent (n = 343) of all head movements in the data. The most frequent torso movements were forward leans, which made up 24 percent (n = 144) of all torso movements in the data.

As figure 4 shows, the frequency of different types of head movements varied in the data. For example, sideways head turns occurred

Table 4. The Number of Head and Torso Movements in the Data (Column 1) and as an Average per Narrative (Column 2)

	All Data (n)	Average per Narrative (n)
head movements	2,482	207
torso movements	599	50

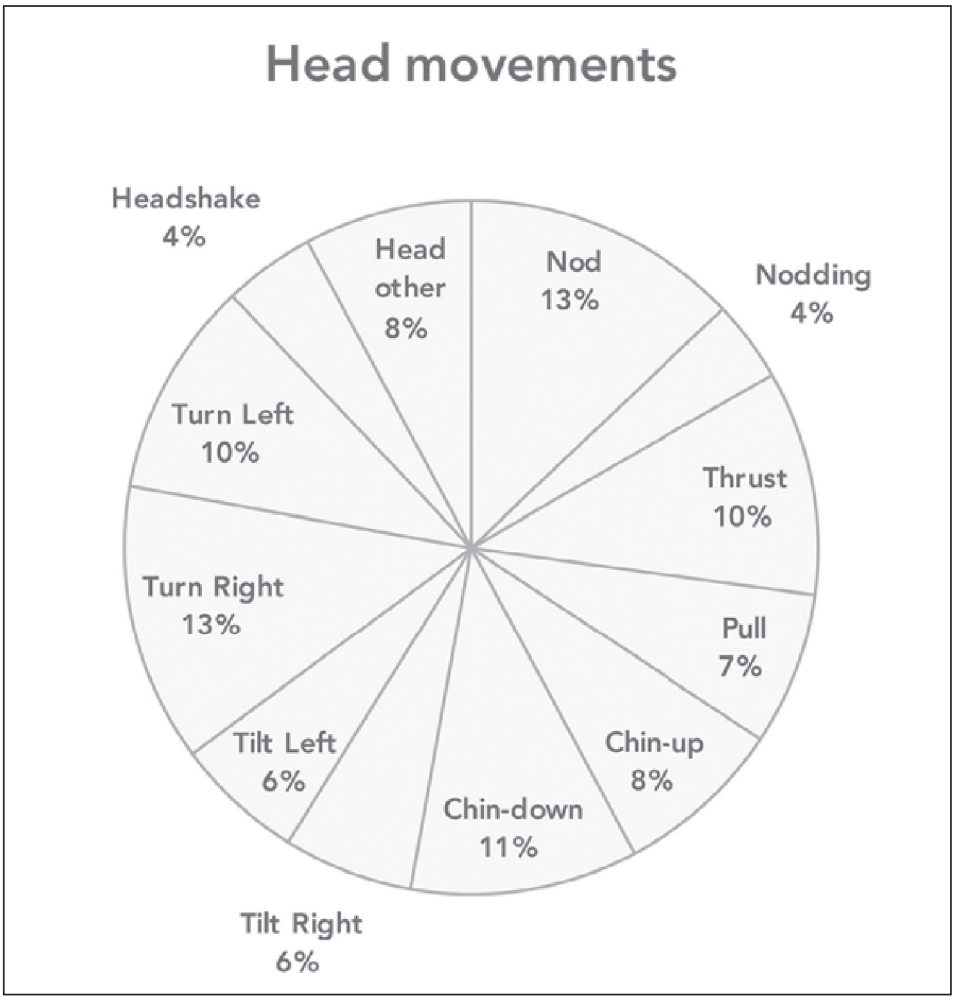

FIGURE 4. Distribution of types of head movements in the data (all twelve narratives).

more frequently (n = 572) than both sideways head tilts (n = 299) and headshakes in which the head turns repeatedly (n = 106). Also, head nods (n = 321) occurred more frequently than repeated nodding of the head (n = 94). Although forward head movements were slightly more frequent than head movements directed backward, right, or left, there was no significant difference between the frequency of head movements produced in the forward-backward (36 percent) and right-left (35 percent) dimensions.

With regard to torso movements, figure 5 demonstrates the distribution of different torso-movement types annotated in the data. Forward and backward leans were the most frequent movements, whereas shoulders up (n = 34) and shoulders shrugged (n = 7) movements were rare. Right and left turning movements (n = 65) were

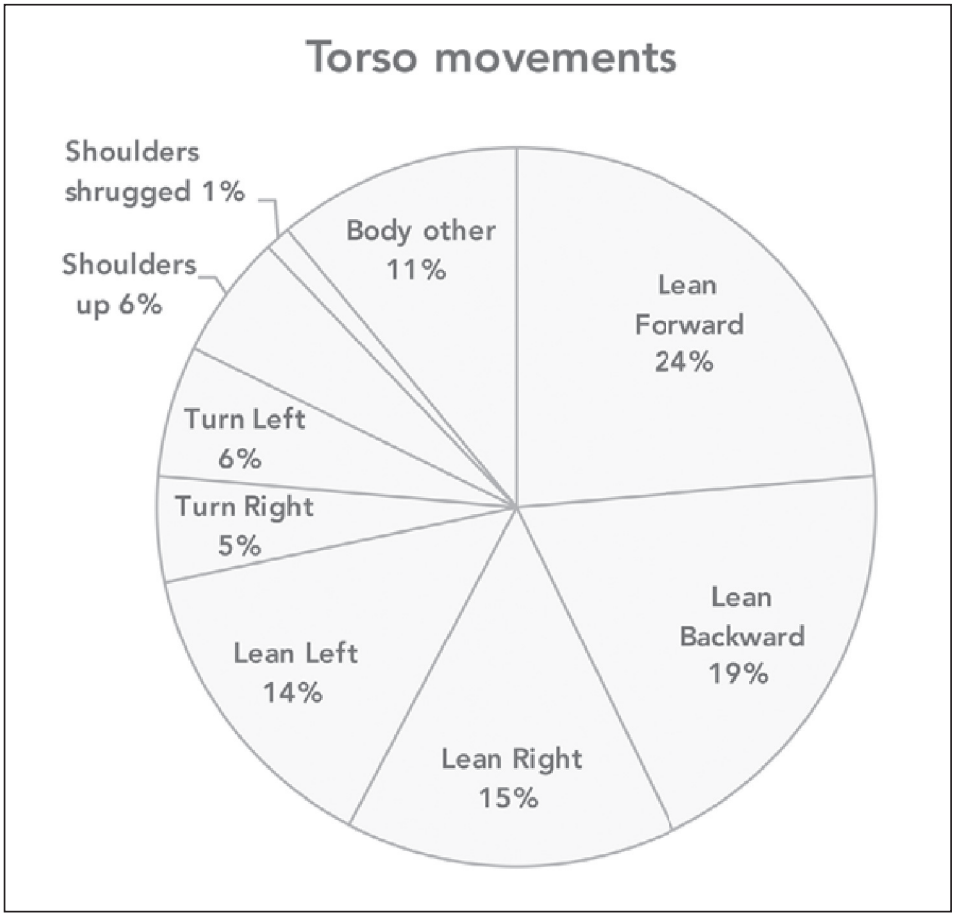

Figure 5. The distribution of different types of torso movements in the data (all twelve narratives).

clearly less frequent in the data than sideways leans (n = 176). As with head movements, there was no significant difference between the frequency of torso movements in the forward-backward (44 percent) and the right-left (40 percent) dimensions.

The overall number of left and right turns of the torso was found to be lower than expected, and the movements annotated as right and left turns of the torso were mostly produced only with the shoulders. This may be the result of several factors. First, during data collection, the signers were sitting down, which affects the spinal movements in the rotation (see p. 181). Second, many of the signers produced long stretches of narrative while leaning back in their chair, which seems to have had an even greater impact on the size and complexity of the turn. Finally, because the rotation in turning movements might be hampered while sitting down, many turns may have been replaced by

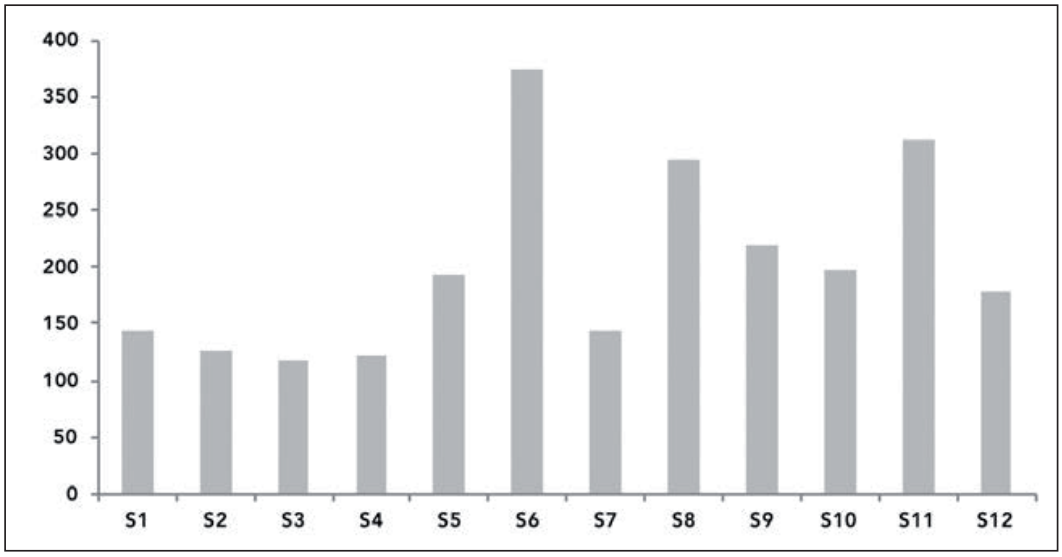

FIGURE 6. Variation in the number of head movements among the narrators.

leans of the torso. Alternatively, the same visual effect may have been achieved by rotation of the head and/or signing in the right or left edge of the signing space.

Finally, the results also showed considerable variation in the degree of activeness of the torso and the head of the twelve signers. This variation is shown in figures 6 and 7 for the head and the torso, respectively.

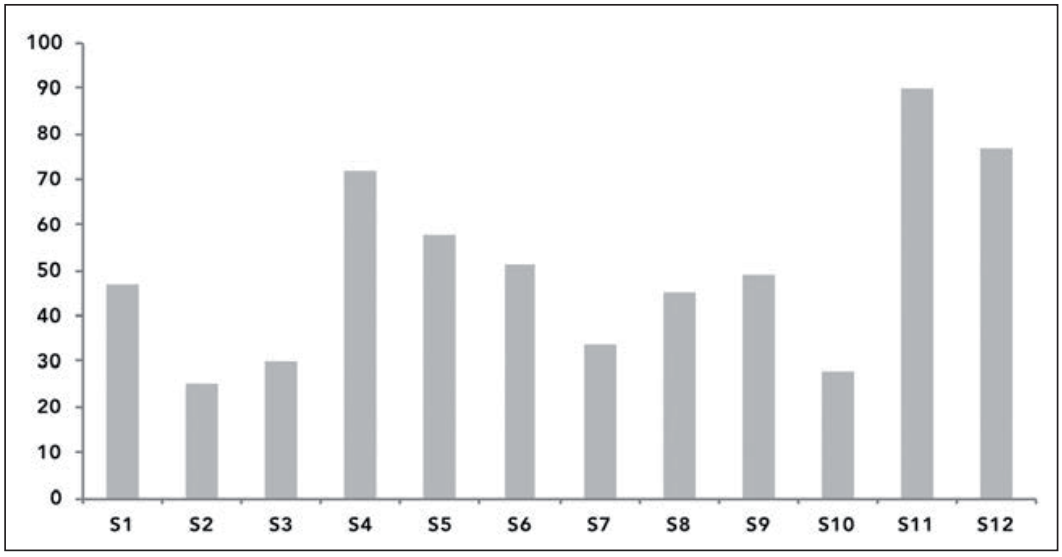

FIGURE 7. Variation in the number of torso movements among the narrators.

Timing according to Direction: Simple, Semicomplex, and Complex Combinations

In the analysis of the timing and direction of co-occurring head and torso movements, three different types of torso and head movement combinations were identified in the data: simple, semicomplex, and complex. Simple combinations of co-occurring torso and head movements include only codirectional movements of the torso and the head. In these instances, the head merely moves along with the movement of the torso (see figure 10). In semicomplex and complex combinations, the head also produces other movements even though it obviously follows the direction of the torso movement. In semicomplex combinations, the signer produces one directionally differing head movement in addition to the codirectional movements (see figure 9). Complex combinations, on the other hand, consist of codirectional movements and several other head and/or torso movements that differ in direction (see figures 15, 16, and 17). The overall frequency of simple, semicomplex, and complex torso and head movement combinations in the data is presented in table 5.

As table 5 shows, slightly fewer than half of the co-occurring torso and head movements formed simple combinations, while 58.4 percent of the combinations were semicomplex or complex. The frequency of these different combinations according to the direction of the torso movement is presented in figure 8.

As figure 8 shows, torso movements to the right or left were produced more frequently in complex combinations than simply with codirectional head movements right and left. In contrast, forward and backward torso movements co-occurred most frequently with simple codirectional head movements in these directions. The results indi-

Table 5. Overall Frequency of Simple, Semicomplex, and Complex Combinations of Co-Occurring Torso and Head Movements in the Data

Combination Type	*n*	Percentage
simple	114	41.6%
semicomplex	71	25.9%
complex	89	32.5%

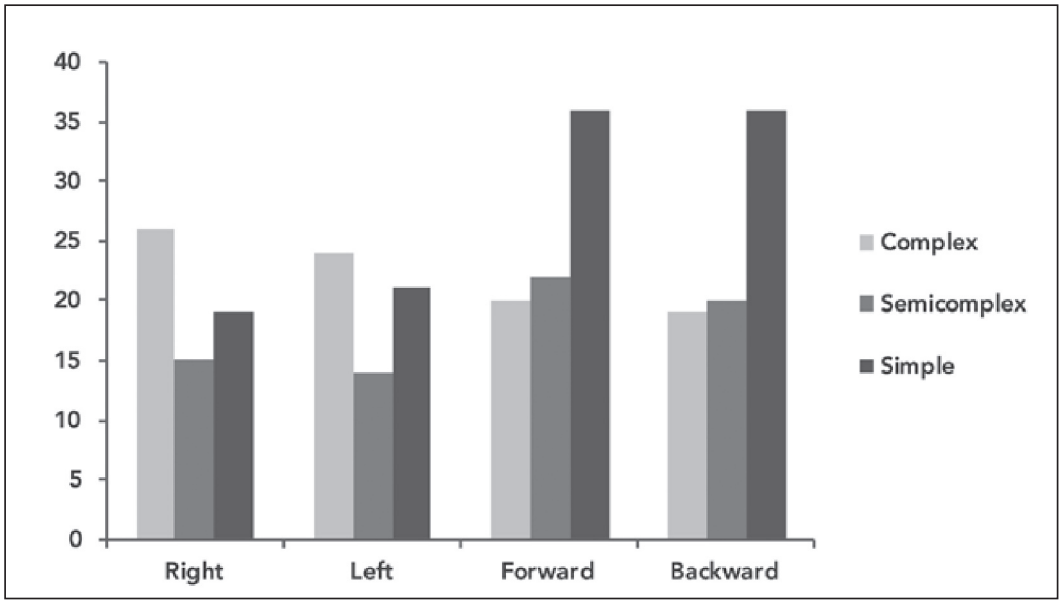

FIGURE 8. The frequency of simple (dark gray), semicomplex (gray), and complex (light gray) combinations of torso and head movements according to the direction of the torso movement.

cate that, in the right-left dimension, the torso produces (presumably long) movements, which allow more complexity in co-occurring head movements than do torso movements in the forward-backward dimension.

Summary

The present study clearly shows that the head is more active than the torso in FinSL narration. The number of different torso movements (n = 599) in the narratives of twelve signers is approximately one-fourth the number of head movements (n = 2482) in the narratives. The results indicate that, even though the head and torso may move together, they do not *have to* move together in narrative signing: The head is free to produce movements and positions with varying functions without any co-occurring movements of the torso.

The results of the analysis of six narratives show that slightly fewer than half (n = 114) of the co-occurrences of torso and head movements were simple combinations of codirectional movements in which the head followed the torso movement. In particular, forward and backward leans of the torso tended to co-occur with only forward

and backward head movements (i.e., thrust, chin-down, pull, or chin-up movements of the head). However, the analysis also shows that the direction of co-occurring torso and head movements frequently reflected complexity: A little more than half of the co-occurrences were either semicomplex (n = 71) or complex (n = 89) combinations, in which the movements are not only codirectional but include simultaneous movements produced in different directions.

Functions of Co-Occurring Torso and Head Movements

Co-Occurring Torso and Head Movements with a Shared Function or Different Functions

According to the analysis, the majority of co-occurring torso and head movements performed essentially the same functions. The overall number of these movement combinations in the four narratives was 140, of which 90.7 percent (n = 127) accomplished the same function. In 70 percent (n = 89) of these emerged in CA sequences in which the torso and head movements depicted the actions or the existence of a referent in the discourse. In 9.3 percent (n = 13) of the co-occurrences, the functions were different. In table 6 the number of co-occurring torso and head movements with the same function or different functions is presented according to the degree of complexity of the movement combinations.

As table 6 shows, although the overall number of different functions in co-occurring torso and head movements is small, the number of different functions increases as the degree of complexity increases in the movement combinations.

Table 6. The Number of Co-Occurring Torso and Head Movements with the Same Function or Different Functions according to the Complexity of the Combination

Complexity	Same Function (n)	Different Function (n)
simple	69	1
semicomplex	34	4
complex	24	8

Functions of Simple and Semicomplex Combinations of Co-Occurring Torso and Head Movements

As mentioned earlier, most of the simple and semicomplex combinations of co-occurring torso and head movements had a common function of depicting referents in discourse. In these CA sequences, the function of the torso and head movements and that of the manual signing was either similar (see figure 9) or slightly different (see figure 10). Furthermore, the data also included sequences of CA in which the simultaneous codirectional torso and head movements represented the action of a referent while the hands narrated the story (see figure 11). This type of depiction has been described as reduced CA (Cormier, Smith, and Sevcikova 2015).

In some cases the simple and semicomplex combinations of torso and head movements were more or less gestural and added to the semantic properties of single signs or utterances. Some of these movements were associated with meanings of exclusion or inclusion (see Wilbur and Patschke 1998) and were often difficult to distinguish from the representation of referents in (subtle) CA sequences (see Cormier, Smith, and Sevcikova 2015). Figure 12 provides an example of codirectional torso and head movements that add to the semantic properties of an utterance.

In 30 percent ($n = 38$) of the co-occurring torso and head movements that performed the same functions, those functions were not related to the depiction of referents in CA sequences. Rather, these movements had prosodic functions (e.g., binding stretches of signing into a larger discourse sequence) (see figure 13) or emphasizing single signs (see figure 14).

Functions of Complex Combinations of Co-Occurring Torso and Head Movements

As shown earlier, most of the complex combinations of torso and head movements performed a shared function of representing referents in discourse. In some CA sequences, the torso and head movements emerged almost simultaneously (see figure 15). However, in others, the torso movement was long in duration while the head produced formally different movements (see figure 16). Although most of the

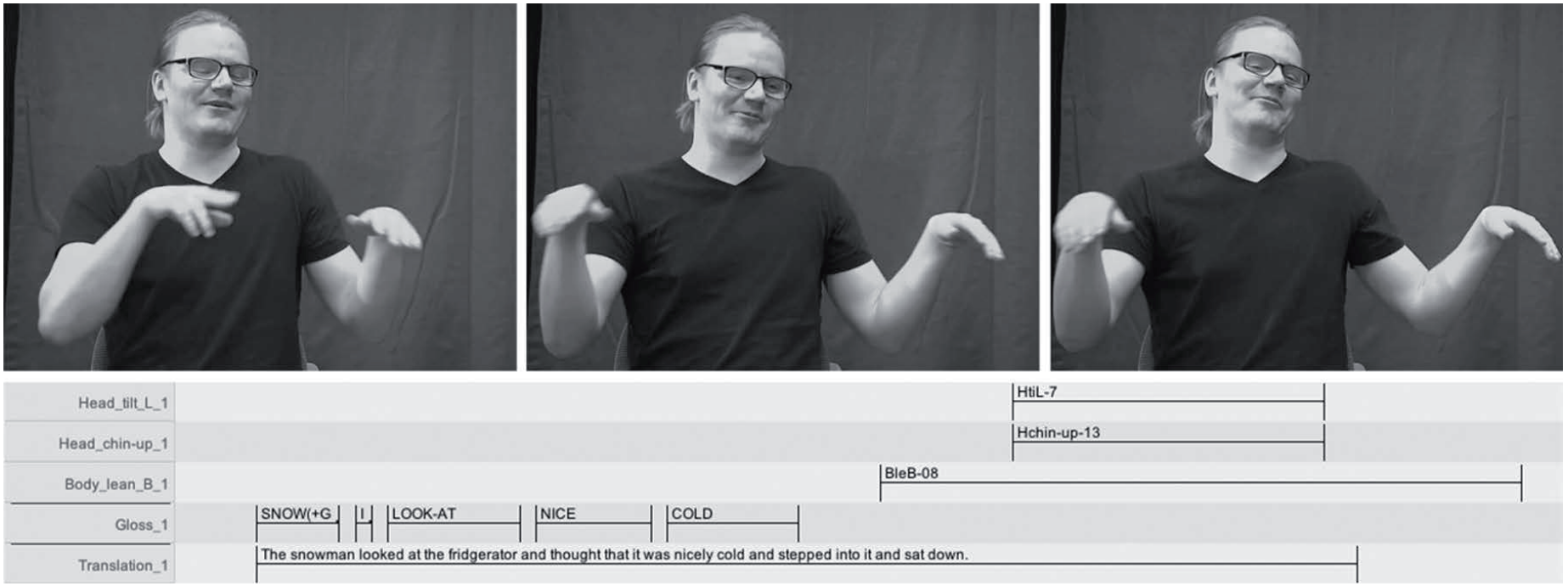

FIGURE 9. CA sequence in which a semicomplex combination of torso and head movements (lean back, chin-up, head tilt left), together with manual movements, constructs the action of a referent (CFINSL005, S1, BleB-08, and Hchin-up-13).

FIGURE 10. CA sequence in which a simple combination of codirectional torso and head movements (forward lean; chin-down) locates and depicts the position of a referent (a boy), while the hands construct the dialogue ("Good night") (CFINSL005, S1, BleF-03, Hchin-down-03).

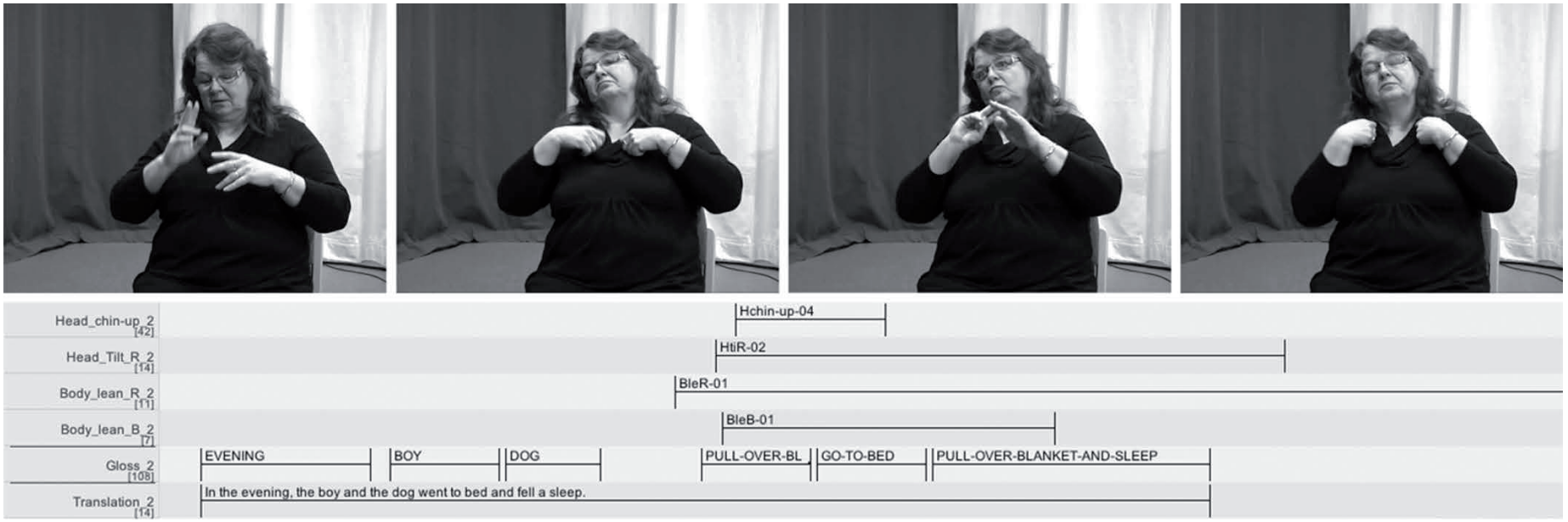

FIGURE 11. An utterance in which a semicomplex combination of torso and head movements (lean back/chin-up; lean right/tilt right) depicts a referent, while the hands change from enacting (PULL-OVER-BLANKET) to narration (GO-TO-BED) and back (PULL-OVER-BLANKET-AND-SLEEP) (CFINSL008, S2, BleR-01, HtiR-02, BleB-01, Hchin-up-04).

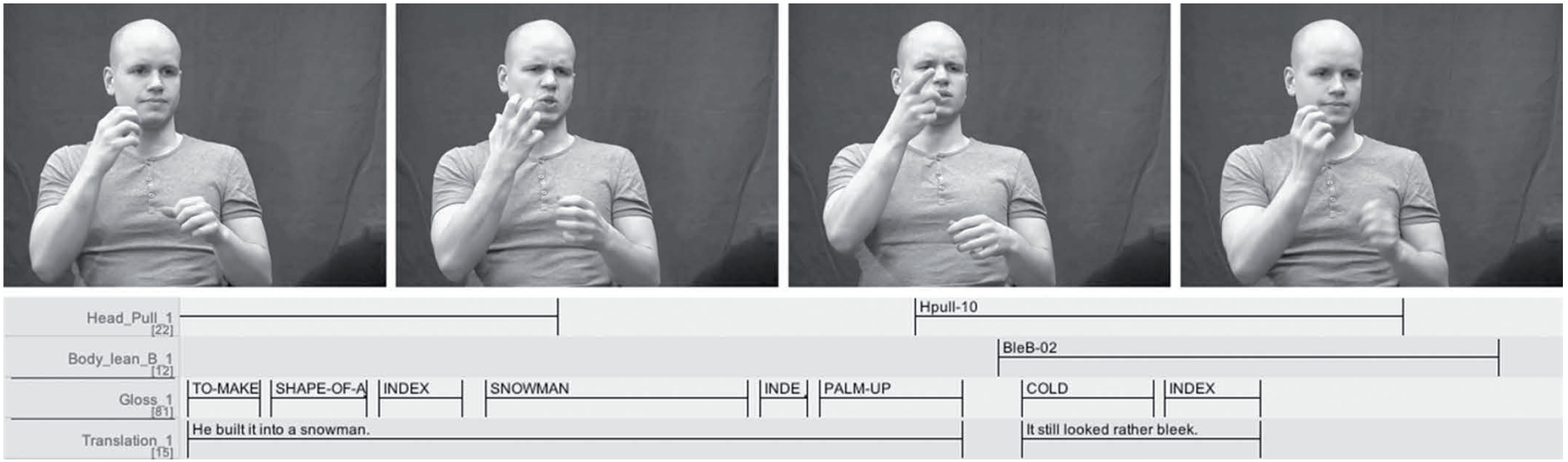

FIGURE 12. A sequence of signing in which a simple combination of a head pull and a backward lean adds attributes to a manually signed sequence ("coldness") (CFINSL008, S1, Hpull-10 BleB-02).

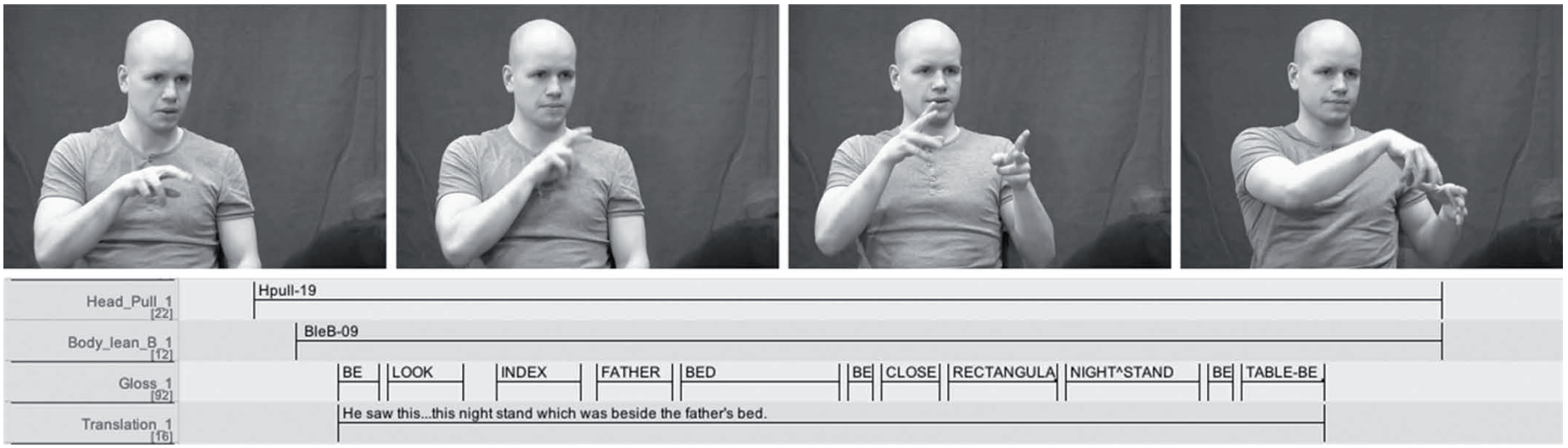

FIGURE 13. An example of a structure in which a simple combination of torso and head movements binds signed units prosodically (CFINSL008, S1 BleB-09, Hpull-19).

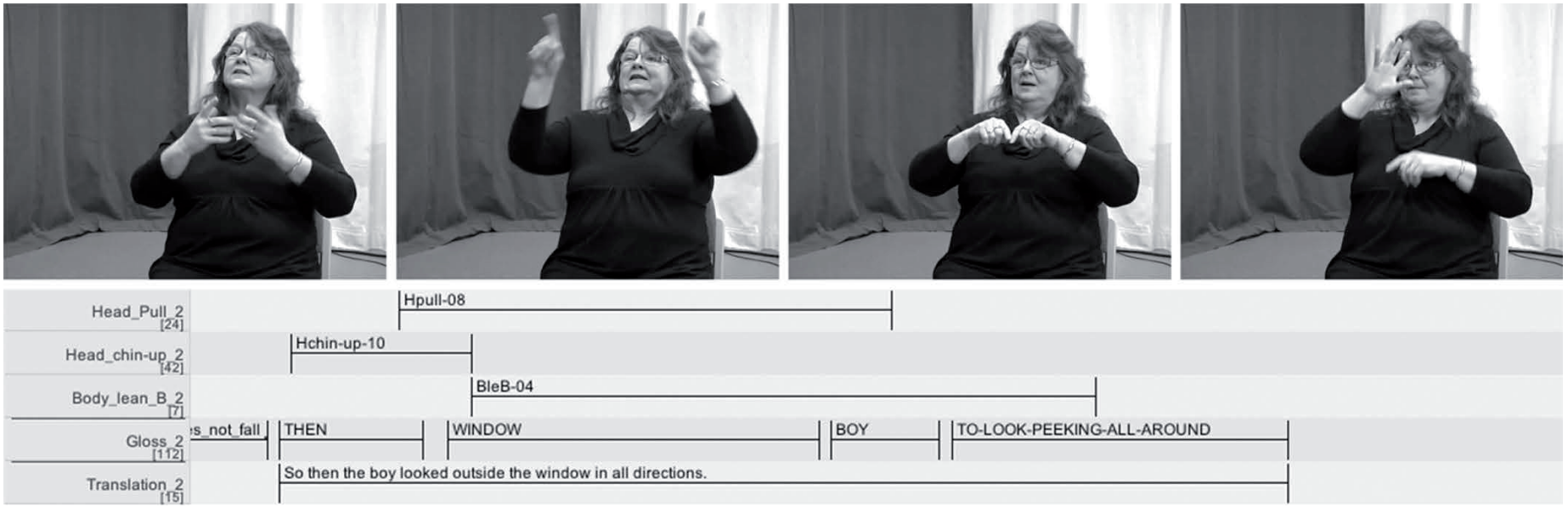

FIGURE 14. An example of an utterance in which a simple combination of torso and head movements adds emphasis to WINDOW. The recovery movement of the head begins at the end of the sign. Notice that the body lean is longer in duration (CFINSL008, S2, BleB-04, Hpull-08, Hchin-up-10).

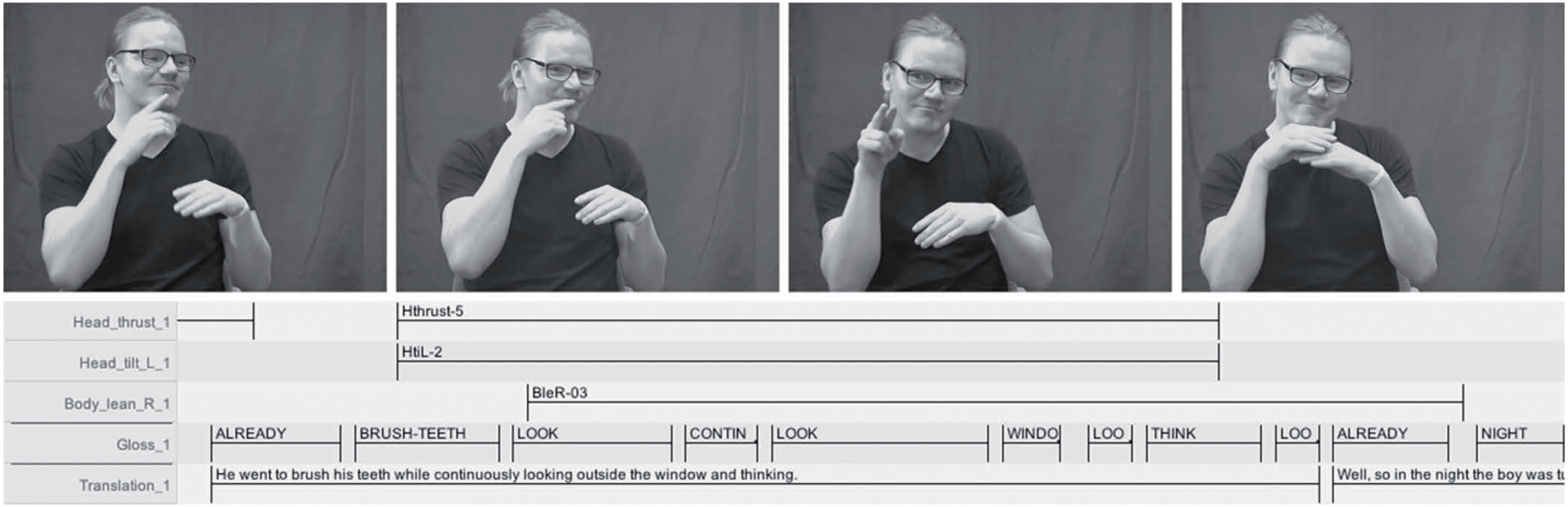

FIGURE 15. An utterance in which a complex combination of torso and head movements depicts a referent in a CA sequence ("continuously look out the window") (CFINSL005, S1, BleR-03, HtiL-2, Hthrust-5).

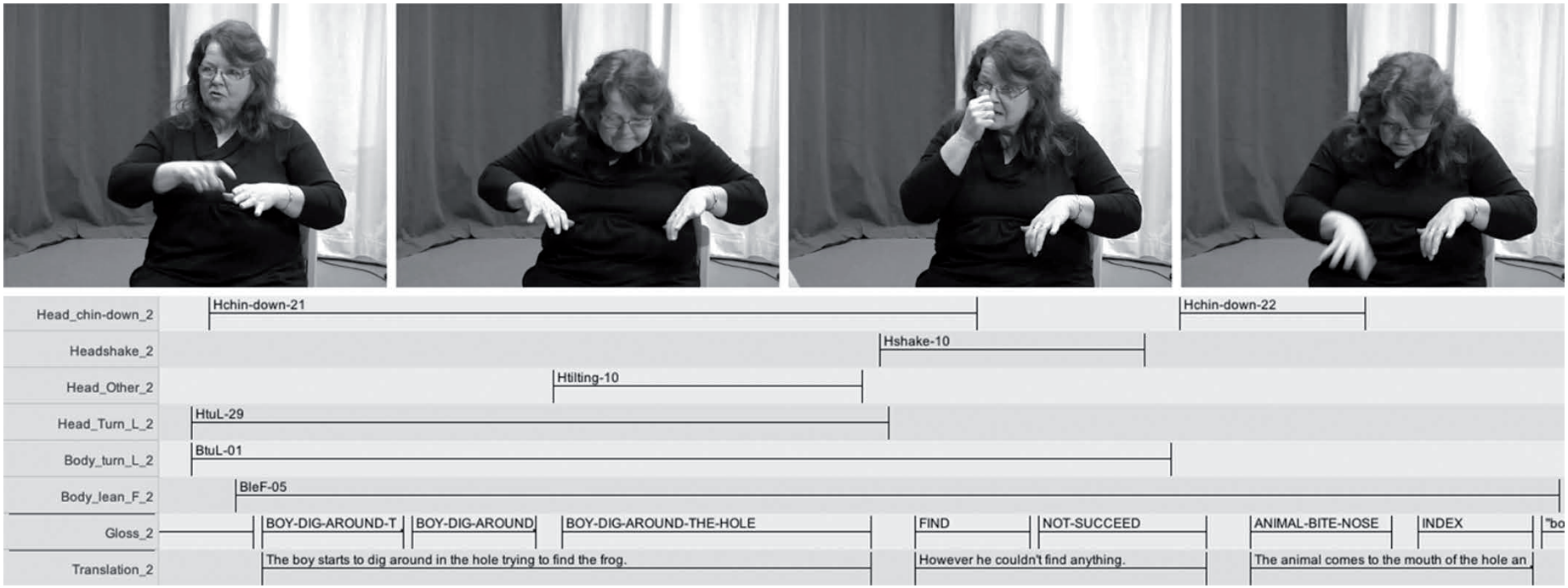

FIGURE 16. An example of a complex combination of torso and head movements. The torso movements bind a longer stretch of discourse, including the depicting of referents, while the head movements perform a variety of functions, such as negation (CFINSL008, S2, BleF-05, BtuL-01, HtuL-29, Htilting-10, Hshake-10, Hchin-down-21–22).

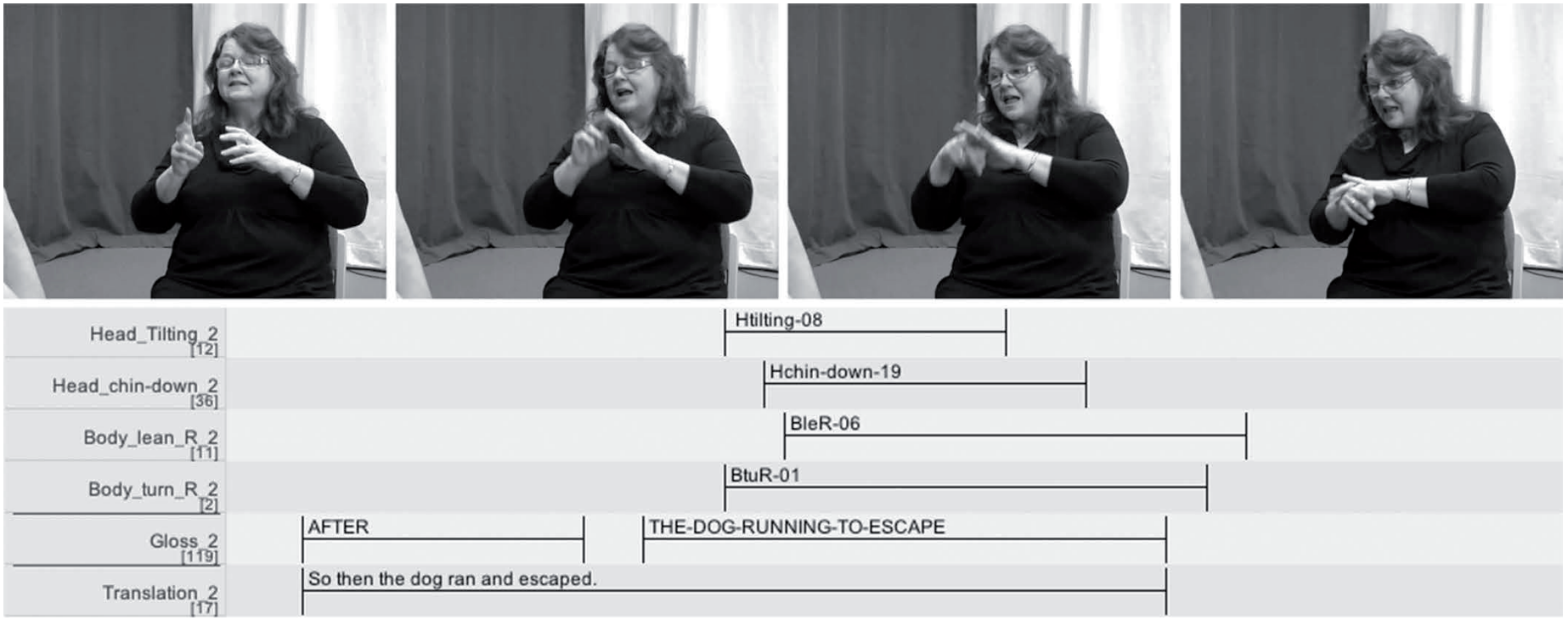

FIGURE 17. An example of a complex combination of torso and head movements. The torso movements bind a longer stretch of discourse, including the depicting of referents, while the head movements perform a variety of functions, such as negation (CFINSL008, S2, BleF-05, BtuL-01, HtuL-29, Htilting-10, Hshake-10, Hchin-down-21–22). An example of a complex combination of torso and head movements. The torso leans and turns toward a location where a referent was located earlier in the discourse. At the same time, the head movements add to the semantic properties of the narration (THE-DOG-RUNNING-TO-ESCAPE) (CFINSL008, S2, BleR-06, BtuR-01, Hchin-down-19, Htilting-08).

complex combinations occurred in CA sequences, some had other functions (e.g., adding to the semantic properties of manually signed sequences; emphasizing; binding long stretches of signing in discourse) (see figure 17). As the complexity of the combination of various torso and head movements increased, differences in their functions grew (see figures 16 and 17). However, in most of these combinations, the torso and head movements performed the same functions (see figure 15).

Differences in the Functions of Torso and Head Movements in the Forward-Backward and the Right-Left Dimensions

Finally, the results of the analysis revealed several differences in the functions of forward and backward torso and head movements. Forward torso and head movements (see figure 13) were used in dynamic bodily depictions in CA sequences that conveyed meanings such as "opening a door," "going inside," "digging and searching for something," and "looking at something." Backward head and body movements (see figures 12 and 14), on the other hand, were found in depictions of more static positions or states in CA sequences and conveyed meanings such as "looking at a snowman from a distance," "going to sleep" (or "sleeping"), "sitting relaxed," and "being amazed." Backward torso and head movements represented dynamic features of referents in contexts such as "flinching away from the heat." In addition to CA, forward and backward movements of the torso and head were found to place emphasis on different lexical units in signing (see also Puupponen et al. 2015).

Compared to simultaneous head and torso movements in the backward-forward dimension, torso and head movements in the left-right dimension performed more varied functions. In CA sequences, head and torso movements to the left and the right convey meanings such as "searching," "looking for something," and "looking around." Such movements also appeared in reference tracking in the discourse: They were directed to previously established meaningful locations in the signing space during CA depictions or other parts of the discourse. In addition, left and right movements were found to bind units in the signing stream prosodically. This same function was also found for backward-forward torso and head movements (see figure 13).

However, it occurred more frequently in the left-right dimension. All in all, left-right movements of the torso often included positions of long duration, whereas the head participated in the representation of referents, for example.

Summary

The results of the analysis reveal that a clear majority (90.7 percent) of co-occurring torso and head movements performed the same function. This was the case regardless of whether the movements formed simple, semicomplex, or complex combinations. However, the difference between functions increased as the complexity of the movement combinations increased. When the co-occurring torso and head movements performed a shared function, the most frequent function was the depicting of referents in constructed action. Other functions for torso and head movement combinations included emphasis, adding to the semantic properties of an utterance, and binding stretches of signing prosodically.

Discussion

The results of the current study show that the movements produced with the torso and the head are closely connected components of signing, which nonetheless must be treated as independent activities in certain contexts. With regard to Research Question 1, the analysis of the activity, direction, and timing of torso and head movements shows that the two body parts can move simultaneously and in a codirectional manner but that the head is significantly more active than the torso in narrative texts (see table 4). The total number of different torso movements was approximately one-fourth the number of different head movements in the data of altogether twelve FinSL narratives. This indicates that the head participates in contexts in which the torso does not and, further, that, in contexts where torso and head movements can be produced together, the emergence of a head movement may in many cases be sufficient. However, as can be seen in table 5, the results also show that, if a torso movement emerges, it is produced either together with a simultaneous and codirectional head movement (simple combination) or with co-occurring but directionally different

head movements. Of all of the co-occurrences in a subset of six narratives, 42 percent were simple combinations, 26 percent semicomplex combinations, and 32 percent complex combinations of torso and head movements. An important question is whether different levels of complexity of torso- and head-movement combinations should be taken into account in the phonological description of a sign language (see, e.g., the classification of simple and complex movements in Brentari 1998).

With regard to Research Question 2, the results of the study show that, when the torso and head movements co-occur, they usually also perform the same function (see figures 12–15). In a subset of four narratives, approximately 90 percent of co-occurring torso and head movements had the same functions, of which most (70 percent) were instances of constructed action. This discourse function is well known for body movements in several sign languages (see, e.g., Hodge and Ferrara 2013). Other contexts in which the torso and the head perform the same function are, for example, when binding sequences of manual signs or emphasizing single signs in a discourse (see also Sandler et al. 2011; Sandler 2012; Puupponen et al. 2015; Jantunen 2016).

According to the data, when co-occurring torso and head movements are purely codirectional, the functions are the same for the activity of both the head and the torso. However, differences in the functions emerge as the complexity of the movement combinations increases and the movements exhibit differences in their direction. In these co-occurrences, the torso movements are usually relatively long in duration and include a hold of a position of the trunk while the head produces relatively short movements, such as thrusts, tilts, or nods. In these instances the torso movements bind manual units of signing into prosodic sequences, while the head movements perform a variety of functions. These prosodic contours are more frequently produced with sideways leans of the torso than with forward and backward leans. Because forward leans occur more frequently (see figure 5) and are used for other purposes (e.g., emphasis), an interesting question is whether the forward-backward dimension is used less for text cohesion. It may be that, in text coherence and reference tracking,

forward leans are used less often than sideways leans (see also Sandler et al. 2011 and Jantunen et al. 2016a).

However, several factors must be taken into consideration when considering the results. Firstly, during the data collection and the signing of the stories, the participants were sitting down, not standing up; moreover, many of the signers were leaning against the backs of their chairs. Sitting is a resting position of the body, and thus it influences the way in which signers move their torso. If a signer is also leaning against the back of a chair, the number of torso movements will very likely decrease, and/or the signer will produce movements in a reduced or otherwise different manner. This, however, allows us to conclude that moving the torso is noncompulsory in many contexts in narrative signing.

Second, the way in which the stories were told may have influenced the number of torso movements. Many of the signers told the stories instead of showing them. That is, they used constructed action less frequently than occurred, for example, in corresponding narratives in Swedish Sign Language (see Puupponen et al. 2016). This may have affected the number of torso movements produced in the narratives. However, as the degree of activeness of the torso and the head has been found to vary in sequences of CA (e.g., Cormier, Smith, and Sevcikova 2015), we cannot conclude that a correlation exists between the number of CA sequences and the number of torso movements in a narrative.

Third, when torso and head movements form simple combinations in which the movements are similar in direction and production (e.g., head pulls and backward leans; head thrusts and forward leans), it is relatively difficult to determine whether the head produces a movement of its own or whether it is merely following the motion of the torso. The results of the current study support the latter interpretation. Actually, it may be that, with these types of body movements, the degree of activeness of the articulators merely increases the amplitude of the movements and the prominence of the contents signed while they are being made. It is an interesting question whether this amplification of movement is comparable to the degree of "loudness" in the larger and smaller forms of signs in manual prosody (see Crasborn 2012).

Fourth, the narratives show a considerable level of variation between individual signers in the degree of activeness of the torso and head (see figures 6 and 7). This may again be a result of the varying degree of telling vs. enacting the contents of the discourse. On the other hand, the variation may also stem from the idiolectic characteristics and styles of individual signers, as well as their age and background.

Finally, but most important, all of the implications of the results are based on an analysis of narrative data. The degree of activeness of the head and the torso will presumably vary according to the different discourse functions and contexts of language use. Narrative data may contain more movements of the torso due to the emergence of CA sequences. However, conversational data have also been found to include various levels of torso and head activity. For example, body leans encode the information structure, some of which has a close connection to the context and environment of a particular discourse (see, e.g., van der Kooij, Crasborn, and Emmerik 2006). The fact that the torso movements in the current study did not occur only in CA sequences supports these findings.

So, in light of the results of the current study, should we consider the torso and head to be one articulator or two separate ones? The results indicate that, although the torso and the head can operate together and are closely connected, they cannot be treated as primarily one unit. Several factors support this argument. First, as stated earlier, the head is much more active than the torso and produces movements such as single nods, nodding, and headshakes, in which the torso does not participate. Second, the movements of the head and the torso are not always purely codirectional even though they both emerge: Semicomplex and complex combinations of torso and head movements were frequently found in the data. Third, although co-occurring torso and head movements often have a common function, this is not always the case. The functions of torso and head movements are sometimes different, and these differences increased as the complexity of the movement combinations increased. Furthermore, although co-occurring movements of the torso and head perform different types of functions, the functions of head movements vary to a greater extent—from syntactic functions (e.g., negation, questions) to prosodic

boundary marking, emphasis, and positive feedback (backchanneling) in discourse. To conclude, because the head and the torso differ in their overall degree of activeness, and because the direction and function of co-occurring movements of the torso and head can differ, we cannot view these two body parts as a single articulator.

However, while keeping this in mind, the results of the current study also prompt one to ask the following question: How should we approach the torso movements if their emergence in many cases depends only on the physical environment and the position of the signer while engaging in discourse? When are they relevant? In the current research, the importance of torso movements came up in two different ways. First, when torso movements were of long duration, they usually performed an independent function. Although they might have emerged with codirectional head movements with a shared function (e.g., CA), their function in many cases became more independent as the torso remained in a static position while the head made other movements. In the utterance shown in figure 16, the forward lean and the left turn of the torso, as well as the codirectional chin-down and left turn of the head, first depict a referent in CA. Then the torso remains in that position while the signer produces a negative headshake, resumes her eye contact with the interlocutor, and signs "he couldn't find it." After the headshake, the torso continues to remain in the same position while the head returns to the depiction. In these torso movements, "holding" the position of the torso binds together a sequence of discourse in much the same way as do manual elements (e.g., theme buoys, fragment buoys) (see Liddell 2003).

Second, the importance of torso movements became more evident as the level of complexity grew in the information conveyed. The annotation and analysis of torso and head movements revealed that, when two or more codirectional torso and head movements co-occur (i.e., when codirectional torso and head movements emerge in several dimensions), they may still perform only one shared function (see figure 11). However, if codirectional torso and head movements (e.g., sideways movements) occur with other codirectional torso and head movements (e.g., forward movements) *and,* on top of that, with other head movements with different forms, the function of the torso movement becomes more independent and necessary. Interestingly, in

the data, these complex clusters of overlapping torso and head movements occurred more frequently during torso movements directed right or left than in the forward-backward dimension.

Conclusion

This article presents a study of the relationship between torso and head movements in FinSL narratives. The results show that, although closely connected in articulation, the torso and head are independent articulators with differences in their degree of activeness and in the directions and functions of their movements. In light of the results I suggest that the annotation and analysis of nonmanual activity would benefit from differentiating between torso and head movements. Furthermore, because the results show that the degree of complexity of combinations of torso and head movements varies, it may be beneficial to take this into consideration while describing the phonological characteristics of a sign language. Finally, as nonmanuals often reflect the gestural and prosodic features of discourse, it is important to consider the "whole" that nonmanual activity forms, regardless of any one particular articulator. When forming a theory of nonmanuality, one should focus on the interaction between different body parts and the semantic content of the discourse. The study presented here contributes to this process by shedding light on the connections between the activity of the torso and the head in a sign language. Especially in the context of FinSL, more research is needed on the interplay between the smaller (i.e., upper and lower face) and the larger (i.e., torso and head) nonmanual articulators.

Acknowledgments

I wish to thank Eleanor Underwood for checking the English of this article and physiotherapist Pasi Murtovaara for consultation on vertebral anatomy and spine kinematics. In addition, I gratefully acknowledge the financial support of the Emil Aaltonen Foundation and the Academy of Finland under grant 269089 (ProGram).

Notes

1. www.jyu.fi/hum/laitokset/kielet/oppiaineet_kls/viittomakieli/tutkimus/finslscorpusproject.
2. users.jyu.fi/~tojantun/ProGram.

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IV

TOWARDS UNDERSTANDING NONMANUALITY: A SEMIOTIC TREATMENT OF SIGNERS' HEAD MOVEMENTS

by

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RESEARCH

Towards understanding nonmanuality: A semiotic treatment of signers' head movements

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This article discusses a certain type of nonmanual action, signers' head movements, from a semiotic perspective. It presents a typology of head movements and their iconic, indexical and symbolic features based on Peircean and post-Peircean semiotics. The paper argues for the view that (i) indexical strategies are very prominent in head movements, (ii) iconic features are most evident in enacting, while non-enacting description is less common, (iii) symbolic types for tokens are infrequent, although some movements—such as nodding and shaking the head—may become more conventional or schematized, and (iv) different types of head movements involve different proportions of iconicity, indexicality and symbolicity as well as different degrees of control in their production and interpretation. The treatment of head movements is extended to a discussion of semiotic versatility in the signification of actions of a signer's body, as well as to the treatment of nonmanuals in the theoretical description of sign languages. Finally, the paper presents a perspective on nonmanuals in which different nonmanual cues are examples of how signification, and human cognition in general, are closely connected to the embodied experience of existing and navigating in the physical and social world around us.

Keywords: head movements; nonmanuality; sign languages; semiotics; iconic; indexical; symbolic

1 Introduction

Signers' head movements, body movements and facial expressions—i.e. nonmanuality—can be approached in several different ways. Since, in sign language linguistics, nonmanuality has been observed to organize texts and discourse (e.g. Wilbur 2000; Sandler 2012) along with the kinematic features of the movements of signers' hands (e.g. Wilbur & Schick 1987; Brentari 1998; Wilbur 1999; Crasborn 2012), it has often been compared to, for example, spoken language prosody. On the other hand, different nonmanual elements have been analyzed as grammatical, and their functions have been associated with, for example, morphological and syntactic phenomena (e.g. Pfau & Quer 2010; Herrmann & Pendzich 2014) as well as with several aspects of interaction such as illocutionary acts, backchannelling, and emotive (Jakobson 1980) meanings (e.g. van der Kooij & Crasborn 2006; Puupponen et al. 2015; Schoonjans 2017). Finally, some nonmanual signals have been shown to be very similar to the bodily gesturing of speakers (see e.g. Schoonjans 2017; Johnston 2018). This may be taken as evidence for the view that signers' and speakers' nonmanual actions are based on the embodied features of human experience, action and interaction (e.g. Streeck 2015), and that this interaction consists of composite utterances in which nonmanual actions combine with manual and/or vocal actions (Enfield 2009; Kendon 2004).

In other words, (a) nonmanuality can be approached like the prosody of spoken languages, (b) nonmanual elements can be seen as parallel to grammatical units such as

words and affixes, and (c) nonmanuality can be approached the same way as speakers' bodily gestures in multimodal interaction. However, the above-mentioned approaches are in many ways overlapping and none of them alone is enough to exhaustively describe the role of nonmanuality in signed languages and communication. It has been widely acknowledged that different nonmanual and manual signals are simultaneously layered in a complex way in the articulation of signers (e.g. Wilbur 2000), that nonmanual signals are multifunctional (e.g. Pfau & Quer 2010; Herrmann & Steinbach 2011), and that distinguishing between prosodic, grammatical and gestural (e.g. affective) nonmanuals is in many ways difficult (Pfau & Quer 2010; Herrmann & Steinbach 2011; see also Puupponen et al. 2015). This raises the question whether categorical distinctions between "the prosodic", "the grammatical" and "the gestural" actually exist in the nonmanual actions of signers.

I suggest here that the treatment of nonmanuals, along with many other phenomena in sign language linguistics, has been affected by *preconceptual biases*, brought about by structuralist semiotics and the criteria for natural language—criteria defined on the basis of written forms of spoken languages (see also e.g. Liddell 2003; Johnston 2013a; b; Dingemanse 2017; Ferrara & Hodge 2018). These biases result in an overemphasis on the symbolic status of nonmanual signals—an eagerness to demonstrate that certain nonmanuals have a categorical status as markers of grammatical phenomena similarly to words, morphemes or signs—and in the presupposition of links between prosodic aspects of speech and certain nonmanual signals.

I argue, further, that in the attempt to distinguish between "gestural" and "grammatical" nonmanuals, the argumentation has focused mostly on facial signals (so-called facial bias). As the expression of emotion is a common feature of human facial expression, this has resulted in associating "nonmanual gesturality" with the "signaling of affect" (see e.g. Herrmann & Steinbach 2011; Herrmann & Pendzich 2014). This oversimplifies both the concept of affect[1] as something gestural and the concept of nonmanual gesturality as something affective. In relation to the former, affect may be expressed, for example, with phonemes, morphemes, morpho-syntactic constructions, whole sentences, prosodic features (e.g. pauses, stress or intonation), and actions of different parts of the body. With regard to the latter, nonmanual gesturality (like speakers' hand gesturing, see e.g. Ekman & Friesen 1969) is not only affective: gradient and unconventionalized nonmanual signals that may be associated with the co-speech gesturing with the face, head and body, may also enact or otherwise signal other types of information than emotion.

To continue along these lines, I argue that the notion that there are conventionalized and categorical nonmanuals (e.g. grammatical nonmanuals) that can be clearly distinguished from gradient, uncategorical nonmanuals (e.g. affective signals) is (i) premature; (ii) mainly based on neurolinguistic perception studies of the actions of the signer's face (e.g. Corina 1989; Corina et al. 1999; McCullough et al. 2005); (iii) that there is not enough empirical evidence of whether such categorical distinctions can be found in the actual language use of signers; (iv) that such presumptions may result in the hand-picking of specific nonmanual actions as relevant subject matter for linguistic analysis of SLs while ignoring others; and (v) that the results of some recent studies on, for example, signers' mouth actions and head movements do not confirm this type of theoretical distinction (Johnston et al. 2015; Puupponen et al. 2015; Johnston 2018). Finally, I suggest that

[1] Affect is a concept which is defined in different ways according to the specific field of interest. In many cases it is used as a synonym for "emotion", while some fields (e.g. philosophy and social theory) distinguish between affect—a vague influence which is not yet clearly "meaningful"—and emotion—a subjective and personal quality of experience which has a function and a meaning, and which can be expressed linguistically (e.g. Massumi 1995).

these (pre)conceptual biases already emerge as a so-called *manual bias* in the way we refer to the actions of signers' face, head and body, that is, in the use of the term *NON-manuals* as a conceptual trash bin for 'everything else besides what is done with the hands'.

As an attempt to step away from such conceptual inconsistencies, this article aims to give a theoretical description of one type of nonmanual activity—signers' head movements—from a wide semiotic perspective.[2] More specifically, the paper seeks to apply C.S. Peirce's (1894; 1903a) semiotic theory of signs to the description of signers' head movements. This means that head movements are not classified as prosodic and/or grammatical and/or gestural. Instead they are seen as semiotic signs that connect to their objects in different ways, and which therefore require different types of interpretations. The motivation behind this approach is, firstly, that it allows one to discuss the significance of head movements without differentiating between "language" and "paralinguistic". Peirce's semiotics offers a framework which does not have its origins in a particular system of signs, such as natural language, and therefore does not differentiate between linguistic and non-linguistic signs. In this way, the level of abstraction in Peirce's semiotics is well suited to a relatively uninvestigated topic such as signers' head movements and their functions in signed interaction. It does not force one to exclude from the analysis elements which *signify* but may not form, for example, conventionalized form-function pairings; that is, that may not be considered linguistically significant from the point of view of structuralist semiotics (e.g. Saussure 1916). A sign may be an element that connects to its object through analogical association of qualities or through a physical spatio-temporal connection in a given instance, such as proximity of timing, and it may even be a unique single event (see Section 2). This includes the notion that meaning is not a static and arbitrary connection between a signifier and a signified but instead a dynamic and motivated phenomenon (Hanks 1990; Enfield 2009).

Secondly, Peirce's semiotics is very suitable for investigating a phenomenon that includes a lot of social and situational variation. It has been shown that the ways in which signers move their head while signing varies a great deal between different signers and different discourse strategies (Puupponen et al. 2016; Jantunen 2017; Puupponen 2018), and that the movements of individual signers do not form distinct formal categories but, instead, head movement types such as a *nod* or a *thrust* may be described as prototypes that the actual head movement events in the discourse resemble more or less (Puupponen et al. 2015). In actual language use, movements occur that share features with, for example, both the prototypical nod and the prototypical thrust, and which therefore are examples of the gradient periphery between different head movement types (ibid.). All in all, head movement types—sequences of movement such as nods or shakes of the head—are un-categorical and multifunctional and show a lot of variation both in form and in form-function patterning. In Peirce's semiotic theory, a sign becomes a sign through the process of semiosis, in which it need not be interpreted according to the rules of some surrounding system (Nieminen 2010). Which interpretation emerges depends on the situation in which the sign is observed, and it can be unique. Therefore, variation in how signs stand for their objects becomes a default feature rather than an exception to a rule (see Section 2).

Although Peirce's semiotics may not be the most common framework for the analysis of different elements in sign languages, the discussion on the iconic, indexical and symbolic features in head movements, presented in Section 3, is connected to several previous theoretical notions on the nature of signification put forward in sign language research. Discussion of, for example, the lexicons of sign languages (e.g. Johnston & Schembri

[2] For a literature review on the forms and functions of head movements in sign languages see, e.g. Puupponen et al. (2015); Lackner (2017); Puupponen (2018).

1999), strategies in signaling meaning in sign languages (Ferrara & Hodge 2018), and mouth actions in Australian sign language (Johnston et al. 2015), have been connected to Peircean semiotics. In addition to Peirce's semiotics, the treatment of signers' head movements in the current paper relies on the more recent discussions on semiotics in linguistic anthropology, psycholinguistics, cognitive linguistics and gesture studies (e.g. Parmentier 1994; 2006; Clark 1996; Kendon 2004; Kockelman 2005; Enfield 2009).

This paper presents a theoretical view—a semiotic typology—of signers' head movements and discusses their iconic, indexical and symbolic features using examples from a sign language corpus. In addition, it discusses the semiotic versatility in the signification brought about by the actions of the signer's body. The examples and discussion on head movements draw from work on a variety of data, including corpus narratives and dialogues, other semi-structured monologues, and dialogue motion capture recordings of signers of Finnish Sign Language[3] (FinSL) (see e.g. Puupponen 2012; Puupponen et al. 2014; 2015; 2016; Jantunen et al. 2016b; Puupponen 2018). In these studies, the analysis was done within the usage-based cognitive-functional framework, and nonmanuals were approached according to their forms and functions in actual communication. The analysis of head movements was based on the view that language is a part of the overall physiological, cognitive and social activity of humans, and therefore that language is inherently connected to other types of human action. The same approach is taken in the current paper. Furthermore, language is seen as including both conventionalized and distinct elements as well as gradient, un-categorical, and unconventionalized features. Conventions in symbolic form-meaning pairing and the schematization of grammatical phenomena are considered to emerge in the language as the result of patterns that develop through frequency of use (see Hopper 1998). Finally, although all the examples in the paper come from FinSL, it is presumed that many of the conclusions reached here about the nature of head movements could also be applied to other sign—and in some respects spoken—languages, due to the common physiological and psychological ground in human interaction. This issue is discussed further in Section 6 of the current paper.

The paper is organized as follows: first, in Section 1.1 a short overview is given of the data and analysis from which the current paper draws, followed by Section 2, which presents Peirce's Theory of Signs and some post-Peircean semiotics, insofar as it is relevant for the discussion of the head movement typology presented in Section 3. The following sections discuss the role of head movements in relation to the semiotic versatility of the signification of signers' bodily actions (Section 4), the implementation of nonmanuals in a theory of language (Section 5), and the connections between head movements and the embodied human experience of being in the world (Section 6). Final conclusions are presented in Section 7.

1.1 An overview of the data

The data used as the basis of the current paper includes corpus narratives and dialogues (CFINSL), pre-structured monologue data (SLM), and motion capture dialogue data (MOCAP), all collected or processed at the Sign Language Centre in the University of Jyväskylä, Finland. The corpus narratives consist of altogether 12 retellings of two picture-books, *The Snowman*, and *Frog, where are you?*, by signers between the ages of 20 and 60, recorded in a dialogue setting with multiple cameras (e.g. Jantunen et al. 2016b; Puupponen et al. 2016; Puupponen 2018). The overall duration of the material is 45 minutes and 12 seconds and it has been annotated in ELAN for manual signs and sentences,

[3] Finnish sign language is a language used by approximately 10000–14000 people in Finland, of whom an estimated 4000–5000 are deaf or hard-of-hearing signers (FAD 2018).

syntactic structure, head movement types, and torso movement types (Jantunen et al. 2016b; Puupponen et al. 2016; Puupponen 2018). From the 12 narratives, the interplay between head and torso movements has been annotated and analyzed for a subset of 6 narratives, and the functions of these overlapping torso and head movements has been annotated for a subset of 4 narratives (for a detailed discussion, see Puupponen 2018). The corpus dialogue data consists of altogether 6 dialogues from the same signers as in the narratives. In these dialogues, the signers discuss their experiences and thoughts on events and other matters related to the deaf world. The dialogue data has been annotated for manual signs and sentences. The examples from the dialogue data used in the current paper have been identified by means of an overall visual examination of the data, and with the search functions available in ELAN.

From the other semi-structured monologues, the discussion in the current paper focuses on a 1 minute 8-second-long stretch of video material, recorded by the Finnish National Association for the Deaf, in which a native FinSL signer discusses the relationship between young deaf people and the activities of the traditional national deaf associations. The data (consisting also of computer-vision based motion analysis) has been annotated for manual signs and sentences, as well as for head movements and their functions (see Puupponen 2012). Finally, in relation to the dialogue motion capture recordings, the data consists of altogether 2 minutes 15 seconds of synchronized motion capture data and digital video material of two continuous dialogues in which two FinSL signers talk about their work, studies, and everyday language use. The data has been annotated for manual signs, head movement types and functions of different head movements, and the analysis included both a detailed description of the different forms of head movements on the basis of the quantitative motion capture data, as well as an analysis of the form-function pairing of different types of head movements (a detailed description of the data, annotation and analysis can be found in Puupponen et al. 2015).

2 The semiotic framework

2.1 Universal categories & semiosis

C.S. Peirce's semiotic theory (e.g. 1894; 1903a) forms the basis of the semiotic framework for the discussion on signers' head movements in the current paper. It deals with all kinds of signification, that is, the process of how things become signs for something else. According to Peirce, knowledge, and the world in general, are comprised of signs. Peirce's conception of signification is based on so-called *universal categories*, a phenomenological triadic distinction that forms the basis of his philosophy (Peirce 1903b). According to Peirce, different aspects of reality can be described on the basis of how things exist experientially. The first of the categories, *Firstness*, is feeling itself: a raw experience of something without thought or conscious processing ([Quality of] Feeling). It is an experience that is not compared, proportioned or connected with any other issue; it is a sort of observation of a quality without a relation to another entity, for example an experience of color. (Peirce 1894; 1903b.) *Secondness* (which he also called Reaction or Struggle) is an element in which two things are in an influential connection with each other. It is a feeling that materializes in relation to another feeling, such as a reflex-like motion emerging because of a stimulus, or an eye-blink emerging in order to moisten one's eye. According to Peirce, things in our experiences and consciousness come true as these types of relations, while single raw feelings exist only when we are not fully awake. (Peirce 1894; 1903b.)

The third category, or *Thirdness*, is thinking: a conscious process in which one learns that something is controlled or governed by a rule or a habit. Thirdness is a tripartite relation in which two things are connected through a third thing, which is a habit or a law. Signification is always an example of thirdness. Something stands for some other

thing, and in so doing, conveys an idea of this other thing. For example, an eye-blink, the physical event caused by the necessity of keeping one's eye moist and clean, becomes a sign when it co-occurs with the boundaries of signed discourse and therefore functions as one of the signals that help us perceive discourse structure. Only the elements of thirdness are intelligent, non-mechanical processes that include reasoning, signs and learning. (Peirce 1894.) Actually, according to Peirce, human cognition—thinking, learning, rationality—is in itself an act of signification (it comes true through signification) and therefore an example of the third universal category.

The core concept of Peirce's signification is *semiosis*, the event involved in the interpretation of a sign. Semiosis is a tripartite relation which consists of the *sign*, the *object*, and the *interpretant*. In semiosis, things become signs because they are interpreted as standing for something else, their objects (Peirce 1903a).

> "I define a sign as anything which is so determined by something else, called its Object, and so determines an effect upon a person, which effect I call its interpretant, that the latter is thereby mediately determined by the former." (Peirce 1903a: 478.)

In Peirce's semiosis anything may be a sign. A sign is a sign only through this process of interpretation, because of the fact that it ends up being interpreted as a sign of something. In semiosis, an entity or an event, such as a flash of lightning, becomes a sign when it is interpreted as standing for its object, a thunderstorm. As Kockelman (2005) points out, the social practice of joint attention is another example of this. In a situation in which a child turns their attention to what their parent is observing, the change in the child's attention is the interpretant, the direction of the parent's attention is the sign, and the thing that the parent is attending to is the object (Kockelman 2005). Nieminen (2010) argues that identifying different forms of a language is in itself already an interpretation of a sign in the Peircean sense, and noticing and distinguishing boundaries in the speech signal are examples of semiotic processes, even though these signs would or could not *have a meaning* in the Saussurean (1916) sense. In other words, signs may signify without being interpreted as meaningful. Some signs do not have a static, conventionalized way of being interpreted as standing for some precise event or entity. They do, however, connect to other signs to form intentional and meaningful social actions (Enfield 2009). The characteristics of a semiotic sign will be discussed in more detail in Section 2.2.

The second part of Peirce's semiosis, the object, is what the sign stands for (Peirce 1894; 1903a; Kockelman 2005). As was pointed out above, an object may be something perceivable, such as something a person is directing their attention to (Peirce 1903a; Kockelman 2005). On the other hand, according to Kockelman (2005: 242), it may be something less precise and more abstract, such as something that directs us to a certain behavior (e.g. stroking a cat) once we have observed a sign (e.g. the cat's purring sound). The purring stands for something, but that something is not as easy to determine as, for example, the object of a pointing action would be. The object may emerge as a synthesis of possible interpretations, such as seeing the purring of a cat as a sign for a purpose which the cat is trying to achieve (e.g. it wants the stroking to continue) (Kockelman 2005). Kockelman (2005) continues that objects may be types which emerge through different contexts of use (e.g. a proposition of an assertion) or they may be tokens in particular contexts of use (e.g. the state of affairs in a specific assertion). Peirce himself also distinguished between so-called immediate objects and dynamic objects. Peirce's immediate object is an object that does not exist independently of the sign; it is the representational object of the sign in a certain sign event, that is, a token (Peirce

1906; Kockelman 2005). A dynamic object is independent of the sign and it determines whether the sign exists. It is not dependent on a particular sign event, and so it is a type rather than a token (Peirce 1906; Kockelman 2005). Type and token are important notions also in relation to the characteristics of a semiotic sign, which will be discussed further in Section 2.2.

The third part of the triadic Peircean semiosis, the interpretant, is what happens in our minds when we experience that a sign stands for its object (Peirce 1903a). It is what our mind does as we "read" or "translate" the sign, that is, when we realize that one thing stands for something else. (Peirce 1903a; Atkin 2013.) Kockelman (2005: 251) points out that the Peircean concept of interpretant does not have to be mental or verbal, instead it may be "embodied in actual behavior". According to Kockelman, these embodied interpretants may be bodily processes without any physical effort or commitment. They are changes in bodily state, such as a feeling of pain or blushing. These interpretants are themselves often perceived as signs by the person experiencing them, or by someone else who is witnessing them (Kockelman 2005). For example, feeling pain while burning one's finger on a hot stove is an embodied interpretant of the sign, the heat from the stove. This feeling of pain is at the same time an interpreter and a sign. The feeling is simultaneously an effect from a previous sign (the thing causing the pain) and a sign for the next event, a reflex-like hand motion away from the heat. The motion event is a new interpretant which includes action. And so on. According to Kockelman (2005: 239), "most objects and interpretants are themselves signs – and so the three-fold relationality continues indefinitely: every component of one third is simultaneously (and/or sequentially) a component of another third." Other embodied interpretants may be energetic behavioral processes or representations. The former "involve physical or mental effort"; people cause them to happen, without necessarily involving "purpose, intention or planning", like, for example, stretching one's neck in order to see the source of a loud sound. The latter involve signs with propositional contents or thoughts, such as the concept underlying the word 'cat' (Kockelman 2005).

In Peirce's semiosis, signs are first recognized as signs, after which the function or meaning of the sign is gradually defined in the process of semiosis, which moves towards its final interpretation. This process may include several stages, in which the object of the previous stage (the immediate object) emerges as a sign for the following stage of interpretation, and which, in the end, reaches the final stage (the dynamic object). However, this process may not be linear or straightforward and it need not reach a final conclusion. All signs do not have an inherent characteristic that ensures that they are interpreted in a certain way (Peirce 1903a; Kockelman 2005; Nieminen 2010).

2.2 Sign

Peirce's classification of signs—in its many versions—may be the best known part of Peirce's semiotic thinking. The discussion of head movements given in the current paper has its roots in Peirce's first and interim typologies of signs, published in 1894 and 1903. The interim typology is often regarded as the most complete and coherent presentation of his classification of semiotic signs. (e.g. Atkin 2013). In this typology, signs are defined according to three dimensions, which are based on Peirce's three universal categories of experience: (i) what signs are themselves, (ii) what signs are when viewing the connection between signs and their objects, and (iii) what signs are on the basis of their interpretant. (Peirce 1903a.) For the purposes of the current paper I will briefly present dimension (i), after which the discussion will focus on dimension (ii) which will be referred to as the *ground* of the sign and which is the basis of the discussion of signers' head movements in Section 3 of this paper.

When describing dimension (i), Peirce (1903a) defined signs as *qualisigns, sinsigns or legisigns*. A qualisign is a quality, a characteristic that may perform as a sign. An example of a qualisign is the quality of a color, such as the property of 'redness'. Actually, a qualisign is not really a sign, and it does not function as a sign in reality. Instead it is an abstract quality which is potentially a sign, such as an impression of a movement that might be a sign of a sign language. When a qualisign manifests and is interpreted as a sign, it always becomes a sinsign. A sinsign is a single actually existing entity or event which functions as a sign. Although a sinsign is not just a quality—like a qualisign—it is a sign because of its qualities, that is, because of its qualisigns. An example of a sinsign would be, for example, a color sample. Finally, a legisign is a law or a convention that functions as a sign. It is a general type that has been established as significant, and which manifests as replicas, tokens of that type. These replicas are sinsigns of the legisign. According to Peirce, single instances of a certain word in a text are all occurrences (i.e. sinsigns) of the same word (i.e. legisign). A replica is a sinsign which is significant because of the law that creates the legisign. It is not an exceptional incident which becomes significant for other reasons, as are other types of sinsigns. (Peirce 1903a; Parmentier 1994; Kockelman 2005; Nieminen 2010.)

Let us look at three different signs: a word that has been uttered, a national flag, and an empty bucket close to wild blueberry bushes in the forest. Of these, an uttered word and a national flag are based on a shared norm: the sign is connected to its object through a convention. A particular word such as 'cat' uttered at a given moment (i.e. a sinsign) is a token (i.e.replica) of a more general type (i.e. a legisign): the normative connection between any instance of the word and its shared meaning or function (Peirce 1903a; Kockelman 2005). However, all sinsigns are not replicas: they do not have a type. The bucket in the forest may become a sign when interpreted as indicating that someone is planning or has at some point planned to pick the berries nearby. It can be interpreted as a sign for someone not far away from the location of the bucket ('someone is coming back soon to continue with this task'). On the other hand, it might result in the thought that the bucket has been left there by accident ('someone has forgotten their bucket') or in concern ('I hope nothing unexpected and serious has happened to the owner of this bucket'). The interpretation of the sign depends on the situation and may vary according to the interpreter: there is no rule or norm for it to be interpreted in one particular way. It is a single token without a type. In addition, a bucket in itself, if put into another context, does not invoke the same interpretation; it does not necessarily result in any interpretation of signification. If it is interpreted as standing for something else, it is a singular event which functions as a sign (Peirce 1903a). Kockelman (2005) calls these types of signs *singularities* and goes on to say that most sign events are singularities, and that semiosis is actually an inductive, rather than a deductive process. That is, the meaning of a type is induced through a token, not the other way around; or the meaning of a token emerges from other co-occurring tokens, potentially abstracting to a type (Kockelman 2005).

2.3 Ground of the sign: Iconicity, indexicality and symbolicity

In relation to dimension (ii), Peirce (1903a) defines signs as *icons, indices and symbols* on the basis of the connection between the sign and its object, that is, the ground of the sign. An icon is a sign that represents its object through its qualities. An icon and its object share these qualities, that is, an icon resembles its object in some way. An example would be a good portrait of a person. (Peirce 1903a.) An index, on the other hand, connects to its object primarily through an actual connection, contiguity in time and space, such as an effect or an impact (Peirce 1903a; Kockelman 2005). According to Peirce, this connection does not induce an analogical association due to the similarities between the sign

and its object, as with iconic signs. Instead, an index is physically connected to its object. This connection is only noticed; interpretation emerges when the physical connection is observed to be conventional (Peirce 1903a). Examples of indexical signs would be smoke (as an index of fire), the sound of rain, a footprint, a pheromone, or a weather-vane. The physical connection between a sign and its object is what makes an index a sign, although indexical signs may have iconic features as well (Peirce 1903a). For example, a sign such as the aforementioned weather-vane includes the association of the similarity of the direction of the object's orientation and the direction of the wind (i.e. iconicity) (Parmentier 1994; Kockelman 2005). Finally, a symbol represents its object through a law-like relationship and is therefore connected to it by means of a convention. Examples of symbols are the lexical words or signs of a natural language. From this conventionality it follows that symbols denote that something is of a certain kind, rather than indicating a single particular thing (Peirce 1894). According to Peirce (1903a), symbols are always types, generalizations of single entities. This means that symbols are always legisigns which manifest as replicas, and the object of a symbol is more general than specific.

According to Peirce, icons, indices and symbols are essential for human cognition and reasoning (Peirce 1984). However, Peirce describes these different representative types as features rather than categories. Peirce (1984: 10) states that in reasoning we must always "use a mixture *of likenesses, indices*, and *symbols*". Furthermore, iconic, indexical and symbolic features may, and usually do, coexist in single signs. Already in his early account of semiotic signs, Peirce (1894) points out that a single sign may simultaneously be an icon and an index, and that symbols often have an imitative origin. An icon does not necessarily have indexical or symbolic features although this is possible, whereas an index must have iconic features (i.e. information about or qualities corresponding to its object), and a symbol must have iconic and indexical features (i.e. directing attention and providing information concerning it or indexing a code) (Peirce 1903a; Silverstein 1955; Parmentier 1994; Kockelman 2005). This same inclusivity can be found in Peirce's Universal Categories: Secondness includes Firstness, and Thirdness includes both Firstness and Secondness. As Kockelman (2005: 246) points out, because of these inclusive relations "it is best to talk about iconic, indexical, or symbolic grounds, rather than to talk about icons, indices, and symbols per se".

Let us consider one frequent example of this connectedness, a footprint. One can easily see how a footprint in the sand has iconic, indexical as well as symbolic features. The indexicality of the footprint lies in its physical connection to its source: the weight of a person's foot leaving a trace in the sand. The indexicality in the sign links an event, i.e. someone walking, to something in time and space, i.e. that the walking occurred in that particular location. In addition, the indexicality links the sign to the foot itself, to the person who left the trace behind. This type of spatial, temporal and causal contiguity forms the indexical ground of the sign (Peirce 1903a; Kockelman 2005; Enfield 2009). On the other hand, identifying the similarity between a trace on the ground and a characteristic of its source is based on iconicity: association between the qualities of the sign, i.e. the shape and size of the footprint, and the qualities of its object, i.e. the shape and size of a foot. This association is a key characteristic in what makes a footprint a footprint, in just the same way as is the physical phenomenon through which it exists. Finally, although we may see only parts of a footprint on muddy ground, on asphalt, or on a beach – left by a shoe, a bare foot, or high heels – we still might recognize what it is: we are guided by our knowledge (which is based on convention) of what footprints are, how they are formed and what they look like (and that they are often imperfect, so to speak). The different semiotic grounds of the sign come together when we use and interpret signs, and construct meaning.

In the following discussion on signers' head movements, with iconicity I refer to a relation between the sign and its object which is based on perceptual analogies (see Peirce 1903a; Parmentier 1994; Kockelman 2005; Enfield 2009; Dingemanse et al. 2015). Indexicality is defined as a relation between the sign and its object that is based on spatial, temporal or causal contiguity (see Peirce 1903a; Parmentier 1994; Kockelman 2005; Enfield 2009). Symbolicity is referred to as a relation between the sign and its object that is based on a norm in a community according to which the sign is regarded as standing for the object (see Peirce 1903a; Kockelman 2005; Enfield 2009). All of these three types of signification are referred to as the *grounds* of a sign or *semiotic strategies*. The paper makes no distinction between these two terms. Conventions and automatization emerging in one person's communicative actions are referred to as *entrenchment*, while socially shared conventions are referred to as *conventionality* (e.g. Wilcox & Xavier 2013).

2.4 Utterances as actions: Semiotic complexity and pragmatic unity

If we broaden our perspective from single semiotic signs to whole utterances, intentional social actions occurring in discourse, it is evident that they are semiotically complex, especially if one counts the signals from different sign mediums—such as speech, movements of the body etc.—as parts of one and the same utterance (e.g. Kendon 2004; Enfield 2009). According to Enfield (2009: 15), in a communicative action, signs from different mediums come together into a "communicative move that incorporates multiple signs of multiple types", which he calls a *composite utterance*. Some of these signs are more conventional (e.g. words, emblems), some unconventional (e.g. pitch, depicting hand gestures), while others are hybrids of conventional and unconventional features (e.g. pointing actions). The interpretation of these holistic chunks of semiotic content happens through "recognition and bringing together of these multiple signs" while presuming "pragmatic unity despite semiotic complexity" (Enfield 2009: 11). That is, although utterances are semiotically complex and consist of signification done simultaneously and multimodally with different sign mediums, these different layers of signification are connected and come to exist together as parts of one event which is driven by intentional social action (Enfield 2009). While investigating signals such as head movements in signed interaction, it is important to acknowledge that their meanings and functions do not emerge, and are not interpreted in, isolation. They are a part of multimodal social actions of communication in which different semiotic resources are available.

In order to maintain clarity in the argumentation regarding the semiotic features of signers' head movements and the semiotic versatility in signers' communicative actions, I wish to make the following terminological and conceptual distinctions: *physical medium*, *sensory modality, sign medium* (i.e. modality of information), and *semiotic dimension* (applied from e.g. Kress and van Leeuwen 2001; Bernsen 2002; de Ruiter et al. 2003; Enfield 2009). With physical medium I refer to the medium of phenomena such as light, movement and space, which are relevant for our sensory systems and sensory, mental and social activities. With sensory modality I refer to sensory systems such as vision, hearing, touch and balance. The term sign medium will be used to refer to the actions of different body parts: the hands, face, head and torso.[4] With sign medium Enfield (2009) refers to modalities of semiotic information such as speech, hand gesture, eye-gaze and so on. For the purposes of the current paper and its approach to language (see Section 1), gesture is not considered to form a coherent sign medium, and it is not differentiated from the

[4] In a more detailed discussion about the actions of signers' hands and face one might find it necessary to divide them further into more specific mediums, such as dominant and non-dominant hand, upper face, lower face and gaze.

"linguistic component" (cf. Enfield 2009: 13). Finally, with semiotic dimension I refer to those features in signals of a specific sign medium that can independently vary simultaneously with other dimensions (Kress and van Leeuwen 2001; Enfield 2009). These could be, for example, the loudness of sound (which cannot be loud and quiet simultaneously) or the amplitude of the displacement of a hand movement (which cannot be a long and a short distance simultaneously). Different parts of a signer's body may produce a variety of movements and positions (i.e. potential signs in different sign mediums) using additional kinematic features available for signification, such as velocity and displacement amplitude (i.e. semiotic dimensions).

3 Iconicity, indexicality and symbolicity in head movements

In this section I will present a typology of signers' head movements according to the semiotic framework presented in the previous section. The discussion will focus on the grounds of different types of signs (i.e. head movements), that is, in the iconic, indexical and symbolic connections between the signs and their objects. As is the case with the underlying theory, iconicity, indexicality and symbolicity are seen in the discussion as connected and overlapping semiotic features of head movements. Head movements of a certain type may therefore show iconic, indexical and symbolic features all at the same time. The main characteristics of the typology are presented in Figure 1 with relation to the different semiotic strategies (i.e. iconicity, indexicality and symbolicity).

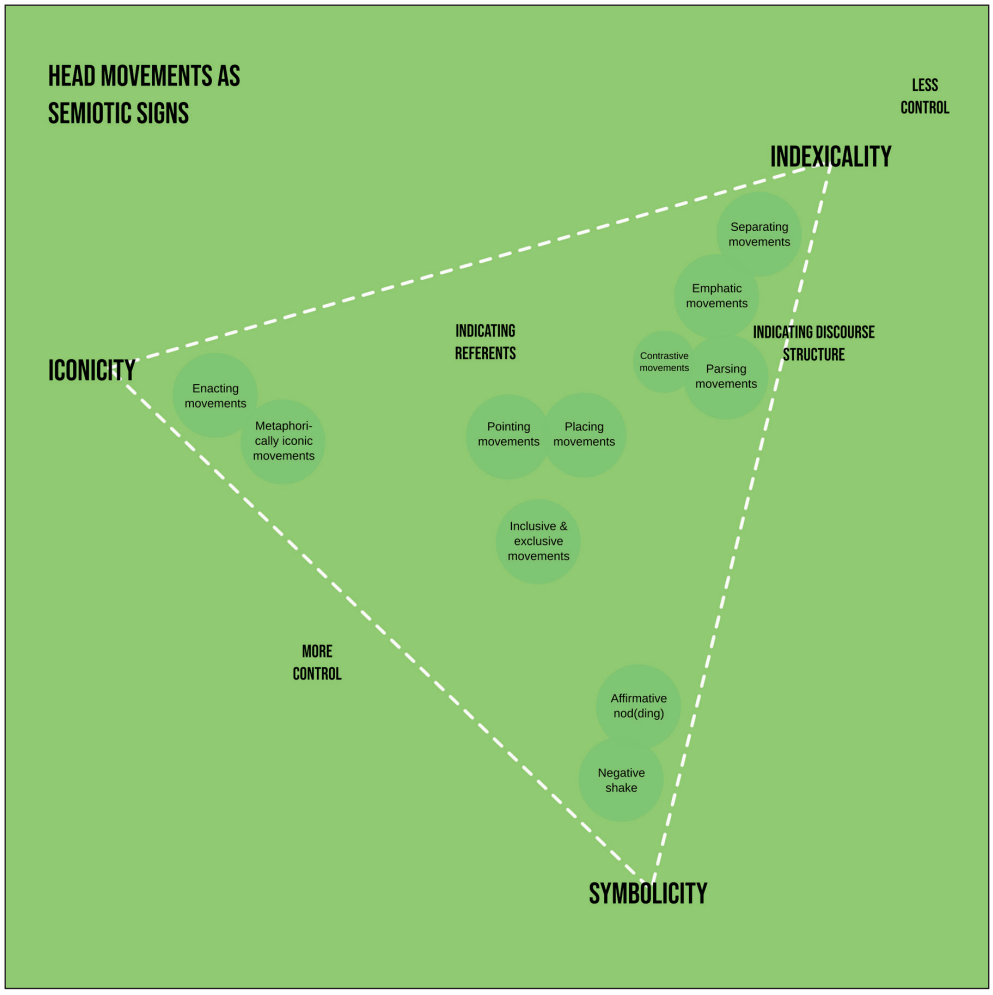

Figure 1: A typology of head movements according to semiotic strategies of iconicity, indexicality and symbolicity.

According to the typology illustrated in Figure 1, all head movements involve iconicity, indexicality and symbolicity, but in different types of movements some semiotic strategies are especially prominent and central for interpretation. This is demonstrated by the stacking of certain types of head movements to the proximity of strategic "poles" of iconicity, indexicality or symbolicity. The following sections discuss the iconic, indexical and symbolic features in head movements (3.1–3.3) and the different proportions of these strategies in different types of movements (3.4).

3.1 Iconic features in head movements

According to the typology in Figure 1, the iconic strategy is important in head movements which resemble their objects either through *enactment* or *metaphorically* (see Figure 1). When a head movement has an iconic relation to its object, its interpretation involves association of the similarities between some characteristics of the sign and some characteristics of its object. *Enacting head movements*, such as the one in Figure 2, mimically enact the head movements of a discourse referent. Figure 2 presents an example of an utterance in which the head movements represent the head movements of a character in a story (a boy). While in the beginning of the example it is debatable whether the head tilt enacts the actions of a referent, the subsequent sideways rotations of the head (i.e. head turns left and right) are clearly enacting movements depicting the actions of the referent (looking left and right). During the enacting head turns, the hands produce the indexical verbal sign LOOK, also directed to the left and right side of the signing space. The indexicality of manual signs is briefly discussed in Section 4.2 of the paper.

Enacting head movements are signs that connect to their objects most prominently through iconicity. They are a part of an embodied depiction of the thoughts, sayings or actions of discourse referents, in which the content is enacted from the referents' point of view—a discourse strategy often referred to as constructed action (e.g. Hodge & Ferrara 2014; Cormier et al. 2015). In the enactment, the actions of referents are projected in a size and manner that resembles real life (e.g. Ferrara & Halvorsen 2017), which in the case of human referents equals the embodied, visual and haptic engagement of human beings in the world. This is in contrast to observer-viewpoint description with fully or partly lexical signs (Johnston & Schembri 2010; Johnston 2012), in which actions are presented as distanced, small-scale description without enactment (e.g. Ferrara & Halvorsen 2017; Ferrara & Hodge 2018). These two strategies may also overlap. As depiction involves

Figure 2: An example of pantomimic head movements (head turns). CFINSL_005_05_00:00:35.[5]

[5] Figure 2 and the following figures are each provided with a reference to the data (see Section 1.1), including a time-code.

actions of different parts of the signer's body, the hands may produce descriptive contents from the observer-viewpoint while other parts of the body are involved in enactment, as is the case in the example in Figure 2. In some recent studies discussing the different degrees of enactment (Cormier et al. 2015; Jantunen et al. 2018a; b), utterances consisting of both observer-viewpoint description and enactment are referred to as reduced or subtle enactment, whereas overt enactment refers to enactments in which hands are involved in the mimic depiction. Furthermore, formally similar or identical manual actions may emerge in either observer-viewpoint description or enactment, depending on the situation (e.g. Johnston & Ferrara 2012). Finally, in enacting movements, the direction of the head movement or the orientation of the face may indicate the relations and semantic roles between discourse referents.

The second type of iconicity in actions of the head, metaphorical iconicity, emerges, for example, in those head movements in which the direction of the movement is associated with an abstract image of a sagittal time line (Figure 3). In this case, forward and backward directed movements of the head or the whole body refer to the linear organization of things in time. Content associated with the future, or with subsequent events in the organization of things ('later', 'after'), is produced with movements directed forward, whereas meanings related to the present, the past or anterior ('earlier', 'before') are produced with movements directed backward. I suggest that in these movements there is an iconic connection between specific features of the sign, i.e. the direction of the movement, and its object. The object in this case is a metaphorical spatial conceptualization of time (see Cooperrider & Nunez 2009): a visual and embodied mental image, common in the Western world, according to which time is spatially mapped, with the ego as a reference point, so that the future is something 'in front of us' and the past 'behind us' (Cooperrider & Nunez 2009; see also Lakoff & Johnson 1980; Wilcox 2000; Taub 2001; Cienki & Müller 2008). These metaphorically iconic sagittal head movements are optional. They may emerge in utterances with deictic signs, such as the FinSL signs FUTURE, and NOW, with manually produced indexical time-lines, or the temporal organization of events may be expressed without any particular head movements. At present, we do not know how frequent they actually are in utterances with time references, and whether they can alone anchor manually signed content to conceptual time-lines, without manual indexicality.

However, according to earlier research on head movements in FinSL (Puupponen et al. 2015), the connection between the direction of a head movement and the linear organization of things in time is not categorical. The surrounding discourse context is a relevant factor in how head movements are directed: the movements may be coincidental, caused by kinematic features of manual movements (Woll 2009; Puupponen et al. 2015), or the contrast between 'future' and 'past' or 'later event' and 'earlier event' may be emphasized with movements produced contrariwise (i.e. 'future' backwards, 'past' forwards). In this

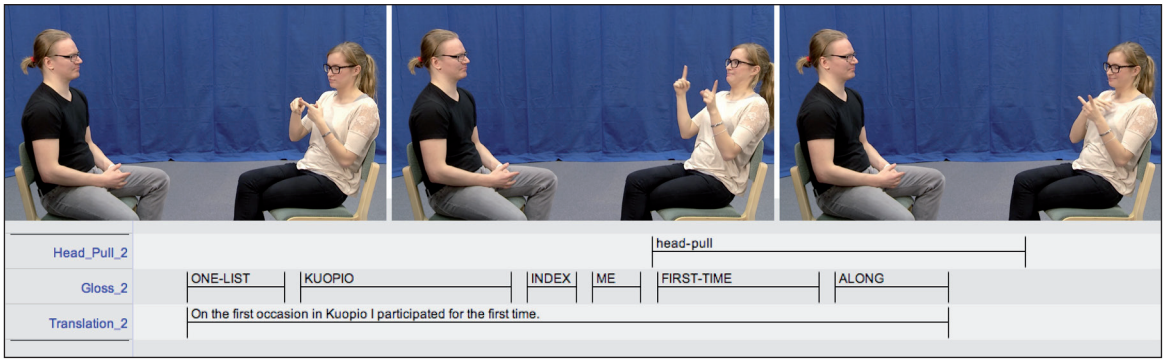

Figure 3: An example of a metaphorically iconic head movement (head pull). CFINSL_005_06_00:03:56.

case it is indeed this *contrastive* function which is relevant in the movements: two or more things are placed in opposite, alternative, comparative, or corrective relations to each other (see Johnston 1992; Wilbur & Patschke 1999; van der Kooij & Crasborn 2006; Crasborn & van der Kooij 2013; Puupponen et al. 2015; Jantunen 2016; Lackner 2017). I suggest here that when the contrastive function of head movements is not connected to a metaphoric concept of a sagittal time-line, its source of iconicity changes (see section 3.4) and the indexical ground becomes increasingly relevant. Contrastive head movements include indexical features of organizing the discourse structure and creating a spatial relation between the contrasted manually signed contents, which is discussed further in Section 3.2.2. It should also be noted that the indexical placement for showing opposition, alternatives etc. may be considered to include iconicity, that is, analogical association (e.g. opposites visualized at opposite sides of the signing space). Finally, metaphoric time-lines in sign languages are not only sagittal: the organization of events in time may be visualized also horizontally or circularly, as has been noted also in the manual gesturing of speakers from several different cultural surroundings (for a summary, see Cooperrider & Nunez 2009). However, in the data from which the current paper draws, head movements have not been found to iconically represent these other time metaphors.

In sum, the iconic strategies in signs produced with the head are most prominent and crucial in enactment, although iconicity is more or less involved in the production and interpretation of other types of head movements as well (see section 3.4). Enacting movements vary in form according to the needs of the depiction: movements and positions of the head imitate their object, that is, the activity of the head of a discourse referent, rather freely. They are often one part of a holistic iconicity in which their meaning emerges only in relation to the actions of other parts of the body: the body, head, and face form a unified depiction that is interpreted as a whole, and the head movement alone cannot be seen as having an independent meaning (head movements and the holistic nature of signers' actions are discussed in Section 4.1). However, enactment need not involve all the aforementioned sign mediums.

Non-enacting iconic head movements are, for example, movements visually representing a time metaphor. In this case the central imitating feature was found to be the direction of the movement. Together with the direction of the manual movements, the movements of the signers' body embody and visualize the imagistic dimensions of human temporal reasoning. On the basis of preliminary examination of the data, it is suggested here that head movements which have non-enacting iconic features are less common than enacting movements. However, this observation is given as a hypothesis for further investigation as it is not based on frequency counts.

3.2 Indexical features in head movements

3.2.1 Indexicality of head movements in enactment and visualized time metaphors

Enacting and time-metaphor movements of the head, presented in the previous section, also have indexical relations to their objects. As was mentioned above, enacting head movements may have indexical functions that point out semantic relations between referents. Orientation of the head and face, direction of gaze, and direction of manually produced enactment/description together indicate spatial relations between referents (e.g. Hodge & Ferrara 2014; Schembri et al. 2018). Head movements indicating referents are discussed in more detail in the next section (3.2.2). In general, the communicative action of enacting a referent can be considered to involve indexical as well as iconic signification. When the enactment involves a so-called invisible surrogate (Liddell 2003)—that is, a referent, for example an inanimate object, is handled by an enacted referent without any explicit visualization of the object that undergoes the handling—characteristics in

the form of the enactment are affected (or according to Enfield 2009 *determined*) by the characteristics of the referent. In the gesturing of speakers, Enfield (2009) sees this type of enacting as an example of spatio-temporal continuity (i.e. indexicality) between the sign and its object.

Metaphorically iconic head movements that are connected to an abstract image of a sagittal time-line are also clearly indexical. The movement of the signer's upper body or head is an index, functioning as a pointer referring to a "vague temporal region" (Cooperrider & Nunez 2009); it indicates temporal organization and the alignment of content in the discourse. Referring to a later or an earlier event always includes a relation: the event in time is presented in relation to a temporal reference point, an origo, which in this case is the ego. If one wants to emphasize with a head movement that the content that is being signed is placed in a later time or in the future, the forward directed movement holds the presumption that the origo is somewhere "behind it" in the present or (more indefinitely) in an earlier time. Temporally deictic words and signs in natural languages, such as the English adverbs 'now' and 'yesterday' or the aforementioned FinSL signs FUTURE and NOW, are traditionally recognized as indexical (although also symbolic) signs which include situating referents in temporal relations. Head movements connected to time metaphors are, however, different in their indexicality: they are not used alone to create temporal relations but, rather, visually emphasize relations that are created with lexical signs.

3.2.2 Indicating referents

According to the typology, indexical features are prominent in head movements that indicate *discourse referents* or indicate *discourse structure*. Movements that indicate discourse referents have been analyzed as signs that direct attention to their objects or bring objects to someone's attention (see Clark 2003; Cooperrider & Nunez 2009). The first type of movement is *pointing movements of the head* referring to specific referents. These movements function as manual pointing: they project a vector from a specific body part to a direction, location or an entity (Kita 2003). They may identify—introduce, re-introduce and maintain—referents which are present at the moment of signing or they may be used to refer to *imaginary referents*, that is, metaphoric locations in the signing space in front of the signer to which referents have been *placed* earlier in the discourse (for an overview see e.g. Liddell 2003; Perniss & Özyürek 2015). This strategy has been referred to as abstract deixis in relation to co-speech gesturing (McNeill et al. 1993). When pointing with manual signs, eye-gaze and movements of the head are directed to these locations, they organize discourse with anaphoric references. With speakers, reference tracking with manual gestures has been found to occur more in the re-introduction of referents than while maintaining them (Gullberg 2006; Perniss & Özyürek 2015). It is unclear whether pointing with the head and eye gaze alone may be enough when an imaginary referent is established for the first time in the discourse.

Pointing head movements may emerge together with indexical manual signs or independently, without manual signs. Syntactically they can function as pronominal core arguments of a clause (see Puupponen et al. 2015). When pointing with the whole head one may, for example, refer to the addressee in a conversation (Puupponen et al. 2015) or objects present in the communicative situation. In those occurrences identified in the data in Puupponen et al. (2015), they were nod-like movements which include tilting the head sagittally or sideways while pointing in the same direction as the gaze. In the study, referring to specific referents by pointing with the head was less frequent than other types of head movements (Puupponen et al. 2015). However, in different types of communicative situations signers may presumably point with their head in multiple different ways. It is suggested here, as a hypothesis for future research, that pointing

with the head emerges more often as giving emphasis to, or as a consequence of, manual movements in indexical signs rather than independently without manual signs. Another potential context for independently occurring head pointing may be situations in which the hands of the signer are in other ways occupied. Independent pointing movements of the head are presumed to be more common in discourse data than in narratives, but in order to throw more light on this, pointing with the head should be investigated further with data consisting of multiple different discourse genres, including discussions on both present and imaginary referents and reference to locations both near and far from the interactants.

Indicating a referent can also be done with sideways movements of the head while connecting the content of manually produced signs to imaginary referents established earlier in the discourse. The signer may, for example, change the orientation of the face along with the eye gaze, tilt the head sideways, or lean the whole upper body sideways, or produce a combination of these movement features. In some of the movements, the orientation of the face changes according to the direction of the gaze. These are referred to as *gaze-aligned* movements (see also Enfield 2009). In these movements the head does not independently point as if projecting a vector to the object to which the signer is guiding attention. The direction of the gaze points while the movement of the head aligns with the gaze and potentially emphasizes the pointing. To this may be added a turning of the shoulders, torso or the whole body in the same direction as the gaze. When manual signs are produced during this action, their interpretation is anchored to the reference point of the pointing (introduced or pre-established). In gaze-aligned movements it is not easy to define whether the gaze and head movement direct attention to something or draw something to someone's attention.

In some movements of the head or the whole upper body, the head moves towards an introduced or previously established location (i.e. an imaginary referent) while the face and gaze may be oriented towards an addressee (as in Figure 4) or to the imaginary referent. As with gaze-aligned movements, these movements anchor the simultaneously occurring manually signed contents to the reference point of an imaginary referent (introduced, re-introduced or maintained). In the head movement typology, this type of indication of a referent with the head is referred to as *placing*. With placing movement I refer to a movement which, instead of projecting a vector in the direction of a referent, "actually positions a temporal [or other] entity in space" (Cooperrider & Nunez 2009: 190; brackets added to the original quote by the writer). This definition is connected to Clark (2003),

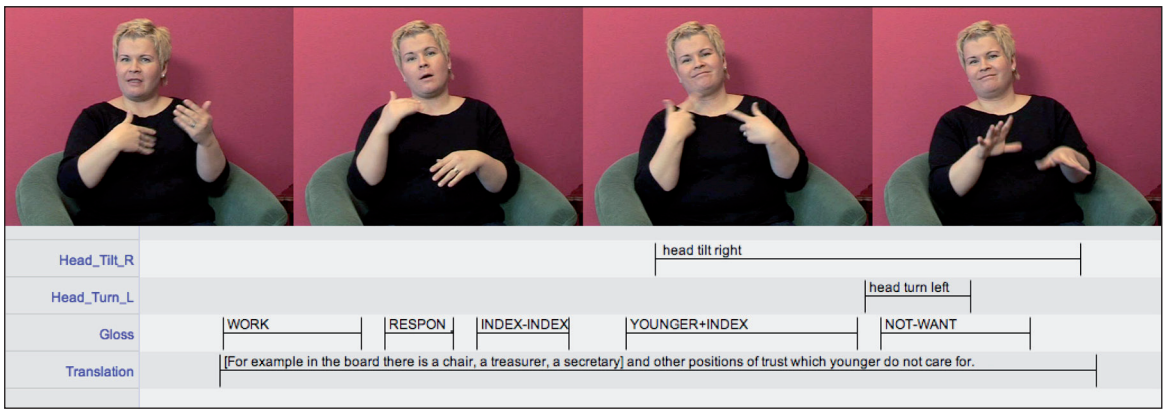

Figure 4: An example of an utterance in which the head tilts towards an imaginary referent (young deaf people), specified in the signing space earlier in the discourse, and connects the signed content to this theme (see also Puupponen 2012). The head turn during the tilt shows exclusion and it is analyzed here as enacting. SLM_2011_00:00:18.

who distinguished between directing someone's attention to something (i.e. pointing) and offering something for someone's attention (i.e. placing).[6]

Placing movements of the head, such as the one in Figure 4, are often longer in duration than pointing movements identifying referents. However, differences in the average durations of these movement types is an empirical question for future research. The anchoring of manually signed content may be done while the head moves or turns sideways, or there may be a sideways hold or a static position of the head during which the content is produced. They are not used for explicit pronominal reference and therefore they do not function as core arguments of a clause. They are, however, used together with manual pointing and pointing with the gaze to track reference in discourse (see also Lackner 2017). They may be optional, as indexical manual signs perform the same function, but they are presumed to occur quite often: the way the discourse is indexically organized is shown in the whole body of the signer, not only in the hands. On the other hand, they may also include enactment (as is the case in Figure 4). In general, it is suggested here that in many cases the difference between pointing and placing functions may not be clear cut. When it comes to movements of the head and eye gaze, in the same way as *moving towards* something may not be easy to distinguish from *projecting a vector in the direction* of something, *directing attention to* something or *bringing something to someone's attention* may not always be distinguishable notions. The interplay between gaze and head movements as well as their indexical functions is a matter which should be dealt with in more detail in future research.

3.2.3 Indicating discourse structure

Head movements which do not indicate referents but only indicate discourse structure organize and parse texts and conversations by binding elements together into continuous stretches, by showing points of transition between these stretches, or by emphasizing elements during the stretches. In the head movement typology these are referred to as *parsing movements*, *separative movements* and *emphatic movements*, and they occur either together with movements of the torso or without them. Parsing movements bind elements together into stretches of discourse without placing or pointing (Figure 5). They are simply movement contours which bind together manual signs in relation to the syntactic structure and organization of the discourse (phrases, clauses, sentences, text episodes, turns in conversation). In sign language linguistics, these types of movements have been

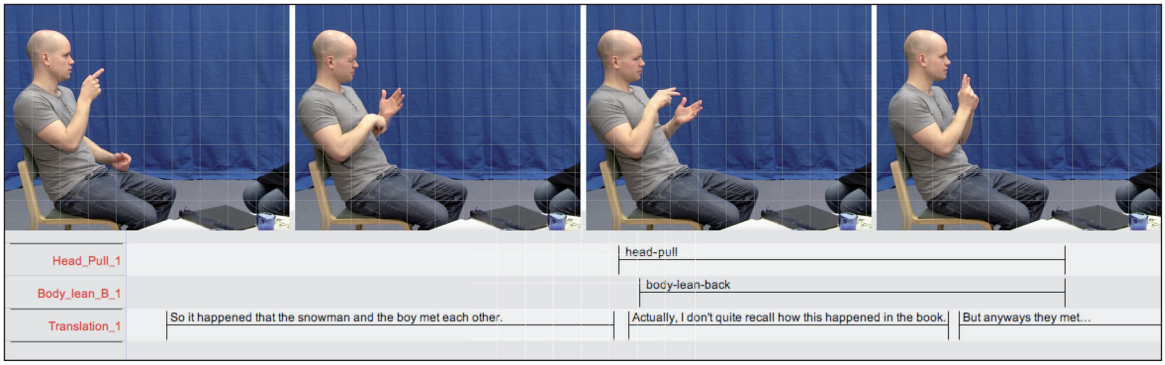

Figure 5: An example of a sequence of utterances in a narrative in which a parsing movement of the head and upper body binds together manual signs and shows the area of a metacomment on the content of the story.[7] CFINSL_008_05_00:05:43.

[6] Clark's (2003) *placement* includes the concrete placement of actual physical objects.

[7] Figure 5 and some of the following figures include a grid in order to demonstrate more clearly the movements of the signer's head.

previously referred to as prosodic "domain markers" (e.g. Wilbur 2000; Pfau & Quer 2010; Puupponen et al. 2015; see also Sandler 2012). Formally they may not differ from placing movements: they are sagittal and sideways head movements which are relatively long in duration and may include a static hold or position of the head. In FinSL (Puupponen 2012; Jantunen et al. 2016a; Puupponen 2018) and Israeli sign language (Sandler 2011), for example, the parsing function has been associated especially with sideways directed movements of the head and upper body, although sagittal parsing is not uncommon. It should be emphasized, however, that head and body movements do not bind elements together on their own. Instead, parsing is done together with the kinematic features of manual movements as well as with the timing of different facial expressions (e.g. Ormel & Crasborn 2012; Sandler 2012).

As mentioned in Section 3.1, movements of the head may also create *contrast* between elements in signed discourse (Figure 6). In this case the head (or the whole upper body) moves, for example, sideways while the content is being signed, after which the head comes back and moves again while content is signed that is in an oppositional, alternative, corrective or comparative relation with the previously signed content (see also Johnston 1992; Wilbur & Patschke 1999; van der Kooij & Crasborn 2006; Puupponen et al. 2015; Jantunen 2016). They are indexical embodied visualizations of a relation between two or more entities, and they may introduce referents which are referred to with anaphoric pointing later in the discourse. As in the example in Figure 6, the contrastive relation always includes at least two elements which are contrasted, that is, it always involves a relation of two entities or events. These contrasted elements may be expressed manually with only single signs or with whole sentences, the choice naturally affecting the duration of the different contrastive head movements. These manual elements may be contrasted with only head movements or also with manual conjunctions (see e.g. Jantunen 2016). Contrastive movements usually include two or three sagittal and/or sideways movement sequences (including the retraction phases of the movements), depending on the number of elements that are put in a contrastive relation. The movement sequences may be produced in distinctly different or even opposite directions, or in similar directions but with tilts to opposite sides. Further, when contrasting only two things, the head movement may emerge with only one of them, as is the case in the example in Figure 6. This is enough to create a perceptible distinction between the two things.

Contrastive movements are parsing movements with a particular function. In this case their indexicality may identify referents (placing) as well as discourse structure (parsing),

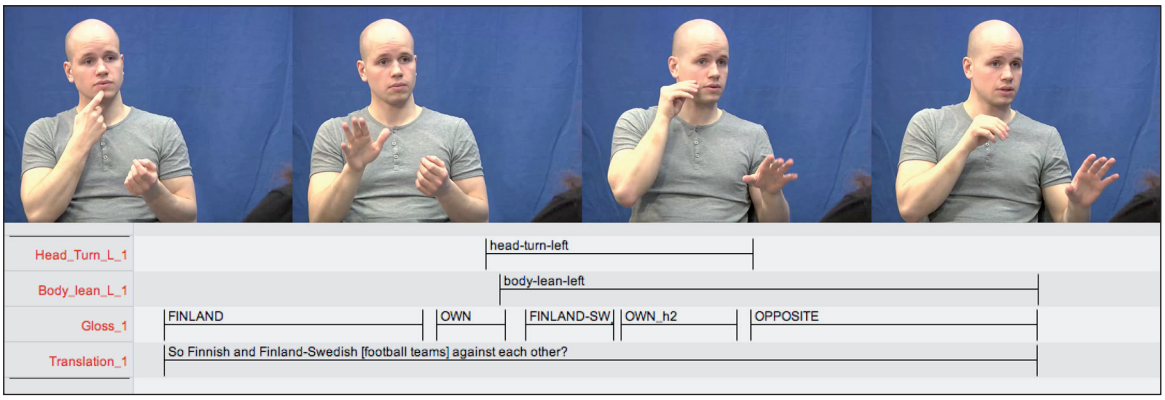

Figure 6: An example of an utterance in which movements of the head and upper body signal contrast between manually signed elements. The 3rd gloss from the right is FINLAND-SWEDISH and the abbreviation at the end of the 4th gloss, 'h2' refers to the non-dominant hand. CFINSL_008_06_00:14:50.

although they do not necessarily have to include a placing function. The temporal placement of the movement is enough to create a contrast. Furthermore, as was pointed out earlier, it can be argued that signaling opposition, alternatives and comparison by means of placing movements to opposite sides of the signing space invokes association of analogy (i.e. iconicity) as well as indexical signification. The stance taken in this paper is that this is one type of iconicity, and that contrastive movements are a good example of how different semiotic grounds come together in actions of the head.

Movements separating stretches of signing emerge on the boundaries between clauses, sentences, text episodes or turns in conversation. They are movements that are relatively short in duration – such as single head nods – and indicate linear transitions between signed sequences (Figure 7). For example, in a study comparing corpus narratives of Finnish and Swedish sign languages, a tendency was found for single head nods to align with syntactic boundaries and to occur sentence-finally in both languages (Puupponen et al. 2015; 2016). In sign language linguistics, these types of elements have traditionally been referred to as prosodic "boundary markers" or "edge markers" (e.g. Wilbur 2000; Pfau & Quer 2010; Puupponen et al. 2015). Stretches of discourse are also separated simply by the transitions between parsing head and torso movements, that is, they are not always pointed out by distinct movement events such as nods. The holds and changes of direction between longer movement contours are in themselves elements that organize the signing string into perceptible chunks, just like phonetic features which indicate word and sentence boundaries in speech.

Finally, in the head movement typology, many different types and forms of movements are classified as emphatic when they reinforce manual movements, and hence also the content conveyed by those manual signs. They may be produced along the movement path of manual signs, or in the opposite direction (hands and head moving towards or away from each other), which intensifies the manual movements. It is suggested here, as a hypothesis for further investigation, that emphatic head movements may be reflex-like consequences of manual motion or movements involving more control in their production and interpretation (see Enfield 2009; Kockelman 2005; Section 4.1) and underlining the content that is being signed manually (Figure 8).

In sum, parsing, separative, and emphatic movements all indicate the structure of larger episodes of discourse or smaller syntactic sequences. They guide one's attention to the organization of the signed content and signal relations between textual elements. It is suggested here, as a hypothesis for future research, that parsing and separative movements may include less control in their production and interpretation, while emphatic movements may be more controlled, depending on the situation in which they occur. This issue will be discussed further in Section 4.1 (see Kockelman 2005; Enfield 2009). Some

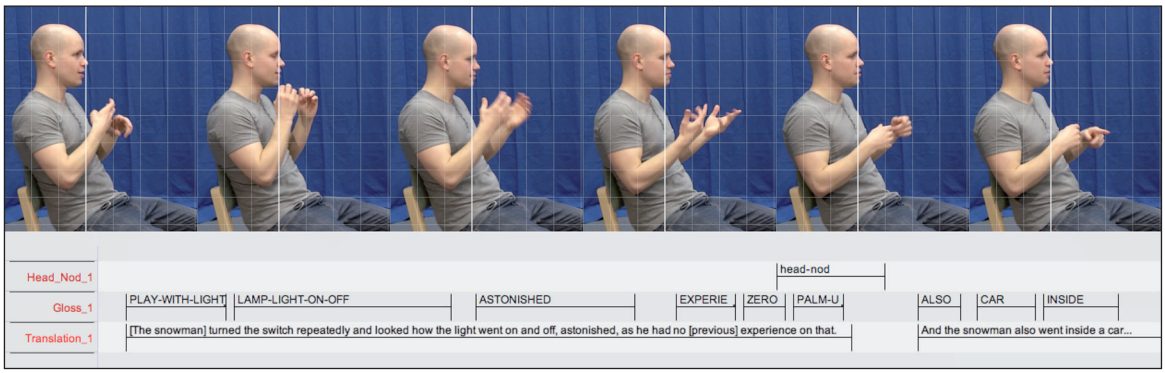

Figure 7: An example of a separative head nod indicating a transition between two stretches of discourse. CFINSL_008_05_00:06:40.

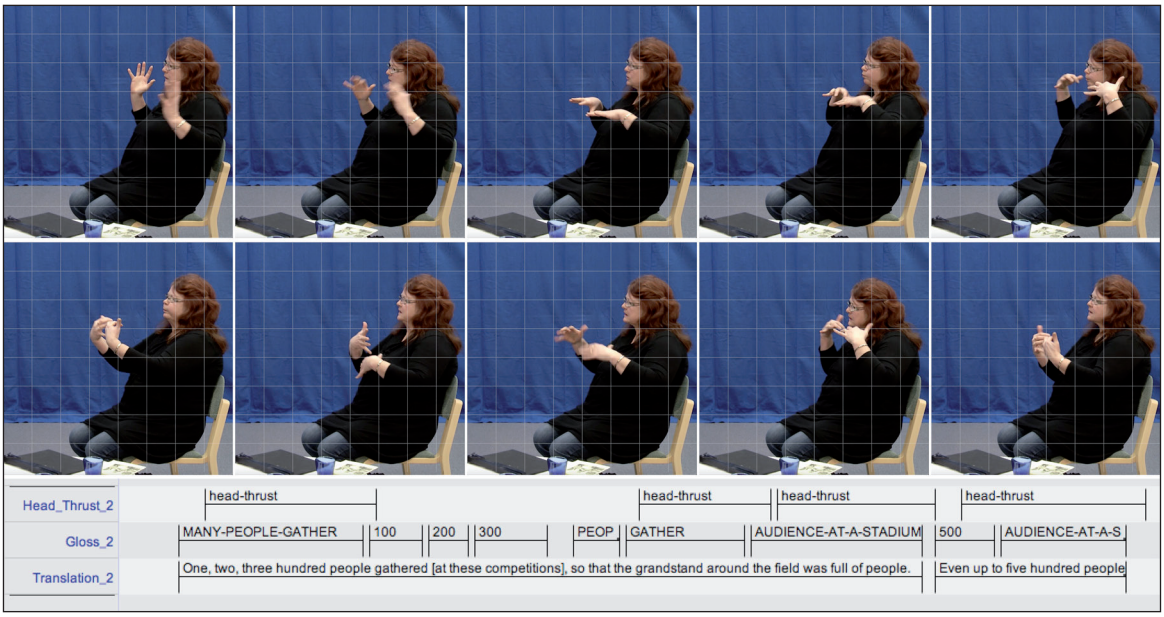

Figure 8: An example of head movements emphasizing manually signed content. CFINSL_008_06_00:05:54.

parsing movements and contrastive movements, presented earlier, may also be considered emphatic. This exemplifies the fact that the typology presented in this paper describes head movements through prototypes, not mutually exclusive categories. Different functions in the signification made with head movements may overlap.

3.2.4 Enactment or reflex-based signaling of embodied experiences? Inclusive and exclusive head movements

Indexical features also emerge in *head movements showing inclusion* (e.g. 'participation', 'going along') or *exclusion* (e.g. 'avoidance', 'rejection') (see also Wilbur & Patschke 1998; van der Kooij et al. 2006; Puupponen et al. 2015). In these instances, the head movement has its roots in a pattern of human behavior typical in the Western world: when we want to be included in something, we approach it, when something is rejected, we move away from it. The origins of these types of movements can be seen in physical reactions, reflexes, and typicalities in the actions of human beings, that is, in the physical and social behavior of humans. They are indices which stand for something else through a natural connection, cues for something through reality, just as blushing, an angry expression, or the sound of rain are indices.[8] We may have a shared experience of certain types of behavioral patterns, which means that they may become more or less schematic and recognizable, as is argued in section 3.3 that discusses headshakes and nodding of the head. An example of an exclusive head movement was given in Figure 4.

On the other hand, movements of the head or the whole body showing inclusive and exclusive meanings may in many cases be interpreted as enacting movements. They may be viewed as iconic depictions of the behavior (experience or feeling) of a referent. When they emerge in sequences of overt enactment (Cormier et al. 2015; see Section 3.1), they may be easily analyzed as a part of the representation of a referent's inclusive/exclusive actions. However, when the signer's upper body leans forward with signs such as SIGN-UP and JOIN, for example, without distinctive enactment from other parts of the body, it is difficult to say whether the movement should be considered enacting or not. Whether

[8] They are indexical signs when someone interprets them as meaningful. They are also simultaneously interpretants (Kockelman 2005), the results of preceding sign events that have caused them to occur (see Section 2).

or not inclusive and exclusive movements always include enactment is an open question and, in the end, the answer may depend on how one defines enactment in signing and which formal features are associated with it. A recent phonetic study of FinSL (Jantunen et al. 2018a) brings out interesting issues concerning this question as it shows that in more subtle degrees of constructed action, eye gaze—which is traditionally seen as the most significant feature distinguishing constructed action from standard narration—need not be included in the enactment.

Enacting or not, inclusive and exclusive movements include indexical reference points. In forward-directed head movements with content such as 'participation', the direction of the movement is produced with relation to a spatial reference point. The reference point may be unspecified and non-anaphoric, in which case more content is not anchored to it during the discourse. It is suggested here that in this case the reference point is usually placed in front of the signer, and inclusive head movements are directed towards the point (forward) while exclusive movements are directed away from the point (backward). If the reference point is more specified and anaphoric—a present or imaginary referent introduced earlier in the discourse—the movement is produced towards or away from that reference point, not necessarily forward or backward in the sagittal plane. Considering the discussion above on the enacting vs. non-enacting nature of inclusive and exclusive head movements, another question is whether anaphoric and specified movements are easier to interpret as enacting than non-anaphoric movements.

3.3 Symbolic features in head movements

The symbolicity of head movements is most evident in negative headshakes and single nods or repeated nodding of the head with positive functions, which form more conventional form-function pairs than primarily iconic or indexical head movements. Headshakes and nods are globally widespread gestures frequent in the communication of both signers and speakers. Although there are observations of some variation in their functions across the world (e.g. LaBarre 1947; Samovar et al. 2007), they are somewhat conventionalized signs for negative (e.g. disapproval, disbelief, negation, grief) and affirmative meanings (approval, agreement, understanding, assuring). In the data from which the current paper draws, they may occur together with manual signs (Figure 9) or independently as responses

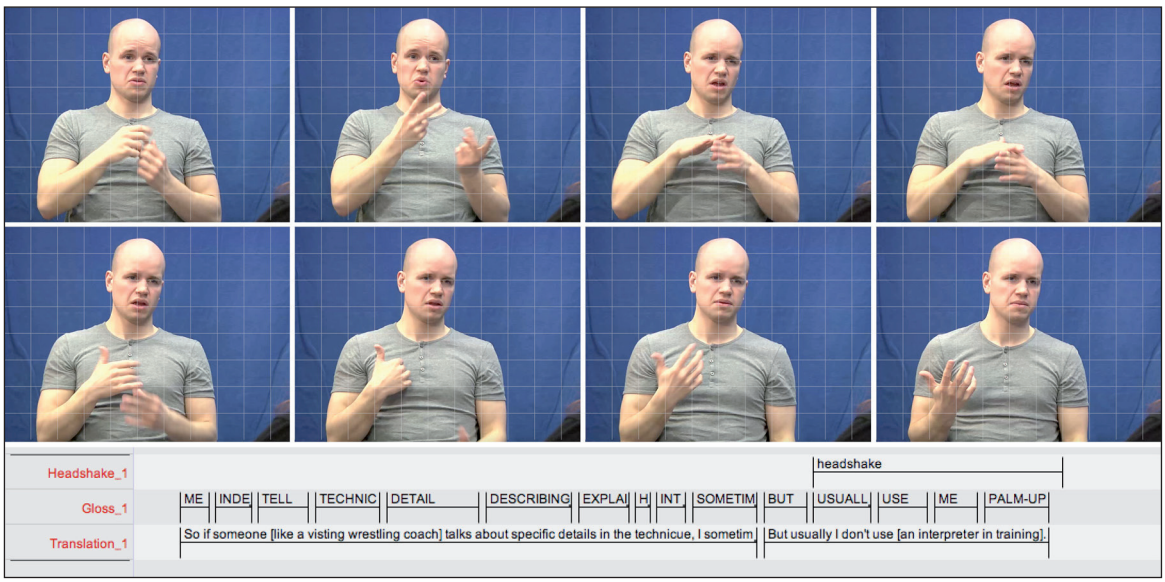

Figure 9: An example of a headshake that changes the meaning of a sentence from affirmative to negative together with the facial expression. CFINSL_008_06_00:19:50.

to questions or as backchannelling cues. They have a more decontextualized meaning-like function than other types of head movements discussed in this paper, that is, their interpretation is not only context-specific and they can be considered as tokens of types.

Although the form-function connections in negative headshakes and affirmative nodding show more conventionality than in iconic or indexical head movements, this does not mean that their functions are clear cut. Headshakes, for instance, may convey different types of meaning related to negation or surprise: disbelief, hesitation, doubt, downplaying, disagreement, negation, sorrow, sympathy towards a negative issue, and so on (Kendon 2002; Johnston 2018; Puhto 2018). When a signer signals something negative with a headshake, this may be associated with the negation of a proposition in the discourse or it may convey meanings related to the way the signer's personal feelings, thoughts or attitudes are positioned against what is said in the discourse (Puupponen 2012; Johnston 2018). Therefore, when we view symbolic head movements as semiotic signs, it is evident that the object to which they connect are not clear cut, but rather a gradient field of different types of functions that are more or less closely connected.

In addition, symbolic head movements are not only symbolic: the connection between the sign and its object is indexical for both of them. Negative shakes and positive nods are indices which show different degrees of conventionalization. For example, the rotation of the head in a headshake may be argued to have its origin in a gesture of rejection, a reflex that is already typical in infancy (e.g. a child avoiding a spoon while being fed). In the 19th century Charles Darwin (1872) suggested that nodding and turning the head have their roots in the way babies lean towards milk (nodding) or reject it (turning). In addition to cyclical shaking movements, this type of function (i.e. a physical act of rejection) may form the basis for different types of exclusive and negative single head turns found in different sign languages (see Figure 4). On the other hand, it has been suggested that head turns stem from avoiding eye contact (Stern & Bender 1974). With relation to the indexical origin of head nods, they have been argued to have their roots in the act of bowing (Morris 1994) and in the development of reptiles already 280 million years ago (Givens 2013). Some scholars have also argued that head nods and head turns may be traced back to human mirror systems and their effect on babies' abilities to imitate their parents' movements and emotions from early on (Meltzoff 2002; Braten & Colwyn 2007; Thagard 2010). The current paper argues for the view that symbolic head movements in sign languages are schematized indexical signs which can be said to differ in their degree of conventionality and to vary in their meaning according to the communicative situation.

Finally, symbolicity occurs also in other head movement types, although not in the Peircean sense of legisigns. As with speakers' manual gestures, so too with signers' nonmanual actions the conventionality may lie in the "types of communicative action" (Enfield 2009; see also Kendon 1988; Okrent 2002), rather than requiring specific forms for specific functions. The ways in which iconic and indexical movements are produced have recognizable features through association and inductive processes even though they do not emerge as types for tokens in the same way as do shakes and nodding of the head. Their recognizability may involve understanding the habits of a single signer (i.e. entrenchment) or conventions shared among a group of signers. Nods and shakes, on the other hand, are easy to associate with convention because they convey meaning that can be understood roughly along the same line of interpretation, whatever the context.

3.4 Proportions of different grounds in head movements

As has been presented in the preceding sections, different types of head movements involve iconicity, indexicality and symbolicity in overlapping ways. For example, enacting and time-metaphor head movements include both iconic and indexical features, movements

indicating referents by placing them in contrastive relations may have iconic features, and symbolicity emerges in different ways in different types of head movements. It may, however, be that these different strategies of signification emerge in different proportions in different head movement types. In order to demonstrate this, I will borrow a visualization suggested by Capirci (2018) for the iconic-indexical-symbolic relations of linguistic signs (Figure 10).

As suggested by Figure 10, the proportions of iconic (yellow), indexical (green), and symbolic (red) grounds are different in different types of head movements. While negative headshakes include a lot of indexicality and symbolicity, their iconicity lies mainly in the associational recognition of tokens to types (see Peirce 1903a; Silverstein 1955; Parmentier 1994; Kockelman 2005). With movements indicating discourse structure (parsing, separating, emphatic) and indicating referents (pointing, placing), the indexical ground is strong whereas iconicity lies in the association of the types of communicative action (together with other sign mediums) to the token sign events, that is, in recognizing their symbolic ground (see Enfield 2009). In addition, as pointed out earlier, in contrastive movements, for example, the spatial relations between the contrasted element may show also other sources of iconic association. As for enacting and time-metaphor movements, the iconic ground is strong but they include a lot of indexicality as well. The symbolicity of these movements lies in the recognition of patterns in the communicative action, that is, in connecting the token enactments and token time-metaphor movements to the "general manner of execution" (Enfield 2009: 19) in which they are done among signers. Finally, one very visible feature in Figure 10 is how redness—symbolicity—is not the most evident feature in all head movements. Symbolicity may not be the prime motor of this type of signification, but still head movements are significant. This, as I argue in Section 5, speaks for the need for a theory of language that embraces less symbolic and unconventional elements instead of pushing them to the periphery.

4 Head movements and the semiotic versatility of signers' actions

4.1 Semiotic complexity & pragmatic unity in signers' actions

As presented in Section 2.5, in a semiotic analysis of signers' head movements it should be noted that head movements in a given communicative situation are one part of a semiotically complex whole—a composite utterance (Enfield 2009)—consisting of several

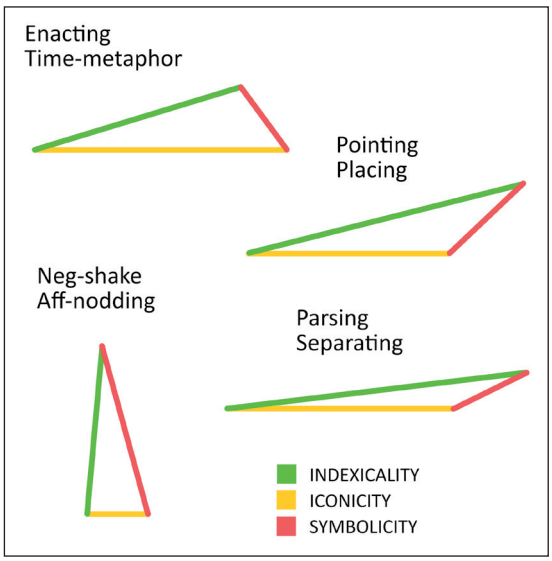

Figure 10: The proportions of different grounds in different head movement types (visualization according to Capirci 2018).

signs from different sign mediums and driven by a unified intentional social action (see ibid.). This applies for all head movements, also movements such as headshakes that are produced without any manual action, for example, in response to an interlocutor's utterance (i.e. they may emerge together with eye contact, facial expressions, and so on). No signals produced with the head in natural discourse emerge in isolation and they cannot be interpreted as isolated entities.

There are, however, differences in what kind of components signals of the head are in clusters of semiotic features. Some of the head movements discussed in Section 3, such as a headshake can be interpreted as conveying meanings. Head movements indicating discourse structure, on the other hand, cannot in themselves be associated with a specific meaning. The function of a parsing or separating head movement comes about in its relation to the whole signed utterance, in its temporal alignment with the actions of the hands. This means that its functions emerge through a physical, actual relation—a co-occurrence or proximity of timing—which makes it an indexical sign (Peirce 1903a; Parmentier 1994; 2006; Kockelman 2005). A sentence-final head nod or a parsing movement of the head (or the whole upper body) organize the discourse by indicating changes or continuities in the structure along the lines of, 'here is a change in the structure of discourse' or 'this is a continuous stretch of discourse'.

Semiotically, a separating head nod or a parsing sideways movement of the head are signs that do not have a clear and easily determined object (cf. Kockelman 2005). Instead, the object is an abstract notion that emerges in the co-occurrence of head movements with manual actions: 'something is happening here that is distinguishable from what has come before and/or is subsequently going to come in the discourse'. This is in line with Kockelman's (2005: 242) notion of the abstract object which is "less precise", "less consistent" and does not necessitate "intentional states such as knowing" (see also Section 2.1). The interpretant of this type of a sign is the feeling or state that comes about when observing the sign, and which may be vaguer and more subconscious than consciously acknowledged: 'the processing and interpretation of these contents is smoother and less obstructed because this signal organizes the structure of discourse'. As a hypothesis for further investigation, it is suggested here that a head movement indicating discourse structure involves less control in both its interpretation and its production, and that it therefore shows a lower degree of *agency* than, for example, a headshake (Kockelman 2005; Enfield 2009). It may be that the existence of such signs becomes evident only when there are perceivable errors or disfluencies in the signing as a result of the atypical use of these signals.

These types of signals are similar to what Enfield (2009) calls implicit indexical resolution. Although Enfield seems to use the term to refer to indexical signs with an *implicit placing* function (see also Clark 2003)—that is, to signs that link other signs in an utterance to specific points in space with mere placement (e.g. a no-smoking sign)—it is partly applicable to signs indicating discourse structure without a placing function. Both types of signs (i.e. a no-smoking sign and, e.g. a separative head nod) are implicit in their indexicality, that is, they come about through the physical situation in which they emerge or to which they are positioned without any explicit indexical content. Despite their implicitness, both sign types are, however, indexically connected to other signs in the semiotic cluster. A no-smoking sign links the interpretation of the content of the sign to a specific location without actually pointing to it (e.g. with an arrow). A head movement indicating discourse structure is linked to the linear structure of signed utterances, or larger stretches of discourse, by mere temporal placement, the proximity of timing. The interpretation of these head movements is interrelated with the holistic interpretation of the whole composite utterance and, further, with the textual entirety that they build together. This unity

in interpretation is possible because of *contextual association* (Enfield 2009), among other factors. The timing and other indexical proximity of these signals are triggers that guide the interpreter to assume that they are "part of one signifying action" (Enfield 2009: 16) together with other signs in the utterance. To summarize, as a hypothesis it is suggested here that head movements include different degrees of control, as has been found to be the case with, for example, eye-blinks in signed discourse (e.g. Wilbur 2000). Movements indicating discourse structure involve less control than, for example, more conventionalized head movements such as headshakes or head movements indicating referents. It is also suggested that different head movement types differ in how dependent their interpretation is on other co-occurring signs in other mediums. While a headshake is connected to its composite utterance, its function does not rely on other signs to the same extent as the function of a separative head nod. Nonetheless, they are all part of intentional communicative actions which, according to Enfield (2005: 17), are driven by a pragmatic unity: the "unified, single, addressed utterance–meaning".

4.2 Signification with the head and other parts of a signer's body: Central semiotic features

It is not surprising that different sign mediums in sign language discourse form a whole, and that different body parts share features in terms of what types of (and how) signs are created with them. However, I argue that there are differences in the central semiotic features signaled with different body parts. This *semiotic versatility* (Wagner et al. 2014: 209) is a feature that is evident in the communication and interaction of speakers as well as signers. Hands convey information regarding shape and size better than speech, while the face is well suited for expressing feelings and attitudes (Wagner et al. 2014). I argue, further, that in addition to approaching the signification of signers as a holistic social action that embodies a cluster of semiotic signs, it is important to discuss the potential differences in the pivotal features of these sign mediums (hands, face, head, body). This requires both that we investigate signification while focusing on signers' specific body part(s) and that we investigate the interrelations of these different parts of signing. In this way we might find out whether or not the central features of different sign mediums in signer's communicative actions are similar and learn more about the roles of and interplay between different nonmanual signals in signed discourse.

The view taken in this paper on the semiotic versatility of signers' actions is summarized in Table 1 with regard to each sign medium. As is shown in the table, manual signs include conventional signs, unconventional signs and hybrids of the two (see Enfield 2009). These signs show different levels of iconicity, indexicality and symbolicity (as defined in the current paper), and it is not uncommon at all for signs to present all these features simultaneously (Ferrara & Hodge 2018).[9] Manual signs have iconic features which require the analogical association of the similarities between qualities of the sign and qualities of its object. A handshape consisting of a stretched index finger used for referring to a small object such as a pen is an example of an iconic feature in a manual sign, as is the signaling of size with tracing movements or qualities of actions with manual kinematics. On the other hand, pointing and placing movements (indicating referents) and some manual kinematics and manual signs (indicating discourse structure) are examples of the indexicality of manual signs. The symbolicity of manual actions can be seen in the shared norms among signers of a language that have emerged through frequency of use and which enable lexicalization processes. Both description with partly lexical signs and enactment are common strategies through which fully lexical signs may emerge in a sign language

[9] Ferrara & Hodge (2018) apply Clark's (1996) notions of description, indication and depiction to the analysis of these different semiotic strategies in signing and speaking.

Table 1: The central semiotic features of the actions of different parts of signers' body: hands (e.g. Padden 1990; Johnston & Schembri 1999; Liddell 2003; Johnston 2013a; b; Jantunen 2016; 2017; 2019), face (e.g. Metzger 1998; Wilbur 2000; Boyes Braem & Sutton-Spence 2001; Thompson et al. 2006; 2009; Sandler 2012; Johnston et al. 2015), head and torso.

Sign Medium	Central semiotic features
Hands	Conventional signs, unconventional signs and hybrids (see Enfield 2009), including - Observer-viewpoint description: fully & partly lexical signs - Indicating referents: pointing; placing - Signaling one's own emotions and attitudes (manual kinematics) - Indicating discourse structure: parsing, separating, emphasizing (manual kinematics, pauses, pointing; buoys etc.) - Signaling grammatical information: e.g. qualities of actions or events (manual kinematics) - Etc. Enactment
Face	Lower part: some hybrids + unconventional signs, including - Observer-viewpoint description: signaling the qualities of entities and their actions, emotions, attitudes (mouth gestures & whole facial expressions) - Signaling one's own emotions and attitudes (whole facial expressions) - Indicating discourse structure: parsing (the spreading of mouthings) - Signaling language contact (mouthings) - Potential for indicating grammatical information - Potential for conventionalized symbolic signs (especially mouthing) Upper part: unconventional signs, including - Indicating referents: pointing and placing (gaze) - Indicating discourse structure: parsing & emphasis (brows & eye aperture); separating (blinks) Enactment
Head	A few hybrids + unconventional signs, including - Conventionalized reaction-based indices: negative-shakes, affirmative nod(ding) - Indicating referents: pointing & placing - Indicating discourse structure: parsing, separating, emphasizing - Movements visualizing (time) metaphors Enactment
Torso/ Whole body	No/few hybrids (shrugging?) + unconventional signs, including - Indicating referents: placing - Indicating discourse structure: parsing, emphasizing - Movements visualizing (time) metaphors Enactment

(e.g. signs that describe whole entities, shape, size or handling) (e.g. Johnston & Schembri 1999; 2010; Liddell 2003; Johnston & Ferrara 2012; Ferrara & Halvorsen 2018; Ferrara & Hodge 2018). Especially interesting is the fact that both of these iconic strategies have a two-way connection to the established lexicon: while signs may conventionalize and become fully lexical signs, this process may move in the opposite direction. That is, fully lexical signs may "turn back" to a more gradient type of signing, such as enactment, a process which is often referred to as delexicalization (Johnston & Schembri 1999; Cormier et al. 2012; Johnston & Ferrara 2012). Johnston & Ferrara (2012: 237) refer to this phenomenon as the "two faces of the sign". To conclude, the manual elements of a sign language form gradient categories (see e.g. Jantunen 2017). This is the result of the different strategies available in discourse.

A signer's face conveys a lot of information as well. All in all, signers' facial expressions are elements that characterize something. They convey information about the qualities

of referents and their actions, emotions or attitudes. For this reason, parallels have been drawn between facial expressions and grammatical classes of spoken languages, such as adverbs and adjectives (mm. Wilbur 2000; Pfau & Quer 2010; Herrmann & Pendzich 2014). These labels have been given in particular to mouth actions—elements produced with the lower parts of the face—and to whole facial expressions in general. However, a recent study (Johnston et al. 2015) has challenged the view that elements produced with the face are "linguistic markers with a grammatical function" (Herrmann & Pendzich 2014: 2149). When the form-function pairing of signers' mouth actions was studied from a large set of video material, they were found to show patterning, but not to function as conventionalized grammatical markers (Johnston et al. 2015). Instead, their use was found to be idiosyncratic, and different types of mouth actions were placed on a continuum from indexical to iconic, unconventional and finally potentially grammatical (Johnston et al. 2015). Upper parts of the face, on the other hand, have a range of indexical functions. Firstly, the direction of the eye gaze is used for pointing at present or imaginary referents or placing imaginary referents to the attention of interlocutors (e.g. Wilbur 2000; Schembri et al. 2018). Secondly, eye-brow movements and eye aperture may parse and emphasize elements, such as old and new information, or the lack of information (see e.g. Wilbur 2000; Sandler 2012). Finally, some eye-blinks, biologically driven actions for keeping the eyes moist, separate stretches of signing by indicating transitions between them (Wilbur 2000; Sandler 2012).

All in all, elements produced with a signer's face form a semiotically interesting research topic. Although different parts of the face may be distinguished on the basis of the elements they produce, the facial expression of a signer is often a unified whole which is interpreted imagistically in its entirety. Apart from the eye gaze and blinking, the upper and lower parts of the face should in this case be investigated as a whole, not only locally. Eye gaze and blinking, on the other hand, may function more independently also during more unified facial expressions (pointing and separating functions). It may be that the signals produced with the face vary in how dependent their interpretation is on other co-occurring signs in other mediums, in the same way as was suggested for different head movements. Finally, it should be noted that when it comes to actions of the face, it is difficult to distinguish between enacting, the non-enacting description of qualities of a referent, and the expression of the signer's own feelings and attitudes (see e.g. de Vos et al. 2009). The face forms a semiotically complex sign medium, which should in some cases be approached as a cluster of smaller and more specific semiotic mediums.

As can be seen from Table 1, the semiotic repertoire of head movements is in some ways more limited than that of the hands and face. The capacity to reflect or imitate visible features in the world is not as diverse for signs produced with the head as it is for signs produced with the hands and the face. The physiology and anatomy of the head (see Puupponen 2018) alone limit the potential for imitation in head movements, and actions of the head are often more approximate than those of the hands and face. Head movements may depict referents, their actions and their qualities, but this is mostly enactment. Non-enacting iconic features are not as common. Furthermore, symbolicity (as defined in the current paper) is not as prominent in the actions of the head as in that of the hands, as was presented in Section 3. Head movements seem to rarely form types for tokens, they involve more analogical association and spatio-temporal contiguity, and they include different degrees of control in their production and interpretation. The conventionality of head movements emerges most probably in the recognizable manner in which certain communicative actions are produced.

Compared with head movements, the actions of the (upper) body have an even more restricted variation in semiotic functions. As is the case with signs produced with the head, also body movements parse and emphasize elements, indicate referents by placing, and enact referents. Symbolic types for tokens are presumably rare and may emerge only in movements such as shrugging the shoulders. However, although the semiotic repertoire in signs' representative nature is more restricted than that of the hands and face, this does not mean that the body does not convey a lot of information. The diversity and richness of actions of the body is shown, for example, in the ways in which signers and speakers convey information related to their identity, state of mind, emotions and social distance with body movements that may not be intended as communicative actions (see e.g. Streeck et al. 2011).

The semiotic versatility of actions of different parts of signers' bodies may be summarized as follows: (i) Hands produce more fully lexical symbolic signs (i.e. types for tokens) than other parts of the body, indicate referents and discourse structure, signal one's own emotions and attitudes, and show semiotic flexibility (signs may emerge both as lexical signs and as more gradient and unconventional enacting); (ii) The face can enact, describe without enacting, indicate referents, and indicate discourse structure, and some signals may become more conventional symbolic signs; (iii) The head can indicate referents, indicate discourse structure, enact referents, and connect to (time) metaphors but symbolic types for tokens are rare, as is non-enacting description, (iv) The (upper) body indicates referents and discourse structure with a slightly smaller repertoire than the head, enacts referents, and connects to time metaphors. As can be seen from the summary, indexicality and iconicity are everywhere while symbolic types for tokens are primarily produced with the hands. As a result, I suggest that the potential for communicative actions of different parts of the body to produce symbolic signs in the sense of Peircean legisigns is strongest for the hands, possible for the face, rare for the head and unusual for the upper body. Thus, the signification with different parts of signers' bodies forms a continuum, from hands to body, between an abundance of symbolic content and very little symbolic content.

These differences in the central semiotic features of actions of different parts of the signer's body come back to the physical characteristics of these different sign mediums. There are differences in what kind of information can easily be conveyed with different parts of the body. Borrowing from Enfield (2009: 18), hand movements "are well suited to iconic–indexical meaning thanks to their rich potential for sharing perceptible qualities in common with physical objects and events". As Wagner et al. (2014) pointed out, the face is a convenient medium for signaling emotions and attitudes. However, tracing the movements or shape of entities is not a feature which is enabled by the physical characteristics of the face; the quantity or volume of entities, on the other hand, may be signaled with, for example, different mouth actions. The physical characteristics of the head and body are not well suited for signals that share physical qualities with physical objects and events, except for showing the actions and existence of referents through enactment. However, as with the hands and eye gaze, with the head and the body one may produce signals which point or place, for example. In this function one may also see differences between the different mediums. As the size of the body part that produces the pointing action becomes larger, so too the object of the pointing becomes less precise. Pointing with the head or the whole body is in many cases—especially when referring to referents that are not physically present—more approximate than pointing with the index finger or the whole hand/arm. Furthermore, while placing movements of the hands function well for indicating precise spatial relations between entities (micro-level), placing movements of the head or the whole body are better suited for large scale thematic, textual

and syntactic sequencing (macro-level). Finally, semiotic versatility in the signs produced with different body parts applies to speakers as well as signers. When looking at, for example, the comprehensive literature review on co-speech head gesturing carried out by Wagner et al. (2014), there are evident similarities between speakers' and signers' head movements, and comparing their forms and functions raises many interesting questions for future research.

5 Including non-manuality in a theory of language

The actions of a signer's face, head and body are idiosyncratic, multifunctional, and gradient elements in sign languages. The "units" produced nonmanually do not form discrete categories, and they are not directly parallel to words and affixes in spoken languages (except, e.g. deictic words, onomatopoeia and ideophones, see e.g. Dingemanse 2017). Signers' head movements, for example, are often optional (see Section 3; also Puupponen et al. 2015; 2016). If one disregards the challenge of defining the linguistic status of nonmanuals and studies first their essence as semiotic signs, we find that signers nonmanually produce signs which vary in the extent to which they contain iconic, indexical and symbolic features. This type of wide approach could include in its analysis elements which might not interest a linguist or a gesture researcher, such as movements which are not produced or interpreted as means of communication but which are rather just a canvas onto which semiotically motivated features present themselves (e.g. a physical tremor). These movements can also be interpreted as signals for something, although they do not actually have communicative intent (stretching one's back, for example). In other words, the investigation may be focused on elements that are communicational in a wider or a more restricted respect, depending on the theoretical approach. In the current paper, the focus has been on head movements that are part of intentional communicative actions (see Kendon 2004; Enfield 2009), but which may show different degrees of control in their production and interpretation while still organizing information into understandable structures. However, the head movement typology presented in the current paper could be extended to include treatment of non-intentionally communicative head movements.

The strength of a more or less wide approach is that it does not automatically exclude elements: when the focus is wide, elements are not left outside the scope of the study (although things do align as peripheral and prototypical in the long run). If the focus is more predetermined—e.g. a formalism for spoken natural language—phenomena which do not fit the premises of the underlying theory may be omitted from the investigation. In the case of nonmanuality, this might lead to nonmanual cues, which are considered "paralinguistic" from the viewpoint of a specific linguistic theory, not being included in the analysis. Given that gradience and unconventionality are characteristic of nonmanuality, this may lead to the exclusion of a significant amount of nonmanual activity from the investigation. On the other hand, it may be that nonmanuals are investigated more broadly, but the interpretation of their functions is affected by assumptions determined by the underlying theory. If the theory presupposes that the elements which it describes are categorical and can be explained according to a fixed set of rules, rules may be formulated without sufficient evidence of their generalizability, or elements that do not "materialize" according to these rules may be seen as exceptions, anomalies. In both cases there is a risk that the theoretical view of the subject—in this case nonmanuality—will become distorted.

Kendon (2014: 3) suggests that, instead of trying to define an interface between "language" and "non-language", we should try to "distinguish these different [semiotic] systems, at the same time analysing their interrelations". With relation to Peircean semiotics, this would mean extending the analysis from symbolic signs with possible iconic and

indexical features to include also iconic and indexical signs which are not legisigns, that is, which do not show the level of conventionalization that symbolic types for tokens do. In the investigation of sign languages this means that, in addition to including in the theoretical description both the conventional/distinctive and gradient/unconventional features of manual elements, one would also have to include the (mostly) gradient/unconventional nonmanual cues. As Kendon (ibid.) points out, the pursuit of understanding how meaningful utterances are successfully conveyed "will require that we incorporate in a systematic way these other systems that do not admit of a formal-linguistic analysis" (see also Liddell 2003). The arguments made about nonmanuality in the current paper follow this line of thought, with the exception that nonmanuals traditionally defined as "linguistic" and "nonlinguistic" are not seen as semiotically two different systems. Instead, nonmanuality is understood as a part of signers' embodied signification, in which semiotic signs are created and interpreted according to their iconic, indexical and potentially symbolic features. I argue that not only manual signs but also nonmanual signs have *two faces* (see Johnston & Ferrara 2012). Types for tokens may emerge from iconic and indexical nonmanual cues, and on the other hand, elements which may have a more conventional or schematized form-function connection may be used in gradient and unconventional depiction. To be more precise, the stance taken in this paper is that nonmanual signs have *many faces*. Nonmanuals are not two-faced as they rarely show a similar level of symbolicity as conventional fully lexical manual signs. Nonmanual cues come into existence in each signification process (semiosis) and their interpretation calls for several options: understanding a typicality or habit; the observation of an actual relationship between coexisting things; and an imagistic recognition of likeness.

On the basis of the issues discussed in this paper I argue that, in order to understand nonmanuals and their role in a sign language, we must also take into account non-symbolic, unconventional and gradient nonmanual signs. These cues cannot be defined simply as either language or non-language as their interpretation varies situationally, they are often optional, and their form-function patterning shows levels of entrenchment (see e.g. Wilcox & Xavier 2013) rather than actual conventionality. Therefore, in order to understand how different types of semiotic processes are connected when signers communicate with meaningful utterances, we must look at how signers act and what they do with language. This means including in the theoretical description of a sign language both elements which form discrete categories and elements which form gradient categories or only show tendencies/inclinations (e.g. gestural features of speech and co-speech gesturing). This means, for example, that variation is regarded as a premise—something which is difficult to achieve if one follows strictly any given formalism. Cognitive and functional approaches to language give room for including both strongly symbolic and less symbolic dimensions of signification in a theory of language.

6 Beyond signs? Nonmanuals and embodiment in interaction

Whether or not one includes the gradient and unconventional aspects of nonmanuals in a theoretical description of language, we are likely to agree that nonmanual cues are semiotic signs that are significant for signed interaction. Another question is how one sees the connection between the nonmanual and manual actions of signers and human bodily actions in general, and how these are related to our cognitive and social reality. A fact which is relevant for all signification in sign languages is that the physical ground for iconic, indexical and symbolic nonmanual signs includes not only visual but also sensorimotor processes. The discussion presented in this section supports the view that human interaction emerges through the moving, active "enculturated living body"

(Streeck 2015: 432) engaging the world kinesthetically and haptically as well as visually and/or auditorily. Signification, and human cognition in general, are inextricably connected to the ways we navigate in our animate and inanimate surroundings. When it comes to the topic of the current paper, this issue is evident, for example, in the exclusive and inclusive movements of the head or the whole upper body, presented in Section 3.2.2. I argue for the view that these movements—as well as many other head movements—are acts of signification that are visibly connected to the embodied human experience, action and existence in the world.

Whether or not all nonmanual actions should be seen as semiotic signs is, however, another matter. According to Streeck (2015: 430), "transparently meaningful" bodily actions exist beyond semiotic signification:

> "The bodily actions of others can be transparently meaningful for us without thereby becoming signs; signs originate when actions are performed specifically for communicative purposes. [–] Intelligible, embodied social action does not require that its significance be expressed—or expressible—in signs."

In this approach, semiotic signification is seen as a part of a larger ecology of interaction in which the embodied agency of a human being comes together situationally with other actors, medias of communication (including languaging-gesturing), skills, conventions, animate and inanimate surroundings, and the storage of information in these surroundings (Ingold 2011; Streeck 2015). Together these different dimensions create a web in which semiotic action, communicating with signs, forms one part. According to Streeck (2015), embodied communication is only partly semiotic. An interesting question for future research is, however, what exactly are these embodied actions which are significant for interaction but which are not signs, and further, how are they interpreted?

In the end, at the core of this discussion is how one defines a sign and the act of signification. The Peircean definition of a sign is very broad. Signs need not involve conventional or communicative intent but they may still be interpreted as signs, and through habit or regularity of interpretation they may become conventionalized signs with new requirements regarding their interpretation. For example, many indexical signs may be reflex-like, physical, subconscious or semi-conscious activities, as was pointed out in Sections 2 and 3 of the current paper. Events such as blushing or directing one's gaze may emerge involuntarily, with less control, but can still be interpreted as significant. Signs may be physical events, such as dark clouds or the sound of water drops hitting a surface, which are not consciously communicated but are still interpreted as indices for approaching or already falling rain. This ability to interpret signs, to view events, actions or entities as standing for something else, is the dimension of signification which is emphasized in Peircean semiotics. Considering this, one might argue that Streeck's transparently meaningful actions are in fact signs in the Peircean sense, if they are interpreted as significant. This would, however, entail that although all actions and events are not signification, all communication and cognition are signification and interpretation of signs.

It is evident that, according to Peirce (1894; 1903a; b), not all action is signification. The universal categories in our experience of reality include different levels of consciousness, while only thirdness is actually linked to thinking. In Peircean trichonomies, the different levels are not disconnected but show different aspects of human experience, thought and action. Peirce's qualisigns, for example, are qualities that may potentially become signs, but they do not actually perform as such. We are surrounded and involved with different types of embodied activity, which includes different levels of social interpretation. With

regard to nonmanuals, it is suggested here, as a hypothesis for future research, that signs produced with the signer's face, head or body may be produced with more or less control and intention (see Figure 1) and still be interpreted as signs for something else because they connect to co-occurring signs from other sign mediums (see Enfield 2009). It is also suggested that actions such as blinking or nodding one's head sentence-finally in signed discourse may be produced with less control than other head movements, and that they may not involve conscious interpretation, either. Nonetheless, whether or not they can be seen as including intentionality or reference by themselves, they organize the discourse (production, interpretation and negotiation of information) moment by moment in interaction. It is an interesting question how this embodied activity is relevant for interaction. The matter of whether these actions elicit representation or not is another interesting question for future research, that is, *how* these types of signs actually guide our action, thought and communication.

7 Conclusion

This paper presented a semiotic typology of signers' head movements and their iconic, indexical and symbolic features, as well as a discussion of semiotic diversity in the actions of a signer's body. It presented the view that indexicality is a prominent feature in the actions of the head, and that it is most evident in movements that indicate referents (pointing, placing), discourse structure (parsing, separating and emphasizing), or information behind a reaction (nodding, shaking, exclusive/inclusive movements). A few of these signals may become more conventional or schematized, as has happened with headshakes and head nodding, but these symbolic types for tokens are rare. The conventionality of head movements is more likely to emerge in the recognizable manner in which certain communicative actions are produced than as shared norms that connect specific forms to specific functions. In addition, iconic signification is central in head movements that enact referents or visually connect to (time) metaphors. All in all, non-enacting description of referents is presumed to be a less prominent feature in head movements. Furthermore, the paper suggested that different types of head movements involve different proportions of iconic, indexical and symbolic strategies of signification, and that, in general, symbolicity is not the most common strategy.

The paper concluded that while all head movements are a part of semiotically complex utterances—consisting of several signs from different sign mediums and driven by unified intentional social actions—they differ in how dependent their interpretation is on other co-occurring signs from other sign mediums, and in the degree of control exercised in their production and interpretation. The paper suggested that in signification with different parts of the signer's body, there are some differences in the central semiotic features, and that the actions of the head and the body are involved in a more restricted repertoire of signification in intentionally communicative actions than are the hands and the face. This means that, although head and body movements are in many ways significant and emerge frequently in discourse, they form a collection of signs with less semiotic diversity than is shown by signs produced with the hands and the face. Their interpretation mostly involves an observation of spatio-temporal contiguity (i.e. indexicality) and analogical association of perceivable qualities (i.e. iconicity). Finally, the functions of nonmanuals such as head movements are seen as inseparably connected to human embodied experience and action in the world, regardless of their degree of conventionality or schematicity. This is seen as support for a wide functional approach that considers non-symbolic and unconventional head and body movements and other nonmanual signs to have an essential place in the theoretical description of languages.

Abbreviations

INDEX = a pointing action with the index finger (except pointing to the 1st person), ONE-LIST = a manual list construction referring to the first listed item or topic, h2 = a sign is produced with the non-dominant hand, [–] = gloss for a sign requires several words, e.g. FIRST-TIME, [+] = several signs are produced as a prosodically unified sequence, e.g. YOUNGER + INDEX

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Competing Interests

The author has no competing interests to declare.

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