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The Complexity of Lexical Movements in FinSL

Abstract

The study presented in this article contributes to the analysis of movement in Finnish Sign Language (FinSL) by investigating its complexity.[1] In the study, manual and nonmanual movements were treated as commensurable, and complexity was seen as a property of a movement which correlates with the number of articulators and joints used in its production. Using the lexical data provided by the Basic Dictionary of FinSL, several types of movement varying in their degree of complexity were identified. The main finding of the study was that the distribution of movements followed the linguistic principle known as *Zipf's Law* derived from spoken language: the least complex movements occurred most frequently, and an increase in complexity was associated with a decrease in frequency. FinSL was thus shown to be similar to spoken languages in its preference for simple forms. Hypotheses about the behaviour of movements, as well as theoretical implications, are discussed.

1. Introduction

This article investigates the complexity of movement in Finnish Sign Language (FinSL) lexemes. The study is based on the empirical portion of my postgraduate thesis (licenciate thesis) (Jantunen 2005) and it builds on the idea of movement complexity introduced in Brentari (1998), with the innovation of treating manual and nonmanual movements as commensurable. So far, the complexity of movement in FinSL lexemes has not been studied and previous research has focused mainly on the study of movement phonemes (Rissanen 1985: 77–87, Savolainen 2000a: 179–183) as well as certain morphological (Rissanen 1985: 91–126, 1987) and phonetic processes (Fuchs 2004).

[1] I wish to thank Fred Karlsson and Päivi Rainò for discussion on the theme of this article, and especially for their constructive criticism of my earlier view (Jantunen 2005) of movement complexity and its relation to signed syllables and their structure.

A Man of Measure
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2. Movement and its complexity

The term *movement* has been used in different senses by different researchers (for an overview, see Crasborn 2001: 93–98). In this article, I will use the term as a label for those dynamic properties in a sign stream that are both sign-internal (i.e. not transitional) and lexical (i.e. specified underlyingly) (cf. Brentari 1998: 129). In principle, this usage of the term is in accordance with Rissanen (1985, 1987) and Savolainen (2000a), but deviates from Fuchs (2004) who deals also with transitional movements.

2.1 Manual and nonmanual movements

Movements can be manually and/or nonmanually produced. *Manual movements* are movements made by the hands, and they can be divided into two classes: *path movements* and *local movements* (Rissanen 1985: 78, Brentari 1998: 4). Path movements are articulated by the elbow or shoulder joint and they result in a discrete change of place of articulation in the sign space on the body (e.g. VALTA$_{472}$ 'power')[2] or in the external space in front of the signer (e.g. PÄIVÄ$_{223}$ 'a day') (Brentari 1998: 129). Local movements are articulated by the wrist or the finger joints and they result in a change of handshape (e.g. KUKKA$_{1142}$ 'a flower') or orientation of the hands (e.g. AUTOMAATTI$_{1007}$ 'an automaton'), or a trilled movement (e.g. SUOLA$_{936}$ 'salt') (id., 130).

Nonmanual movements are movements made by articulators other than the hands. Traditionally, nonmanuality has been more or less neglected in phonological analysis, and this may be one of the factors that have caused the current situation in FinSL research where there is no consensus as to what exactly the nonmanual articulators are and what is hence the exact nature of nonmanual movements (cf. Rissanen 1985: 20, Pimiä 1987: 27, Savolainen 2000a: 183–184, Takkinen 2002: 34, Fuchs 2004: 225–243). In Jantunen (2005), I have given the status of nonmanual articulator to the *mouth*, *head* and *torso* on the grounds that they are the

[2] In the text, signs are referred to as glosses which are to be understood as rough translations of the meanings of signs. Following the standard convention in sign language research, the glosses are written in capital letters (see e.g. Savolainen 2000b: 192–195). All glosses referring to FinSL signs are accompanied with a subscript index which is the number of the lexical entry in the Basic Dictionary of FinSL (Malm (ed.) 1998) and its web-version *Suvi*.

only nonmanual articulators found in the *Suomalaisen viittomakielen perussanakirja* (Basic Dictionary of FinSL; Malm (ed.) 1998) which are independently responsible for the production of a lexical movement (cf. KYLLÄ$_{1219}$ 'yes', ON-KUULLUT$_{560}$ 'has/have heard' and MUKAVA$_{1109}$ 'nice', respectively). Although in itself arbitrary, this stipulation is essential to the study presented in this article (see Chapter 3).

Not all mouth movements deserve the status of lexical movement. In most sign languages there are two types of mouth movement: *mouthings*, which are usually silently produced (parts of) spoken words, and *mouth gestures*, which have, at least synchronically, no connection to spoken language (e.g. Rainò 2002). Following Hohenberger and Happ (2002), I will consider only mouth gestures to be lexical elements; mouthings I take to be phonologically irrelevant though frequently occurring code-mixing. One clear fact supporting this decision is the observation that in language contact situations mouthings, but not mouth gestures, are usually dropped (Rainò 2002: 41).

In this article, manual and nonmanual movements are treated as commensurable. There are three main arguments for this decision: (1) signs containing only nonmanual movements are as well-formed as signs containing only manual movements (cf. KYLLÄ, ON-KUULLUT, and MUKAVA); (2) in signs containing both manual and nonmanual movements, the nonmanual movements are structurally as essential as the manual ones (cf. LÄHTEÄ$_{865}$ 'to go'); (3) the production of the abstract shape of a movement does not depend upon the articulator. The last argument refers to the so-called movement migration phenomenon, that is, for example, to the process through which the abstract shape of the default manual movement in the sign HÄMMÄSTYÄ$_{1000}$ 'to surprise' is enhanced with a nonmanual body movement of similar shape (Jantunen 2005: 41–45; see also Brentari 1998: 220–224, Crasborn 2001: 163–261).

2.2 Complexity of movement

Brentari (1998) classifies movements as either simple or complex. *Simple movements* are defined as movements involving a single local or path movement (e.g. MUSTA$_2$ 'black') whereas *complex movements* are considered to be movements involving more than one co-occurring local or path movement (e.g. KULTTUURI$_{1182}$ 'culture') (id., 237). In general, complexity is understood to be a property of a movement which correlates with the number of joints used in the movement's production.

The definition of complexity given in Brentari (1998) is not sufficient since it deals only with manual movements. In order to cover also nonmanual movements, I suggest that the definition be expanded so that a movement is taken to be complex also when it is produced with more than one articulator. This suggestion relies on the arguments presented in the previous chapter for the commensurability of manual and nonmanual movements (see also Jantunen 2005: 35–47). In practice, it means that the movement in UJO_{268} 'shy', for example, is more complex than the movement in MUSTA since UJO contains both a local movement and a head movement whereas MUSTA has only a path movement.

Complexity of movement is thus here considered to correlate with the number of joints and articulators, or parallel subcomponents, used in the production of movement.

3. An analysis of the complexity of lexical movements in FinSL

3.1 Data and method

In the analysis of movement in FinSL, 231 signs were investigated, all of them taken from the Basic Dictionary of FinSL (Malm (ed.) 1998). In practice, the data consisted of lexemes in the dictionary which were (i) maximally one-handed, (ii) monomorphemic, and (iii) produced with a single sequential movement (as defined in Brentari 1998: 205–206).[3] If a lexical entry contained general information about alternative ways to produce a sign, then the relationship between analysed signs and lexical entries was many-to-one; otherwise the relationship was one-to-one.

All signs were grouped into subtypes according to the complexity of movement involved. For the reasons explained in Chapter 2, manual and nonmanual movements were considered to be commensurable, but signs were further grouped according to the nature of the articulators used in their production. The movements involved in the signs were checked from

[3] The criteria for choosing the data were all syllable-related (for a discussion see Brentari 1998: 227-230 and Jantunen 2005: 66–70). In practice, they ruled out signs like $VIITTOA_{1003}$ 'to sign' (two hands and more than one sequential movement), and $EI\text{-}TIEDÄ_{10}$ 'does not know' (a negative derivative consisting of two sequential morphemes). Despite efforts to limit the data exclusively to monomorphemic lexemes, some signs in the data, especially those containing mouth movements, are still likely to be multimorphemic (cf. Pimiä 1987, Rainò 2002).

the video provided in the web version of the Basic Dictionary of FinSL (Malm (ed.) 1998), *Suvi*, although the video contained the phonetic realisations of the signs and only the phonological realisations were of interest. *Suvi* was especially useful in distinguishing between mouth postures and movements. In making the distinction, the following rule was observed: all mouth gestures were classified as movements, except for those relevant to this study marked in the dictionary with the symbols [h^{yy}], [^{yy}], [šš], [θ] and [^{ii}] or with the phrases *huulet yhdessä* 'lips together' and *posket pullistuneet* 'puffed cheeks' (all with their different variants). It should be noted that the symbol [B] and its variants were interpreted as movements since in many cases [B] is either opening or closing *b*. The distribution of movements into subtypes was analysed statistically. Although the sample was rather small for statistical analysis (n=231), from the evidence of other similar studies (e.g. Hakulinen & al. 1980), it is believed to be predictive in FinSL in general.

3.2 The results

In the course of the analysis, four main types of movement varying in their degree of complexity emerged: movements with only one subcomponent, movements with two subcomponents, movements with three subcomponents and movements with four subcomponents. In the remainder of this article they are referred to as *simple*, *complex*, *supercomplex* and *hypercomplex* movements, respectively.

1. THE MAIN MOVEMENT TYPES IN FINSL (TABLE 1). Simple movements (e.g. MUSTA 'black', MUKAVA 'nice', ON-KUULLUT 'has/have heard', and a variant of KYLLÄ 'yes') were the most common movements in the data (57 %). Complex movements (e.g. $HENKI_{1107}$ 'spirit', KULTTUURI 'culture', UJO 'shy' and $KOVIN\text{-}PIENI_{586}$ 'very little') were also common (35 %). Supercomplex movements (e.g. $MIES_{1025}$ 'a man', $VÄHÄN_{1190}$ 'a little', and LÄHTEÄ 'to go') were rarer (8 %), and hypercomplex movements are best characterised as exceptions (less than 1 %): in fact, only one sign in the data, $EI\text{-}TUNNE_{1148}$ 'does not know him/her', involved a movement analysable as hypercomplex. The division of movements into the four main movement types follows the well-known linguistic principle called *Zipf's Law*: the least complex forms are the most common forms in a language and an increase in complexity is matched by a decrease in frequency (Zipf 1949).

movement type	n	%
simple	131	57
complex	80	35
supercomplex	19	8
hypercomplex	1	–
Σ	*231*	*100*

Table 1. Division of movements into the four main movement types in the data.

2. THE SUBSTRUCTURE OF THE MAIN MOVEMENT TYPES (TABLE 2). A simple movement was most typically (96%) a manual movement (in many cases a straight path movement). Manuality was the dominant feature also with the signs containing complex movements; 86% of all complex movements in the data were manually produced (typically simultaneous combinations of a straight path movement and a some sort of local movement). Supercomplex movements consisted most commonly of a complex manual part (typically co-occurring path and local movements) and a simple nonmanual part (mouth movement); 63% of all supercomplex movements in the data had this substructure. The subparts of the only hypercomplex movement in the data were supercomplex manual movement (path movement and complex local movement) and simple nonmanual movement (mouth movement).

main type	subtype	n	%
simple	simple manual	126	96
	simple nonmanual	5	4
	Σ	*131*	*100*
complex	complex manual	69	86
	simple manual and nonmanual	9	11
	complex nonmanual	2	3
	Σ	*80*	*100*
supercomplex	complex manual and simple nonmanual	12	63
	supercomplex manual	7	37
	Σ	*19*	*100*
hypercomplex	supercomplex manual and simple nonmanual	1	–

Table 2. The subtypes of the four main movement types and their distribution in the data.

Nonmanuality was rare in both simple movements (4%) and in complex movements; of the complex movements in the data, 14% contained nonmanuality, and only 3% were produced completely with nonmanual articulators (always head and mouth). Nonmanuality was the norm in supercomplex movements (63%); supercomplex movements produced solely with manual articulators were less typical (37%). From the data it appears that hypercomplex movement cannot be identified without paying attention to nonmanual articulators.

Two further generalizations can be made on the basis of the data: (1) substructurally, manually produced movements can contain at most three subcomponents and, again substructurally, (2) nonmanually produced movements can contain at most two subcomponents.

3. THE USE OF MANUAL AND NONMANUAL ARTICULATORS (TABLE 3). Movements in the data were most typically manually produced (87%). If a nonmanual articulator was involved, then it was most likely to be layered with a manual articulator (10%). Movements that were produced only with nonmanual articulators were rare (3%).

articulator type	**n**	**%**
manual	202	87
manual and nonmanual	22	10
nonmanual	7	3
Σ	*231*	*100*

Table 3. Use of manual and nonmanual articulators in the data.

3.3 Discussion: hypotheses and theoretical implications

On the basis of the data and the results, two predictions can be made with reference to the synchronic and diachronic behaviour of lexical movements in FinSL: (1) nonmanual movements will tend to be dropped (because of their infrequency) and (2) movements in general will tend to be reduced in complexity (because simple movements are the most frequent).[4] So far,

[4] There seems to be a limit to this reduction, that is, movements cannot be dropped completely. There are a few signs in FinSL which contain no lexical movement (e.g. most hand alphabets and numerals from 0-8). Interestingly, in their synchronic production, these signs are usually inserted a short straight epenthetic movement (Jantunen & Savolainen 2002: 22, Jantunen 2005: 93-95; cf. Brentari 1998: 75).

both predictions can be said to have gained some empirical support in FinSL. Concerning the first prediction, Jantunen (2003) has shown that in the diachronic development of signs the responsibility of conveying lexical content tends to shift from nonmanual articulators to manual articulators. Moreover, in the language of younger deaf people the mouth movements no longer seem to be so essential (cf. Rainò 2004: 48). Concerning the second prediction, synchronically, complex movements tend to reduce in complexity. For example, the sign VÄHÄN 'a little', which in its basic form has a supercomplex manual movement, is in many cases produced only with a complex movement (straight movement and handshape change), or even with a simple movement alone (handshape change). The reduction in complexity can be explained in terms of ease of articulation (cf. *Zipf's Law*).

The research described in this article has certain theoretical implications, too. Because all the lexemes used in the study contain only one sequential movement, and since such a movement is a working correlate of a signed syllable (Brentari 1998: 205), the four main movement types found in the study could also be viewed as the main syllable types in FinSL. However, since the signed syllable is not a clear concept (see Corina & Sandler 1993: 185–201) and would require a lot of elucidation, the theoretical implications cannot be further pursued here.

4. Conclusion

In this article, I have examined the complexity of lexical movements in FinSL, defining complexity as a property of a movement which correlates with the number of subcomponents (joints and articulators) used in its production. As a main result of my analysis, four main types of movement varying in their degree of complexity have emerged: simple, complex, supercomplex and hypercomplex movements. Since the distribution of movements into these types follows the linguistic principle known as *Zipf's Law*, which is derived from spoken language, it is concluded that FinSL is similar to spoken languages in its preference for simple forms. On the basis of the results, I have presented two hypotheses about the synchronic and diachronic behaviour of movements in FinSL: nonmanual movements will be dropped and movements in general will be reduced in complexity. The proper testing of these hypotheses is left to future study.

References

Boyes Braem, Penny & Rachel Sutton-Spence (eds.) (2002) *The Hands Are the Head of the Mouth: The mouth as articulator in sign languages*. International Studies on Sign Language and Communication of the Deaf 39. Hamburg: SIGNUM Verlag.

Brentari, Diane (1998) *A Prosodic Model of Sign Language Phonology*. Cambridge, MA & London: A Bradford Book.

Corina, David & Wendy Sandler (1993) On the Nature of Phonological Structure in Sign Language. *Phonology* 10: 165–201.

Crasborn, Onno (2001) *Phonetic Implementation of Phonological Categories in Sign Language of the Netherlands*. LOT Dissertation Series 48. Utrecht: LOT.

Fuchs, Bertold (2004) *Phonetische Aspekte einer Didaktik der Finnischen Gebärdensprache als Fremdsprache*. Jyväskylä Studies in Humanities 21. Jyväskylä: The University of Jyväskylä.

Hakulinen, Auli, Fred Karlsson & Maria Vilkuna (1980) *Suomen tekstilauseiden piirteitä: kvantitatiivinen tutkimus*. Publications of the Department of General Linguistics 6. Helsinki: University of Helsinki.

Hohenberger, Annette & Daniela Happ (2002) The Linguistic primacy of signs and mouth gestures over mouthings: Evidence from language production in German Sign Language (DGS). In Boyes Braem & Sutton-Spence (eds.), pp. 153–190.

Jantunen, Tommi (2003) Viittomien historiallinen muutos ja deikonisaatio suomalaisessa viittomakielessä. *Puhe ja kieli* 23: 43–60.

—— (2005) *Mistä on pienet tavut tehty? Analyysi suomalaisen viittomakielen tavusta prosodisen mallin viitekehyksessä.* Licenciate thesis, University of Jyväskylä, Department of languages, Finnish Sign Language.

Jantunen, Tommi & Savolainen, Leena (eds.) (2002) *Suomalaisen viittomakielen perussanakirja. Täydennysosa 1: Numeroita ja lukumäärien ilmaisuja*. Helsinki: KL Support Oy.

Malm, Anja (ed.) (1998) *Suomalaisen viittomakielen perussanakirja*. Kotimaisten kielten tutkimuskeskuksen julkaisuja 104. Helsinki: KL Support Oy.

—— (ed.) (2000) *Viittomakieliset Suomessa*. Helsinki: Finn Lectura.

Pimiä [= Rainò], Päivi (1987) Suomalaisen viittomakielen suunliikkeistä. In Pimiä & Rissanen, pp. 25–47.

Pimiä, Päivi & Rissanen, Terhi (1987) *Kolme kirjoitusta viittomakielestä*. Publications of the Department of General Linguistics 17. Helsinki: University of Helsinki.

Rainò, Päivi (2002) Mouthings and mouth gestures in Finnish Sign Language. In Boyes Braem & Sutton-Spence (eds.), pp. 41–50.

—— (2004) *Henkilöviittomien synty ja kehitys suomalaisessa viittomakieliyhteisössä*. PhD Dissertation, University of Helsinki. Deaf Studies in Finland 2. Helsinki: Kuurojen Liitto ry. [html based CD-ROM]

Rissanen, Terhi (1985) *Viittomakielen perusrakenne*. Publications of the Department of General Linguistics 12. Helsinki: University of Helsinki.

—— (1987) Toistoprosesseista kuurojen viittomakielessä. In Pimiä & Rissanen, pp. 1–24.

Savolainen, Leena (2000a) Viittoman rakenne. In Malm (ed.), pp. 168–188.

—— (2000b) Viittomakielten erilaiset muistiinmerkitsemistavat. In Malm (ed.), pp. 189–200.

Suvi = Suvi – Suomalaisen viittomakielen verkkosanakirja. [Helsinki]: Kuurojen Liitto ry, 2003. Online publication, URL: http://suvi.viittomat.net. 11.6.2003.

Takkinen, Ritva (2002) *Käsimuotojen salat. Viittomakielisten lasten käsimuotojen omaksuminen 2–7 vuoden iässä*. PhD Dissertation, University of Jyväskylä. Deaf Studies in Finland 1. Helsinki: Kuurojen Liitto ry.

Zipf, George Kingsley (1949) *Human Behaviour and the Principle of Least Effort*. Cambridge, MA: Addison-Wesley.

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