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Cross-modal iconicity and indexicality in the production of lexical sensory and emotional signs in Finnish Sign Language

Abstract: In the present study, cross-modal (i.e., across sensory modalities such as smell and sound) iconicity (i.e., resemblance) and indexicality (i.e., contiguity) in lexical sensory and emotional signs in Finnish Sign Language will be considered from an articulatory perspective (i.e., the production of signs). Such cross-modal iconicity has not been extensively studied previously, so here, with the help of cognitive semiotics, I aim to carefully describe the cross-modal patterns observed across 118 signs, including 60 sensory signs and 58 emotional signs. The analysis is framed within the theoretical model of Semiotic Hierarchy, which entails a non-reductionist view of meaning. In addition, a pheno-methodological triangulation will be applied: phenomenology (first-person method), literature of phenomenological and semiotic descriptions (second-person perspective) and experimental findings (third-person perspective). The results of this analysis show that (a) 71 of the 118 sensory and emotional signs are cross-modally indexical, (b) only 10 of the 71 signs can be regarded as cross-modally iconic, (c) cross-modal iconicity is highly diagrammatic, (d) iconicity and indexicality are highly integrated, and (e) articulatory feedback matters in the formation of semiotic patterns. This study contributes to our understanding of cross-modal iconicity in signed languages, as well as studies in semiotic systems more generally.

Keywords: cross-modal; iconicity; indexicality; cognitive semiotics; signed language

1 Introduction

According to the doctrines of semiotics, the (semiotic) sign,[1] as put forth by Charles Sanders Peirce and re-interpreted by later scholars (e.g., Jakobson 1965; Sonesson

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1 To avoid terminological vagueness, the term *semiotic sign* (in short, S-sign) refers to the concept of a sign used in the field of semiotics. The term *sign* refers to a lexeme produced in signed language.

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2016), is any meaningful expression (e.g., sign, word, or photo) comprised of three different parts (Sonesson 2016: 9): a *semiotic sign* (henceforth, S-sign) stands for its *object* ('what about') through an interpretation by someone (*interpretant*). Moreover, an S-sign stands for its object based on grounds ('ways') with varying predominance: *iconicity* (resemblance), *indexicality* (contiguity), and *symbolicity* (conventionality). The sign BIRD, 'a bird', in Finnish Sign Language (FinSL), is an example of a semiotic sign. The flapping hands look like flapping wings (iconicity); the flapping wings indicate the whole body of the bird (e.g., eyes and beak) (indexicality); and the sign is conventional in the FinSL community (symbolicity). I will investigate cross-modal iconicity and indexicality in the production of lexical signs[2] that semantically relate to senses and emotions in FinSL.

In signed language (and gesture), gestural expressions (produced by the hands, head, and body) are primarily perceived by vision. The affordances of the gestural–visual system lends itself to the iconic expression of actions and entities. Recently, in addition to symbolicity, iconicity has been increasingly regarded as a general property of signed and spoken language (e.g., Perniss et al. 2010; see also Ahlner and Zlatev 2010; Devylder 2018; Dingemanse 2011; Cormier et al. 2015; Jakobson 1965; Taub 2001).

There are different types of iconicity, and they can occur at all levels of linguistic structure (e.g., prosody, phonemes, and syntax) (see review by Taub 2001). Relating iconicity to sensory modality, we find that *intramodal iconicity* is a kind of a resemblance that stays within the same sensory modality (e.g., Giraldo 2020: 43). For example, the voiced onomatopoetic word *meow* resembles a sound that a cat makes (sound–sound). The FinSL sign BIRD visually looks like the way a bird flaps its wings (visual–visual).

In contrast to intramodal iconicity, *cross-modal iconicity* (also known as synesthetic sound symbolism; Hinton et al. 1994, or synaesthetic metaphors; Ramachandran and Hubbard 2001) occurs when an S-sign resembles an object across sensory modalities (Ahlner and Zlatev 2010). Sapir's (1929) experiments, where English speakers were asked to match fictive words including contrast vowels (e.g., *mil* and *mal*) with a large or a small object, show a high degree of consistency in the results of the task. Later studies also show similar reports. The fictive words *bouba* and *kiki* are matched with round, soft objects, and sharp, hard objects, respectively (e.g., Ramachandran and Hubbard 2001). Perception of these sound–haptics–proprioception iconic words are based on gestalt sound patterns (e.g., mumu), rather than individual phonemes (e.g., m, u) (Ahlner and Zlatev 2010). A word can also resemble experiential properties other than sensory properties. In an example from Japanese, the word *sowasowa* refers to a

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2 Simply put, the term "lexical signs" commonly refers to conventionally fixed units in a sign language vocabulary, in contrast to non-lexical or less lexical signs, which are more like "ad hoc" or "depictive" units.

psychological state "restlessness due to anxiety before an important event" (Vigliocco and Kita 2006). Such iconic spoken expressions for non-auditory properties are found in many spoken languages, especially in several Asian and African languages (Dingemanse 2011; Perniss et al. 2010).

While some work has been done on such cross-modal iconicity in spoken languages, there has been less attention to cross-modal iconicity in sign languages. This may be explained by the vision-centric bias in both scientific and folk discussions where signed language iconicity is conceived primarily as visual. DeMatteo's (1977) work, "Visual Imagery and Visual Analogues in American Sign Language," is an example of this bias. Although some researchers have investigated iconicity, metaphor, and metonymy in signed language from the sensory (and experiential) perspective, they have not provided any descriptions of cross-modal iconicity (e.g., Taub 2001; Zeshan and Palfreyman 2019). In the context of sign language linguistics, Napoli (2017) stands out, as she explicitly considers the phenomenon of cross-modal iconicity. More recently, Keränen (2021) has also discussed the concept.

Turning to indexicality, some signed language linguists have recognised that metonymy (or indexicality, as termed by semioticians) can overlap with iconicity, although there has been little focused research attention on this (e.g., Emmorey 2014; Taub 2001; Zeshan and Palfreyman 2019; exceptionally Wilcox et al. 2003). Taub (2001: 76) comments that iconic bodily movement can metonymically represent, for example, the concept of 'karate'. Zeshan and Palfreyman (2019) explain that the places of articulation around the body (e.g., eyes, and nose) often metonymically refer to the sense-related meanings affiliated with those locations (e.g., seeing and smelling). In comparison to signed language linguists, gesture scholars have described metonymy and its overlap with iconicity in gesture in considerably more detail. For example, Mittelberg and Waugh (2014) state that gesturing hands "are always metonymic in some way". Therefore, indexicality also needs to be considered in investigations of iconicity. Henceforth, the term indexicality, rather than metonymy, will be used to align with the tradition in semiotics.

Napoli (2017: 518) defines iconicity chains as two cross-modal links between three areas, where a mapping goes "[1] from any perception or other somatosensory information into [2] a visual realization and from there into [3] a semantic sense" (brackets added by me). For example, the sign HAPPY, which is similar in several sign languages, entails one or two hands repeatedly hopping on the signer's chest. Napoli (2017: 527) describes how the iconic mapping of this sign goes from (1) the beating heartbeat (somatosensory), (2) to the hopping hands at the chest (visual realisation, that is, production), and then (3) to the abstract concept 'happy'. She claims that both links are cross-modal and iconic.

However, a critique of Napoli's work is that her descriptions are too general. Instead of providing detailed descriptions, Napoli (2017: 525) instead simply says that

all iconic mappings are complex, relying "on metaphor, metaphony, and/or analogy". For example, there is no proper descriptions of how an area 2 (e.g., the hopping hands) resembles an area 3 (e.g., the concept 'happy'). Thus, it is not clear whether the links are iconic, indexical, and/or metaphorical, and how. This first problem causes a second problem: it is not clear in her analysis whether the mappings are indeed cross-modal and how. In conclusion, the notion for cross-modal iconicity is lacking and hence needs further exploration.

In Keränen's (2021: 17) preliminary semiotic analysis of the FinSL sign SMELL, he suggests that although the sign semantically refers to a non-visual object, it is intra-modally iconic (the hand as a flying gas into the nose; visual–visual) and cross-modally indexical (the visually perceptible place of articulation at the nose indicates the place where we smell odour; visual–smell). His analysis carefully describes both the evident iconicity and indexicality in order to properly understand cross-modal patterns.

The current study will analyse lexical signs from both the sense- and emotion-related semantic fields. Some linguists consider emotions as abstract concepts, and so lexical signs for emotions are (perhaps always) metaphorical (and iconic) (e.g., Napoli 2017; Taub 2001). It is not clear what is meant by the term abstract, however. Chemical senses (i.e., taste and odour), for example, have sensory and emotional values due to the neural and associative closeness between them (e.g., pleasure from a sweet candy); accordingly, like the word *good*, the word *sweet* can be used for non-metaphorical pairing words like "sweet melody" based on the emotional meaning of positivity (Winter 2019a, 2019b: 199–210). The present study will provide insights into the semiotic patterns of emotional signs.

In the analysis, I focus on signs' physical production (i.e., myself producing signs), rather than their perception by an interlocutor (i.e., observing signs). The most important difference between production and perception is that only the former includes articulatory feedback (see Emmorey et al. 2009). Therefore, I assume that the semiotic processes involved in production may differ from those in perception. Focusing on production makes an analysis more specific and provides comparative research questions for the investigation of perception in the future.

The results from the current study will deepen our understanding of cross-modal patterns in production and contribute to wide-ranging applications and studies in signed language, such as etymology and literature, as well as a general discussion of cross-modal iconicity and indexicality in meaning-making studies. The study will also provide a comparative notion for semiotic systems, which rely on different kinds of articulatory and sensory affordances. The very understanding of the cross-modal patterns will influence the design of third-person experiments in the future.

In sum, I will investigate cross-modal iconicity and indexicality in the production of lexical signs that semantically relate to senses and emotions with the help of cognitive semiotics – a transdisciplinary study of meaning that integrates methods and

concepts from linguistics, semiotics, and cognitive science (Zlatev 2015). I will apply the theoretical model of Semiotic Hierarchy (Zlatev 2009, 2018) to give a non-reductionist view of the key concepts (see Section 2.1). Applying pheno-methodological triangulation, I will combine a first-person method, with second-, and third-person perspectives to gain multi-faceted insights into the subject of study, while acknowledging the validity of the method and the perspectives in investigating the subject of study (Zlatev 2015). To systematically use intuition in analysis, I will utilise phenomenology – a systematic and careful study of experience (first-person method, i.e., conscious interpretation). Through this paper I will also utilise semiotic and phenomenological descriptions by other scholars (second-person perspective, i.e., intersubjective sharing; see Sections 2 and 3). The analyses will also be informed by the literature from experimental research (third-person perspective, i.e., detached observation). My research question is the following: how does cross-modal iconicity and indexicality manifest in the production of lexical sensory and emotional signs in FinSL?

2 Conceptual backgrounds

2.1 Semiotic hierarchy, grounds, and S-signs

As stated above, the current study applies the theoretical model of semiotic hierarchy. This theory combines phenomenological, evolutionary, and developmental insights, to reach a non-reductionist notion of meaning-making (Zlatev 2009, and 2018). According to Zlatev (2018), the hierarchy includes five vertical levels (or layers) of meaning-making, and each level corresponds to value-based relationships between a human and their world: life (living body, pre-conscious), subjectivity (lived body, pre-reflective), intersubjectivity (empathy and sharing), signitivity (sign function), and language. The non-reductionist notion disagrees with a reductionist notion(s) that suggests that iconicity could be attributed solely to one level, such as only neural connections or only social factors.

To meet the purpose of the current study, a simplified model of the hierarchy consisting of three levels was applied: *subjectivity*, *intersubjectivity*, and *signitivity*, without diminishing the importance of the other levels (Table 1). The level of life is

Table 1: A simplified Semiotic Hierarchy (modified from Zlatev 2018: 6).

Signitivity: representational meaning-making
Intersubjectivity: meaning-making through two or more subjects
Subjectivity: perceptual meaning-making within the lifeworld

not considered here because it involves pre-consciousness, which would require specific approaches and methods to investigate. At the subjective level, a person is more or less pre-reflectively perceiving, acting, and having experiences within the physical world filled with lived experiences – the lifeworld. The intersubjective level of meaning-making is "*the sharing of affective, perceptual, and reflective experiences between two or more subjects. Such 'sharing' can take different forms, some more immediate, while others more mediated by higher cognitive processes*" (Zlatev 2008: 215 [original emphasis]). At the signitive level, there are S-signs and semiotic systems (e.g., language, gesture, and depiction), all which are essentially representational. Unlike the original hierarchy, the levels of signitivity and language are merged here, because here it is not relevant to separate linguistic from "non-linguistic" units. All such units usually co-occur in signing (e.g., pantomime-like facial expression co-occurring with a lexical sign) – the hybrid system as Jantunen (2018) puts it.

Looking at the table vertically, the higher-order levels do not replace the lower ones but emerge from and transcend them (Zlatev 2018: 2). For example, S-signs are essentially intersubjectively guided (Zlatev 2018: 19). The levels co-occur in one world, instead of 'worlds' in the Popperian sense (Zlatev 2009).

At each level there are horizontally dialectical processes between two ends: spontaneity and sedimentation (Zlatev 2018: 6). Any act of meaning-making can be spontaneously manifested, but through use and time, they can be sedimented into habits (e.g., bodily position and movement such as signing), intersubjective norms (e.g., culture), and conventionalised S-signs (e.g., lexical de-iconised sign), and vice versa.

According to Sonesson's classification (e.g., 1996, 2014, and 2016), the grounds are not S-signs but rather potential signs (e.g., perceptual experiences of similarities) that may become S-signs. At the signitive level, an S-sign is formed based on grounds with varying predominance: iconicity, indexicality, and symbolicity (Jakobson 1965). To be a *representational* S-sign, a S-sign is differentiated from its object, and the latter is more in focus than the former by virtue of the grounds (Sonesson 2016: 9). In sum, S-signs are representational by virtue of grounds, emerging from and depending on perceptual and social experiences and processes.

2.2 Iconicity

Cognitive linguistics (e.g., Occhino et al. 2020; Wilcox 2004)[3] and (cognitive) semiotics roughly share the notion of iconicity in terms of the fact that, to perceive signitive

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3 However, Wilcox's (2004: 122) definition of cognitive iconicity as a *close distance* between phonological and semantic poles vaguely conflates with indexicality (contiguity or "closeness") (also criticised by Zlatev and Möttönen 2022).

iconicity, a person cognitively perceives (i.e., construal or interpretant of) a resemblance between the properties of the S-sign (form) and the properties of the object (meaning) (for a more detailed comparison between cognitive semiotics and cognitive linguistics see Zlatev and Möttönen 2022), abandoning the traditional notion of a direct iconic S-sign–object link.

Then, in semiotics, the well-organised and nuanced notion of iconicity classifies kinds of icons into three types, which Peirce calls hypoicons (Sonesson 2016: 8): image, diagram, and metaphor. Although one of these types in a sign may dominate the others (Jakobson 1965), they are usually integrated (Colapietro 2011).

An S-sign is an image if it resembles its object because of simple qualities – which I understand as the most basic and experiential qualia. For example, a colour in a colour palette resembles a colour on a wall (Sonesson 2016). An S-sign is a diagram when it resembles its object because of internal relations, even if the two do necessarily not share qualitative properties. For example, the signed syntactic order can be diagrammatic of the temporal order of an event (e.g., Sallandre 2007). Imagistic properties can be arranged into a diagram to resemble an object in a gestalt manner. In an example of the diagrammatic face by Devylder (2018): the imagistic geometric shapes X, X, O, I do not make sense but, in a certain arrangement, the O is perceived as a head, the two Xs as eyes, and the I as lips. I use the term *gestalt diagram*[4] to describe such imagistic-diagrammatic relations. Moreover, as one of its functions, a diagram makes invisible things (e.g., economic rise and fall) perceptible (e.g., statistical figures) (Santaella 2020: 304).

Note, sometimes it is challenging to identify properties as either *real* imagistic or diagrammatic. For example, according to Sonesson (2016: 44–45), a realistic picture is rather diagrammatic (arrangement of colours and materials), although it may be experienced as imagistic.

Regarding the perception of iconicity, Sonesson (2016) distinguishes two kinds of iconicity: primary and secondary iconicity. The former is the iconicity of an S-sign (e.g., realistic picture) perceived without prior knowledge of its relation to an object. The latter refers to the perception of iconicity based on some knowledge, for example, in this analysis, as a native deaf signer, I am familiar with the (at least possible) origins of several FinSL signs.

While images and diagrams are a matter of resemblance between an S-sign and its object, metaphor, as the most complex type of (diagrammatic) iconicity, is a matter of resemblance between two objects (or interpretations) of an S-sign (i.e., target and source), with various degrees of tension according to the semantic incongruity (e.g., unexpected) between them (Stampoulidis et al. 2019). According to Taub (2001), many

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4 Dingemanse (2011) uses the similar term gestalt iconicity, however, to describe diagrammatic iconicity in individual ideophones.

abstract signed language signs are both iconic and metaphorical: a sign iconically represents a concrete, sensory object (e.g., 'a projectile bouncing off a wall') (source), and, in turn, this source is interpreted in terms of an abstract target (e.g., information bouncing off a head, referring to a failure of communication). Throughout the rest of this paper, the term iconicity will be used as an umbrella concept for both image and diagram, while the term metaphor will refer to itself.

Relating the types of iconicity to sensory modality, we have seen that a signed language sign can be an image, and a sentence can be a diagram in an intramodal iconic fashion (e.g., visual–visual) (Sections 1 and 2.3). In cross-modal iconicity, as shown in the introduction, a certain sensory S-sign resembles a distinct sensory object. This may be partly explained by diagrammatic iconicity. Dingemanse (2011: 45) explains that because speech itself is of a sensory kind, it shares suprasensory attributes (e.g., duration, intensity, and quality) with other sensory experiences. However, as already emphasised above, iconicity usually overlaps with indexicality.

2.3 Indexicality

At the signitive level, an indexical S-sign stands for its object because of a contiguity-based ground. Two kinds of contiguities are distinguished: *spatiotemporal contiguity* (one indicates another because of their co-occurrence in time and/or space) and *factorial contiguity* (a part indicates the whole, or vice versa) (Sonesson 1996, and 2014).[5] These two contiguities have similarly been explored as external metonymy and internal metonymy (see Mittelberg and Waugh 2014).

In addition, contiguity is formed in a S-sign in *performative* and *abductive* ways (Sonesson 1996, 2014). In the former, an S-sign (e.g., arrow or finger pointing) itself causes a contiguity between the S-sign and an object. To exemplify, an index finger is directed at a table, causing a spatiotemporal contiguity between the finger and table. In the latter, a prior knowledge of a relationship between two things (i.e., indexical ground) is a condition for establishing an indexical S-sign. For example, a certain dialect is known as belonging to a certain linguistic community.

For clarification, whereas the concepts of metonymy and synecdoche in cognitive linguistics (e.g., Meir 2010; Wilcox et al. 2003) roughly correspond to the concepts of spatiotemporal and factorial contiguities in (cognitive) semiotics (e.g., Sonesson 2014), semiotics has a wider notion of indexicality, concerning different kinds of contiguities and how these emerge (e.g., abductive part-whole relation vs performative finger pointing) – also beyond the scope of language. Then, some sign

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5 Sonesson (2014) distinguishes between the terms contiguity and factoriality. Here, I categorise them as subtypes of the main type of contiguity on which indexicality relies to emerge.

language linguists seemingly tend to limit the concept of indexicality to finger pointing or pronoun use (e.g., Johnston 2012).

Aligning with the Sonessonian terminology, Mittelberg and Waugh (2014) describe the tendencies of certain kinds of contiguities in gestures. The contiguity depends on which *proximity zones* a gesturer (or an interlocutor) engages to refer to an object. Briefly, the zones are distinguished as three main parts: inner body (e.g., anatomy, sense, or emotion) – body (i.e., perceptible body parts) – outer body (i.e., any imagined or real object outside the body). Factorial contiguity usually occurs in the body zone (e.g., a hand → whole body), and spatiotemporal contiguity usually occurs in both the inner and outer body zones. Similarly, Wilcox and colleagues (2003: 146) report that iconic facial or manual articulators can indexically represent the inner experience. These imply that indexicality cross-modally connects gestural articulators with inner states.

To my knowledge, the concept of cross-modal indexicality has not been discussed, despite a passage by Keränen (2021). It may have an explanatory potential. I preliminarily define cross-modal indexicality as an S-sign that represents its object across sensory modalities by virtue of contiguity.

3 Methodology

The method employed and the data selected for the current study (Appendix A; B) aimed to investigate the research question: how cross-modal iconicity and indexicality manifest themselves in the production of lexical sensory signs in FinSL. The data comprises 118 signs that were available for analysis: 60 sensory signs (35 touch,[6] 17 sound, 5 taste, and 3 smell) and 58 emotional signs from the Finnish Signbank lexical database (The University of Jyväskylä, Sign Language Centre 2018). Because cross-modal iconicity is the focus of the current study, sight-related signs that are considered as intramodal are not included. In selecting the data, I acknowledge that most FinSL signs have several, less prominent sensory and emotional aspects (e.g., petrol and its smell, or police and their associative emotions) (see more about sensory strength in Winter 2019b). Other signs such as cognitive or speech act signs (e.g., THINK or TELL) are quite context-dependent (e.g., thinking angrily, or telling by signing), thus, I have left them for future research. Therefore, to bear the purpose of the research in mind, signs were selected that relate to senses and emotions as closely as possible. Lastly, because the signs were selected from Signbank, they include only minimal facial expressions. As such,

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6 Here the term touch in short refers to a semantic field related to somatosensory sense.

facial expressions are not included in the current analysis. Instead, the focus is on the movements and postures of the hands, body and head.

I analysed the 118 signs by reproducing them and reflecting on their form and meaning using my intuition. Intuition (i.e., consciousness), as a first-person method, is an epistemological priority to study meaning-making (Zlatev 2015). Often, researchers implicitly use their own intuition (first-person) and empathy of others (second-person) when conducting third-person methods (Zlatev 2015). Here, though, intuition is used systematically with the help of phenomenology – "the [first-person] study of human experience" (Sokolowski 2000: 2 [brackets added by me]). Phenomenology is a scientifically open-minded and self-correcting ('objective') study in the sense that, instead of maintaining default, natural attitude (i.e., prescriptive prejudices and immersed, habitual perception), it aims to carefully reflect and describe essential structures of experience so that descriptions are intersubjectively open for comparison and correction by any phenomenologically attuned person (Zahavi and Gallagher 2012: 21, and 28).

The current study applies the basic four-step phenomenological method coined by Edmund Husserl, the father of phenomenology: *epoché, phenomenological reduction, eidetic variation*, and *intersubjective corroboration* (Zahavi and Gallagher 2012: 31). Epoché-attitude is a kind of bracketing or suspending of the natural attitude, taking a curious approach to the dimensions of an experience. Phenomenological reduction is a matter of consciously reflecting on an immediate appearance of an object. To borrow a metaphor, phenomenological reduction is not like "switching the light to see what the room looks like, it's rather exploring it in the dark, by feel" (Petitmengin and Bitbol 2009: 378).

Eidetic variation is a kind of imagination or manipulation of an experience in order to disclose essential properties of the experience. To use the example of the diagrammatic face (from Section 2.2), one removes or changes some parts of the face until essential parts are disclosed which make the thing look like the human face. In the current analysis, I did this by changing the sign (i.e., comparing signs or changing articulatory properties of a sign such as handshape and location) to see if its object changed, or imagined possible alternative objects of a sign (e.g., a pointing at the sky can indicate a cloud or outer space), to disclose iconic and indexical patterns.

How should the validity of phenomenological methods be measured? A thing appears to the experiencer in a certain way depending on several factors (see *identity in manifolds* Sokolowski 2000), such as its way of being (e.g., physical properties), the spatial relation between the thing and the experiencer (front, behind etc.), and cognitive acts (perceiving, remembering, analysing, etc.). In the context of the present study, it is important to acknowledge that the appearance of a sign being pre-reflectively perceived differs from the appearance of the same sign being reflectively perceived (i.e., analysed through phenomenological reduction and eidetic variation)

in some way. Therefore, the validity of phenomenological descriptions is measured in terms of its *authenticity* (i.e., the process of becoming aware of real experiential dimensions and describing them as truly as possible), rather than *representative accurateness* (i.e., appearances reflected identically correspond to the appearances pre-reflected) (Petitmengin and Bitbol 2009).

In other words, to ensure authenticity, we must encounter our *experience* with the open and sensitive mind-set to become aware of its nuanced dimensions (e.g., iconicity as resemblance and its subtypes), instead of 'concealing' them by the habitual mode of knowing or perceiving. Then, we should use precise, consistent, and sensible language to accurately indicate and highlight dimensions, allowing scholars to validate (or challenge) the descriptions with the phenomenological nod "yes, that is [a type of] experience I could have" (Van der Zalm and Bergum 2000: 212 [brackets by me]). Moreover, it is preferable to avoid for example the use of misleading metaphors (e.g., iconicity as distance by Wilcox 2004).

Therefore, intersubjective corroboration is necessary for encouraging us to share and compare our careful descriptions with those of others, to make corrections and to come closer to essential structures. Moreover, *mutual entanglement* encourages us to let phenomenology profit from – and be challenged by – third-person findings (Gallagher 1997). To do that, I will also cite relevant third-person findings in my analyses. Lastly, phenomenological descriptions can be applied to design or evaluated by future third-person research.

To summarise, while many sign language linguists and others do rely on their intuition when describing semiotic processes – although claiming otherwise – they occasionally are biased towards preconceptions over their own experience (see Section 5.1) or do not provide careful and intersubjectively open descriptions (see Section 1). In this case, phenomenology is relevant and useful in the present study.[7]

Before moving on, it should be noted that signed language lexical signs are able to lose their iconic and indexical origins, because of articulatory change and/or not knowing the historical origin of the sign (e.g., Emmorey 2014). In this analysis, it was methodologically necessary to know (at least some of the possible) origins of signs for 're-constructing' (secondary) iconicity and indexicality in the signs, to describe them. Thus, such unidentifiable or vague signs are not considered in the following sections.

In Appendix A, a numeric, descriptive overview of the study's results is based on the information in Appendix B. Those provide insights into the research question and

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7 Note that phenomenology does not imply a bias-free study. Instead, the four-step method, along with the literature of phenomenology, progressively enhances the process of becoming aware of and understanding direct (also biased) experiences, rather than achieving this instantaneously.

complement the qualitative analysis, and vice versa. In Appendix B, inspired by Eduard Marbach (Marbach 1993 referred via Gallagher 1997), the formal notation is not used to describe a content but to capture a structure of highly complex semiotic patterns in individual signs in a simplistic fashion. To ensure the intelligibility of the overview, it will be summarised after the qualitative analyses in Sections 4.1–4.5, and a brief instruction is provided in Appendix B.

4 Analysis

4.1 Articulatory feedback at the subjective level

In this and the next section, I will consider the intramodally iconic sign HAMMERING (referring to the meaning of the action of hammering) at the subjective (perceptual meaning-making) and then signitive (representational meaning-making) level of Semiotic Hierarchy. The analysis of this intramodal sign provides us with a starting point to consider the cross-modal patterns found in the dataset (Appendix B).

In the sign HAMMERING, the hand is in a grasping position and moves as if it is hammering a nail (Figure 1a). At the subjective level, when producing this sign, I see my hand in my peripheral field of vision as visual feedback. The experiments by Emmorey et al. (2009) show that hearing non-signers tend to look at their hands when producing a difficult sign in order to correct it. In the same project, deaf signers were asked to recognise numeric signs shown in pictures in their peripheral field of vision.
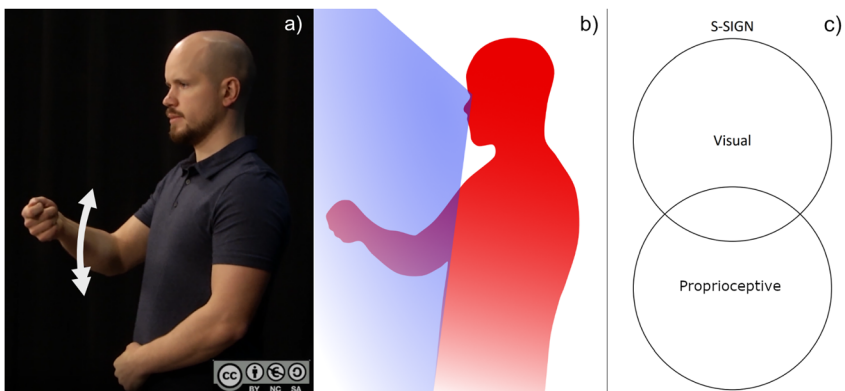

Figure 1: This figure shows: (a) the sign HAMMERING (The University of Jyväskylä, Sign Language Centre 2018), (b) an illustration of how the signer sees his own hand (blue) and feels his body (red) from his view of point, and (c) a schematic model of visual and proprioceptive S-sign.

They succeeded better when the signs were shown from the visually familiar point of view of a signer (i.e., the back of hand) than of an interlocutor (i.e., the front of hand), suggesting that visual feedback matters in articulation (Emmorey et al. 2009: 403). The sign HAMMERING is a S-sign based on visual feedback or visual S-sign for me as a signer.

However, proprioceptive feedback (i.e., the feeling of positions and movements) may be primary in monitoring signing (Emmorey et al. 2009). In their experiment, signers and non-signers were asked to reproduce foreign signs shown in a video. During reproducing, their eyes were blocked from seeing their hands. Thus, their signing relied only on proprioceptive feedback. The findings showed that some participants even performed the task slightly better without visual feedback. Naturally, signing without proprioceptive feedback would be very uncontrolled. In an example from the real life, a man named IW suffers the loss of proprioceptive sense from the neck down, and hence his bodily movement has been uncontrolled when not seeing his body (Cole 1995). More obviously, a signer cannot see their own face, or profoundly deafblind people use tactile sign language,[8] indicating that signing depends on proprioceptive feedback. Thus, when producing the sign HAMMERING, I feel my hand and implicitly whole body, the sign is also a *proprioceptive S-sign* (i.e., an S-sign based on proprioceptive feedback) for me as a signer.

Occhino (2016: 83–84) has a similar conclusion that a S-sign (or phonological pole in cognitive linguistic terms) can comprise visual and proprioceptive feedback.[9] However, in addition to that, I simultaneously receive visual and proprioceptive feedback from my signing as a gestalt one, rather than as separated sensory stimuli – aligning with the increasing number of studies on multisensory integration, which show how senses interact and overlap, to act and perceive effectively (e.g., Ernst and Bülthoff 2004). Thus, in signing, proprioceptive and visual S-sign are necessarily integrated as one gestalt S-sign – albeit with varying sensory salience. Importantly, although we may conceptually separate senses from motor, these are tightly intertwined in our action (see e.g., Emmorey et al. 2009; Ernst and Bülthoff 2004). Then, a certain sensorimotor loop can become a habitually sedimented skill such as signing (Zlatev 2018; similarly articulatory motor routine by Occhino 2016: 11). Back to sensory integration, Figure 1b illustrates how a signer may receive the articulatory feedback; Figure 1c illustrates a schematic model of that.

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8 Deafblind people may have various degrees of blindness and hence of visual feedback.
9 However, while Occhino recognises the role of proprioception in articulation, she largely emphasises the role of vision in iconicity in her conclusion (2016: 193).

4.2 The sign HAMMERING at the signitive level

The actual action of hammering a nail within a certain environment is quite multisensory – including at least touch, sight, and perhaps sound. This multisensory concept of the action – perhaps less or more schematised, arising from generalisation of recurring tokens of the action (e.g., Occhino 2016; Taub 2001) – is an object to which the sign HAMMERING roughly refers. Accordingly, the sign is iconically motivated by our sensorimotor experience of the action at the subjective level.

Regarding the iconicity of the sign HAMMERING, we can say that the visual S-sign (i.e., how the hands look in signing) resembles the visual object (i.e., how the hands look in the imagined action). This is the traditional notion of *visual–visual iconicity* in sign language linguistics, i.e., intramodal iconicity.

However, this sign also involves intramodally proprioceptive iconicity: a proprioceptive S-sign (i.e., how I feel my hands and implicitly my whole body in signing) resembles the proprioceptive object (i.e., how my hands and often implicitly my whole body feel in the imagined action). There are similar reports, albeit less or more explicitly: since speech involves *bodily* and auditory experiences, it has a rich internal structure for making iconicity (e.g., Dingemanse 2011: 44; Perlman et al. 2018: 9) consider the correlation between the iconicity and semantic properties of 200 concepts across four signed and spoken languages. They show that more iconic signs strongly correlate with more haptic meanings – even stronger than with visual meanings. Taub (2001; 61, 90, and 230) also observes that a kinaesthetic aspect of an action can be represented by a kinaesthetic aspect of a sign. Even earlier, in a rating experiment of tactile iconicity by Griffith et al. (1983), blind (by touching) and sighted people (by seeing) rated the iconicity of 166 sign stimuli in a similarly consistent way. Thus, in addition to visual–visual iconicity, there is *proprioceptive–proprioceptive iconicity* in the sign HAMMERING.

Because of multisensory integration, the visual and proprioceptive S-sign resemble its visual and proprioceptive object as a gestalt one (Figure 2). Although the perceptual aspects of production at the subjective level may cross-modally interact (e.g., Ernst and Bülthoff 2004), the S-sign intramodally resembles the object at the signitive level. Figure 2 illustrates that the intramodal iconicity of the sign HAMMERING is highly imagistic, since there are multiple simple qualities: visual–visual, proprioceptive–proprioceptive, and sensory integration.

In Figure 2, only the iconic aspects of my hand feeling and looking like an imagined hand in the action of hammering are depicted. However, in my mind, there is more than that: the (implicit) whole body, a hammer, a nail, an (implicit) environment, and so on. This is because of spatiotemporal and factorial indexicality: the hammering-like sign indicates relevant parts of the action of hammering and an
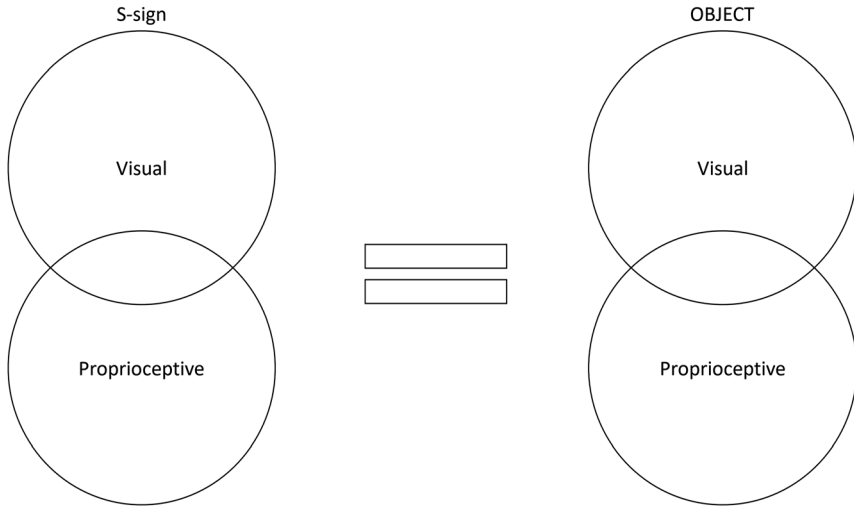
Figure 2: In the FinSL sign HAMMERING, a visual and proprioceptive S-sign resembles a visual and proprioceptive object in an intramodal and integrated fashion.

actor's whole body. We can compare it to a picture that partially captures an object and indicates the rest (Sonesson 2014: 41). Moreover, that the same sign also refers to merely a tool 'hammer' is a matter of a different indexical pattern. To summarise, similar to any action-related sign, the sign HAMMERING is intramodally iconic and intramodally indexical.

4.3 Intramodal iconicity and cross-modal indexicality

Now, we move on to the data considered for this study and begin with two smell-related signs (Appendix B). Firstly, the sign SMELL (fingers trembling at the nose) can refer to both the action of smelling or an olfactory experience (Figure 3a). My
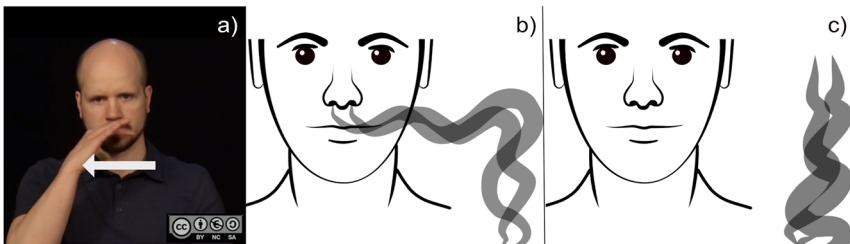

Figure 3: This figure shows: (a) the sign SMELL (The University of Jyväskylä, Sign Language Centre 2018), (b) how an action of smelling is typically shown in a cartoon, and (c) that the action of smelling is not relevant.

impression of the sign is that visible gas moves through the air into the nose so that an imagined experiencer smells it, in a way similar to how it is typically depicted in a cartoon (Figure 3b).

If we consider the visual iconicity of this sign, the visual aspect of the hand looks like the visual aspect of imagined visible gas (visual–visual iconicity). More exactly, because several visual properties of the hand (skin, nails etc.) (Figure 3a) themselves do not qualitatively resemble several visual properties of the gas (e.g., grey cloud-like thing) (Figure 3b), the resemblance must be largely based on a gestalt diagram: properties of the hand (e.g., visual opaqueness, size, location, and movement) are combined to quasi-imagistically look like the flying gas.

What is interesting is that the visually perceptible sign iconically represents the *invisible* olfactory experience. To explain how this is possible, I suggest that we have experiences of associating a smell, for example, with the visible smoke from a fire. Such an example is one of many sources of the abductive indexical relation between gas and smell. Thus, iconicity is naturally used to represent this indexical relation, like in the FinSL sign (Figure 3a) and the drawing (Figure 3b).

Moving on to the sign's proprioceptive iconicity, without seeing my head, the proprioceptive aspect of my head (proprioceptive S-sign) imagistically represents the proprioceptive aspect of an imagined experiencer's head (proprioceptive object). This is a kind of proprioceptive–proprioceptive iconicity, at least when not seeing myself in a mirror. In sum, the iconicity of the sign highlights various sensory aspects: the visual aspect of the hand as gas, and the proprioceptive aspect of the body as imagined experiencer.

When considering the sign's indexicality, my head factorially indicates my whole body. Moreover, my hand (i.e., the gas) is close to my nose (i.e., the experiencer's nose). This spatial contiguity indicates the odour object. If my hand was far from my nose, there would not be the same imagery of an experiencer smelling the gas, in a way similar to how it would be depicted in a cartoon (see Figure 3c). Thus, there is an abductive indexicality based on the knowledge that the nose smells when something enters it.

However, in alternative imaginations, this spatial contiguity does not necessarily always indicate the odour object but also any odourless gas, other chemical elements, or actions (e.g., breathing in). It is the symbolicity of the sign that guides us to re-process the same indexical pattern for the odour object. In sum, the sign SMELL is intramodally imagistic and gestalt diagrammatic, and cross-modally indexical (Figure 4).

I now briefly compare the sign SMELL with another FinSL sign, glossed SMELL-INDEX (an index finger pointing at the nose). The finger-pointing is of a performative index (see Sonesson 1996, 2014), causing the cross-modal contiguity between the finger (proprioceptive and visual S-sign) and the smell (odour object).
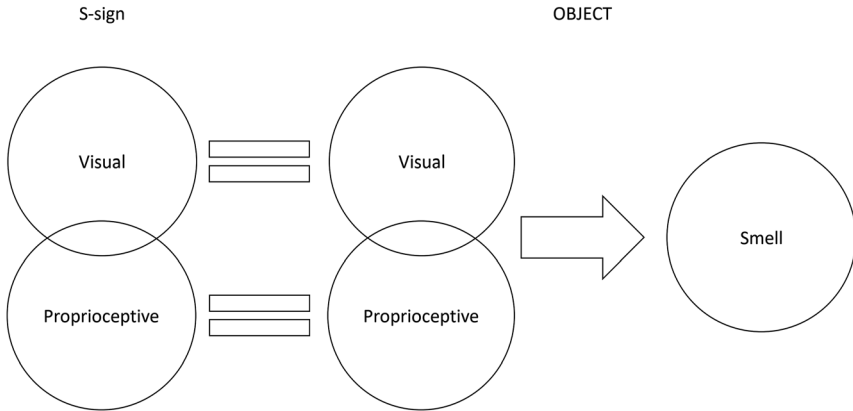
Figure 4: A sign intramodally resembles a certain aspect of an object, and at the same time this iconicity cross-modally indicates the odour object.

4.4 Cross-modal iconicity: volume

We now move on to the sign sɪʟᴇɴᴛ(BqBq) (Appendix B), which refers to silence or a decrease in loudness (Figure 5). The primary function of this iconic sign is to measure the size or volume of a thing (also known as e.g., Size and Shape Specifiers or drawing, see a discussion Keränen 2021), rather than to re-enact an action (e.g., holding).
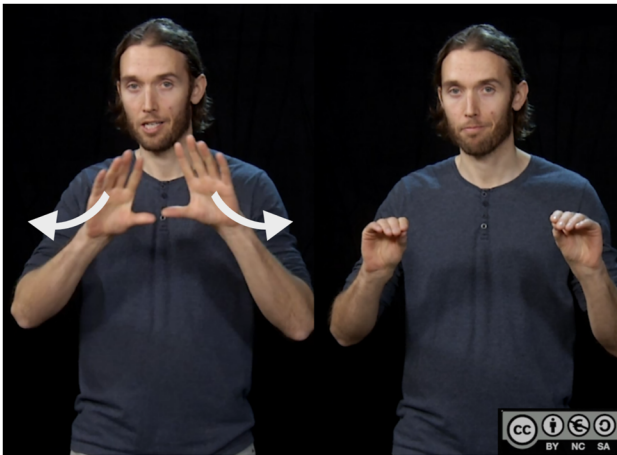

Figure 5: The sign sɪʟᴇɴᴛ(BqBq) (The University of Jyväskylä, Sign Language Centre 2018).

The iconicity of this sign lies in the resemblance between *the decrease of* the loudness and *a decrease of* the proprioceptive and visual aspects of the sign (feeling and seeing the hands closing), which indicates the thing being measured. This sign is a kind of cross-modal proprioceptive-visual–sound iconicity based on the supra-sensory attribute *volume* (Figure 6).

The indexicality of this sign lies in the measuring hands indicating the thing being measured: the proprioceptive and visual S-sign cross-modally indicates the auditory object (i.e., decrease in loudness). However, in alternative imaginations, it could equally represent any decrease (e.g., snow melting). Thus, the indexicality of the sign SILENT(BqBq) is conventionally cross-modal.

Some followers (e.g., Meir 2010; Taub 2001) of Conceptual Metaphor Theory (CMT) (Lakoff and Johnson 1980) would deductively argue that the sign is iconic–metaphorical because the sign is iconically motivated by the imagery of the measuring hand, and by a metaphor "less high is less loud". However, I argue that the sign is not necessarily metaphorical because it is a matter of *suprasensory resemblance between the S-sign and the object*, rather than between two objects with semantic incongruity. This can be applied to several non-linguistic, non-metaphorical matchings (e.g., brighter and a higher pitch or economic rise and a higher bar). On the other hand, I do not deny that it is possible to interpret the sign as metaphorical in an incongruent way such as a made-up expression: "the musical liquid runs into the plughole".
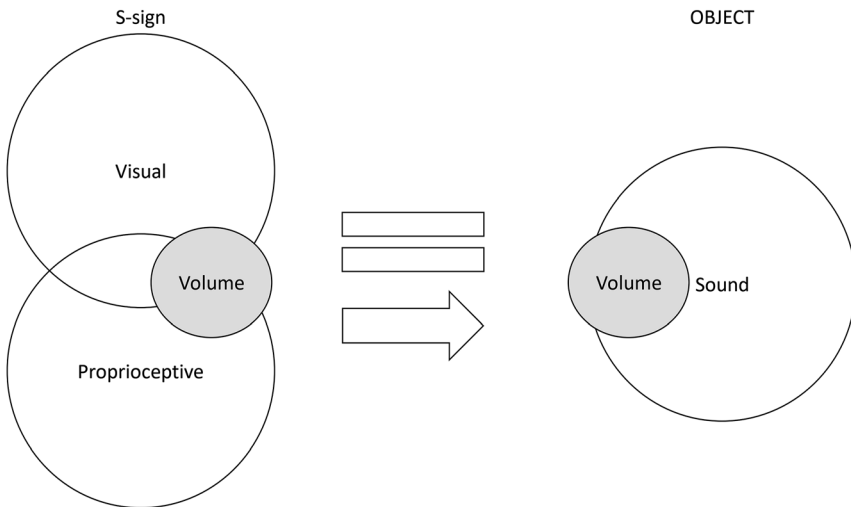

Figure 6: A volume of a visual and proprioceptive S-sign cross-modally resembles and indicates a volume of an auditory object.

In sum, the sign SILENCE(BqBq) is cross-modally iconic (a diagram) and cross-modally indexical (abductive). In addition to this sign, there are five more cross-modally iconic signs in the dataset that rely on volume: HARD-OF-HEARING, DEAFENING, DEPRESSION, BE-FRUSTRATED(chest) and BE-FRUSTRATED(palm) (Appendix B).

4.5 Cross-modal iconicity: quality

Another kind of cross-modal iconicity that was found in the dataset is analysed as the suprasensory attribute of *quality*[10] (see Dingemanse 2011). The quality-based cross-modally iconic signs found in this study are not quite heterogeneous. However, one commonality identified was that these signs iconically represent how a particular qualia is experienced (e.g., what is it like to touch a wooden or metal surface) in a *diagrammatic manner*, rather than an imagistic manner.

To illustrate this group of signs, I consider here the FinSL sign INTERESTING (Appendix B), which involves the hands pulling away from the signer's chest as the thumb and bent index finger close together (Figure 7). The sign semantically refers to an interesting thing or being interested, and as such refers to its qualia (object): attention or desire is almost compellingly directed at an attractive thing so that the eyes and body are directed towards it. This sign is also indexical. The signer's chest
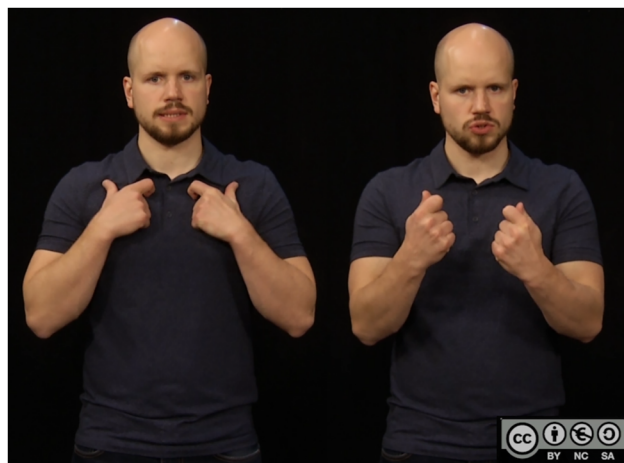

Figure 7: The sign INTERESTING (The University of Jyväskylä, Sign Language Centre 2018).

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10 The term *quality* may deserve a more appropriate term to avoid conceptually conflating with imagistic quality.

indicates the whole body and the emotional experience. In alternative imaginations, the sign may indicate various objects (e.g., pulling the signer's clothing).

I regard the primary function of this sign's iconicity to show how a thing is attracted, directed, magnetised, or absorbed towards something, rather than as an action that is re-enacted (i.e., actual pulling). For the moment, I call this function *being-pulled*. The *being-pulled* function is also found in several other FinSL signs, including HEAR(L) (pulling into the ear), from this study's dataset (Appendix B), as well as other signs not included in the current study, such as BLOOD-COLLECTION (pulling at the arm from where blood is usually taken) and CAR-ACCELERATING (rapid pulling away from the chest).

The *being-pulled* iconicity can be further illustrated by comparing it with the concrete measuring iconicity (Section 4.5). With measuring iconicity, for example, when someone tells how thick a book is, they may use their thumb and index finger to measure the thickness of the imagined book, such as with the intramodally iconic sign THICK. In the mind, the sign highlights the aspect of the imagined book being measured, rather than an aspect of the hand. The iconicity is based on spatial resemblance: the distance between the thumb and the finger resembles the distance between the edges of the book.

A similar resemblance is also at play in the *being-pulled* iconicity of the sign INTERESTING (and in the signs mentioned above). In the mind, the sign highlights the aspect of the experience of being pulled, rather than the aspect of pulling hands. The iconicity is based on a qualia resemblance: how a person is almost compellingly directed towards something. In other words, the *qualia of being-pulled* towards the pulling hands (proprioceptive and visual S-sign) resembles the *qualia of being-pulled* towards the attractive thing (emotional object). This shows that the cross-modal iconicity of the sign is diagrammatic, similar to the pattern that was shown in Figure 6. In the data for this study, such quality-based cross-modal iconicity is also found in three other signs: HEAR(G), FALL-IN-LOVE, and SHOCK (Appendix B).

Interestingly, because emotion itself is not a sensory kind, the sign INTERESTING and its emotional object do not share suprasensory attributes, but rather some kind of broader supraexperiential attribute.

At this point, some followers of CMT would describe the sign INTERESTING (and other emotional signs) as metaphor with the formula (Table 2): the pulling hands (articulators) – the *imagistically iconic* pulling hands (source) – concept of being interesting (target). In other words, in such *imagistic* imagery, human hands or

Table 2: The metaphorical interpretation of the sign INTERESTING.

Articulators	Iconic source	Target
Pulling hands	Imagistic pulling hands	Being interested

Table 3: The metaphorical interpretation of the sign THICK.

Articulators	Iconic source	Target
Measuring hand	Imagined measuring hand	Distance

others grasp the other person's shirt and pull it so that the person tilts forward. Then, in metaphorical comparison, the *imagistic* hands-pull-shirt resembles the experience of being interested in terms of the being compellingly directed towards something interesting. Metaphors, such as "an interesting movie pulls a rope tied to a person," allow us to compare two incongruent objects (Stampoulidis et al. 2019) and evoke the feeling that these "transgress borders" (Sonesson 2019: 3).

However, to further illustrate, the articulator-source-target formula can also intentionally be applied to non-metaphorical signs, such as the sign THICK (Table 3). In this case, a measuring hand (articulator) imagistically resembles the action of measuring something (iconic source), which in turn, resembles the thickness of a book in terms of distance (target). However, as analysed above, the measuring hand does (gestalt) diagrammatically resemble the thickness. We do feel that the diagram (sign–object) is more direct than the metaphor (object–object).

Similarly, the sign INTERESTING and other more concrete signs that have the being-pulling iconicity can be interpreted as diagrams (sign–object) with certain indexical patterns – without the need for imagistic imagery, such as hands pull the shirt, and, without evoking the feeling of transgressing borders. Moreover, because the aspect of being-pulled is part of both the pulling hands and the experience of being interested (i.e., factorial), the diagram based on these part-whole relations is not contextually and culturally incongruent. Therefore, it is not necessarily metaphorical.

4.6 A distribution of semiotic patterns across the dataset

In this section, I present a brief overview of these semiotic patterns across the dataset (Figure 8; Appendices A and B). In total, 71 signs of the total 118 are semantically cross-modal – that is, they semantically refer to senses other than sight and touch (i.e., sound, smell, taste, and emotion). However, 32 of the 118 signs were touch-related signs and were not analysed as semantically cross-modal but intramodal (see Section 5.1). Out of the 118 signs, 15 signs labelled with N/A are unidentifiable or vague in terms of their iconicity and indexicality.

All of the 71 semantically cross-modal signs are essentially cross-modally indexical: a proprioceptive and visual S-sign indicates a distinct sensory or emotional object. Forty-six of the 71 semantically cross-modal signs were analysed as intramodally iconic and cross-modally indexical (Section 4.3). Three of the 46
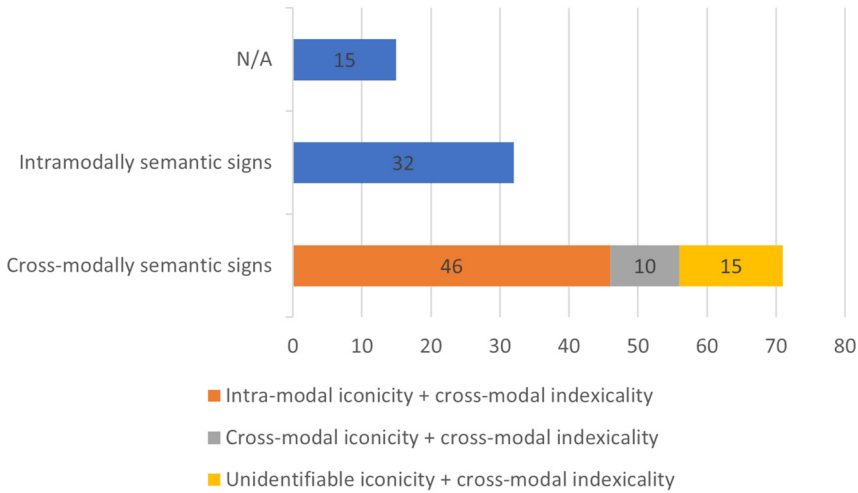
Figure 8: The descriptive distribution of the analysed data

signs are performative indices such as finger-pointing (e.g., the sign SMELL-INDEX in Section 4.3). In 15 of the 71 signs, the iconicity in the hands is unidentifiable, but the place of articulation was analysed as at least cross-modally indexical (e.g., chest and emotion). Only one sign, for addict, was analysed as a metaphor (something pulls chains tied to the neck).

Only ten of the 71 signs were analysed to be cross-modally iconic and cross-modally indexical – and they are found in four sound- and six emotion-related signs. According to the results, two kinds of cross-modal iconicity were found: volume (in three emotion- and three sound-related signs) and quality (in three emotion- and one sound-related signs). Lastly, in at least 100 of the 118 signs, the body and head are highly imagistic, representing themselves as an imagined body and head.

5 Discussion

5.1 Answering the research question

The research question for the current study (how cross-modal iconicity and indexicality manifest in the production of lexical sensory and emotional signs) will be answered by summarising and concluding the results of the qualitative analyses (Sections 4.1–4.5) and the distributional analysis (Section 4.6).

Most of the touch-related signs are analysed as intramodal kinds because of the fact that producing signs essentially comprises both proprioceptive and visual

feedback (Section 4.1), so that the touch-related signs will always exhibit an intra-modal pattern: proprioceptive feedback – proprioceptive aspect of object. This is consistent with reports by other scholars on the role of proprioception in iconicity (see Section 4.2). This finding shows that an articulatory approach to iconicity and indexicality provides precise analyses and fruitful insights.

Regarding iconicity, 46 of the 71 semantically cross-modal signs in the dataset are analysed as primarily intramodally iconic and cross-modally indexical: a sign intramodally resembles an aspect of an object, and in turn cross-modally indicate the object (see the sign SMELL in Section 4.3). Only ten of the 71 signs were also analysed as cross-modally iconic (and cross-modally indexical). Two kinds of cross-modal iconicity were observed in the dataset: *volume* and *quality*. In the former, a sign resembles its object via the suprasensory attribute volume (Section 4.4). In the type of quality-based cross-modal iconicity, a sign iconically represents how a particular qualia is experienced in a largely diagrammatic manner (Section 4.5). Interestingly, cross-modal iconicity is found in only sound- and emotion-related signs.

While most FinSL signs in the data integrate both imagistic and (gestalt) dia-grammatic properties (Sections 4.3–4.5), cross-modal iconicity is diagrammatic. This is explained by the fact that sensory properties of gestural articulators do not share distinct sensory and emotional experiences in the form of simple qualities, but rather share internal relations.

The qualitative analyses (Sections 4.3–4.5) and the descriptive overview (Appendices A and B) show that indexicality is pervasive in all signs. The iconicity manifests by virtue of which S-sign appears to resemble the *indexically targeted* object. In addition, the body parts indicate the whole body (factorial), and manual or bodily postures cross-modally indicated inner states (spatiotemporal) (e.g., the sign SMELL in Section 4.3). This finding provides evidence for the notion of the proximity zone (Section 2.3; Mittelberg and Waugh 2014). In line with the general doctrines of semiotics, iconicity and indexicality in signs are tightly and complexly integrated.

As a general explanation, a reason why intramodal iconicity dominates in this study's data is probably because it efficiently (or economically) indicates intended objects (e.g., downward lips indicating sadness). Thus, when intramodal iconicity is inefficient or inappropriate for some reasons, different strategies are necessary to indicate intended objects. Cross-modal iconicity in sound and emotion signs can be explained in two ways: on the one hand, diagrams are used because of the lack of shared simple qualities, and on the other hand, shared structural properties between the body and sounds or emotions. Furthermore, I consider metaphor to be just one strategy, with its specific functions (e.g., creativity). Similar to several scholars (e.g., Dingemanse 2013; Green 2014; Keränen 2021; Zlatev 2019), to conclude, meaning is conveyed in the limitation of possibilities within a certain

semiotic system – however, not forgetting broader factors, including context, culture, and cognition.

In consistency with the previous chapter, the signs in the dataset often implicitly involved the body and head imagistically representing themselves. To interpret this, the imagistic non-manuality can be seen to serve two functions: 1) a signer can construct an action (e.g., Cormier et al. 2015) to indicate a certain sensory or emotional object, and 2) a signer's bodily location can serve as an "indexical seat" for inner phenomena (e.g., Zeshan and Palfreyman 2019). This supports that non-manuality is worth considering (Puupponen 2019). More generally, the high amount of imagistic non-manuality evident in the dataset also implies that all experiences are experienced by someone from a first-person point of view and accordingly how (perhaps all) iconic S-signs are formed.

To reflect on the group of emotional signs, it was mentioned that because emotions are abstract many have considered emotional signs to be (perhaps always) metaphorical (e.g., Meir 2010; Napoli 2017; Taub 2001). However, the present study shows that emotions can be expressed by various intramodally iconic strategies such as showing actions (e.g., a fist up for punching indicates hate) and drawing (e.g., an outline of smile on mouth indicates happy) or less frequently by cross-modally – or cross-experientially – iconic strategies (e.g., the sign INTERESTING in Section 4.5) – without metaphorical processes.

The reasons why many sign language linguists tend to interpret emotional and other signs as metaphorical may be multilevel. One is that they prescriptively assume emotions as abstract. However, as has been proved, emotions are experienced within our body directly and quite universally (Nummenmaa et al. 2014). This implies that emotions can be expressed iconically and indexically, without the need for metaphor. Consequently, because emotional signs are not necessarily metaphorical, the assumption of emotion as an abstract concept needs to be reconsidered.

Second, most examples used by the linguists are of proper metaphors, as in Meir's (2010) example of anger in the chest as boiling water in a container. Third, linguists also tend to overgeneralise famous 'metaphorical' formulas of CMT in analysis. For example, Zeshan and Palfreyman (2019) apply the formula NOT SEEING IS NOT (WANT TO) KNOWING to the South Korean and Chinese sign where the signer's hand is on the eyes. However, this can be explained by the pattern that iconicity indicates the psychological motivation: a person puts the hand on their eyes because they do not want to see something. Similarly, in their statistical and cross-linguistic study, Börstell and Lepic (2020) apply spatial metaphors (e.g., SAD IS DOWN) to consider directional movements and positions (e.g., up or down) of signs. However, at least a part of signs can be regarded as non-metaphorical, again. For example, in a sign for sadness, the intramodally iconic downward lips indicate the emotion.

Fourth, many sign language linguists do not systematically take account of the concepts of diagram and indexicality as well as their interrelation. As a result, this can lead us to automatically interpret less obviously iconic, that is, diagrammatic, signs as metaphorical. Similarly, Sonesson (2019) regards "universal primary metaphors", including spatial metaphors, as diagrams that represent the invariants of the common lived experience.

On the other hand, I do not deny that it is possible to interpret any signs as metaphorical in certain contexts. Instead of debating which analysis is more correct, we can see that iconic and metaphorical processes are only different types of S-signs (Sonesson 2019; Stampoulidis et al. 2019). And while we are not free to claim that just anything is either iconic or metaphorical, we do need to justify our claims with careful description while being loyal to our experience. This leaves the question of whether people prefer cross-modal and/or metaphorical interpretations in dynamic, everyday use of language or other semiotic systems. Importantly, to emphasise the dynamic nature of meaning-making, whether signs are metaphorical (Stampoulidis et al. 2019) or cross-modally iconic, both processes can become conventional and lose their prominence. Then, one of the processes come "alive" only through conscious (re-)interpretation (Stampoulidis et al. 2019).

As a caveat, I must note that my descriptions of this dataset of lexical signs are hardly exhaustive for all of the kinds of cross-modal patterns to be found in FinSL and other sign languages. More research is thus needed. I also acknowledge that interpretations of any particular sign may vary across individuals (see ambiguous iconicity Keränen 2021). However, as mentioned in Section 3, here I aimed to reflect, become aware of experiential dimensions and essences (types), and to describe them, rather than collecting individual or singular interpretations (tokens) (see Petitmengin and Bitbol 2009).

5.2 Reflections beyond the research question

The articulatory perspective adopted here can also contribute to studies of spoken language. For example, among several scholars, Ahlner and Zlatev (2010) conclude that the word *mumu* is cross-modally iconic, a sound–proprioception gestalt. However, it can be alternatively argued that the voiced word is intramodally iconic based on the resemblance between the proprioceptive feedback and the proprioceptive aspect of the object. Consequently, this raises a question about whether cross-modal iconicity is less prevalent in language than has been previously thought. In both spoken and signed languages, we must also ask the question of how semiotic patterns in production differ from ones in perception (i.e., merely observing).

The identification and analysis of cross-modality is not a simple task. The first difficulty relates to the fact that vague multisensory perceptions are usually difficult to distinguish and describe with verbal expressions (see a discussion about ineffability by Winter 2019b: 31–49). For example, flavour is highly multisensory: a flavour can be influenced by the combination of taste and smell as well as haptics, vision, and sound (e.g., Spence 2015). As such, tasting salt may not involve only a salty taste. Therefore, we may identify multiple alternative analyses to describe the semiotic patterns for the FinSL sign SALT. This may be true for many signs.

Another difficulty in a particular sign's semiotic composition relates to the categorisation of the senses. Many Western folk cultures distinguish between five senses (sight, touch, smell, sound, and taste). With such a categorisation, for example, the sign ACHE would be regarded as intramodal because the concept of pain falls within the scope of the sense touch. However, a construct of five distinct senses is a cultural construct; constructs of the senses vary across cultures and scientific conceptions (see more discussion by Winter 2019b: 11–15). For example, some neurologists (e.g., Craig 2003) regard pain as a distinct sense from touch. Under this conception, the sign ACHE would then be regarded as cross-modally iconic because of the crossing between the proprioceptive feedback and the pain. This second difficulty implies that the task of identification of cross-modality comprises a kind of biological–social tension. Such a view aligns with the Semiotic Hierarchy (Zlatev 2009, 2018).

6 Conclusions

The present study has provided multifaceted insights into the cross-modal iconicity and indexicality of produced sensory and emotional signs in the FinSL lexicon, and has implications for other sign languages. In the production of lexical signs, articulatory feedback (sight and proprioception) is important for the formation of semiotic patterns. All 71 semantically cross-modal signs from the data were analysed as necessarily cross-modally indexical. Only ten of the 71 signs were identified as cross-modally iconic in this study, and highly diagrammatic based on two suprasensory – or more broadly supraexperiential – attributes, either volume or quality. Cross-modal iconicity was found in only sound- and emotion-related signs. In almost all signs, images and diagrams as well as indexicality were observed to be highly integrated.

While sign language linguistics has paid much attention to performative indices such as pointing and use of space, the present study shows the importance of paying attention to abductive indices, including spatiotemporal and factorial contiguities. In addition, the present study works to demonstrate that iconicity is a general property

of language (Perniss et al. 2010), while also showing that indexicality is an equally general property of language. In the context of linguistics, this idea is not novel (see Jakobson 1965). I end this study by quoting Colapietro (2011: 159): "To speak of an icon is, accordingly, a shorthand way of referring to the iconic function of a sign whose mode of signification always encompasses more than this specific function".

Data availability statement

The datasets analysed during the current study are available in the lexical database of Finland's Sign Languages, the Finnish Signbank: https://signbank.csc.fi/.

Appendix

Numbers in Appendix A show the frequency of semiotic patterns found in the results of the analysis, based on the information in Appendix B.

Appendix A: Table of the frequency of semiotic patterns

The Non-manuality, Dominant hand and Non-dominant columns (4–6) refer to the articulatory parts of a sign. Each articulatory part is considered in terms of its iconicity type (IMG, GES, DIA) and iconicity modality (INT, CRO) in the rows. In Column 7, a whole sign is considered in terms of its kinds of indexicality (Abductive (ABD) or Performative (PER)), kinds of contiguity (spatiotemporal (SPA), factorial (FAC) or both (SPF)), and metaphoricity (MET) in the rows. In the rows *Others*, if need be, articulatory parts or a whole sign are labelled as ambiguous (AMB) and un-identifiable (XXX). The row *Total* sums up the frequency of the types. The number 67 in the non-dominant hand shows that half of the signs are one-handed.

Concepts	Subtypes	Glosses	Non-manuality		Dominant hand		Non-dominant hand		Sign			
			Iconicity	Modality	Iconicity	Modality	Iconicity	Modality	Index	Contiguity	Modality	Metaphor
Iconicity	Image	IMG	100		40		22					
	Gestalt diagram	GES	0		28		14					
	Diagram	DIA	0		20		12					
Modality	Intramodal	INT		100		78		44			32	
	Cross-modal	CRO		0		10		6			71	
Indexicality	Performative	PER							3			
	Abductive	ABD							96			
	Spatiotemporal	SPA								3		
	Factorial	FAC								0		
	Facto. & S.temp.	SPF								102		
Metaphor	Metaphor	MET										1
Others	Ambiguous	AMB	0	0	4	1	5	1	5	0	0	
	Unidentifiable	XXX	18	18	26	29	15	16	14	13	15	
Total			118	118	118	118	67	67	118	118	118	1

Appendix B: The glossary list of signs

In the first column, a number labels each sign (118 signs in total) in groups according to the semantic fields of touch, sound, smell, taste, and emotion. The second column contains hyperlinked glosses (in English) for videos of the signs. The other columns correspond to the columns in Appendix A, a whole sign and its articulatory parts (non-manuality, non- and dominant hand) are considered in terms of iconicity, modality, indexicality, contiguity, and metaphoricity.

To briefly instruct on how to read Appendix B, each sign and its non-manual and manual parts is labelled with glosses in the list that are based on the concepts (e.g., image, diagram etc.) discussed in Sections 2.2 and 2.3. See explanations for the glosses (e.g., IMG). For example, the sign INTERESTING (see also Section 4.5) was labelled in a following way: the whole body (non-manuality) is intramodally (INT) imagistic (IMG); both hands (non- and -dominant hand) are cross-modally (CRO) diagrammatic (DIA); signing at the chest factorially (FAC) indicates the whole body and spatio-temporally (SPA) the emotion, in a cross-modal manner (CRO). Since the sign is not necessarily metaphorical, it was not labelled as metaphor (MET).

Touch

No.	Glosses in English	Non-manuality		Dominant hand		Non-dominant hand		Sign			Sign
		Iconicity	Modality	Iconicity	Modality	Iconicity	Modality	Index	Contiguity	Modality	Metaphor
1	NARROW	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	INT	
2	BECOME-BREATHLESS	IMG	INT	GES	INT			ABD	SPF	INT	
3	TOUCH	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	INT	
4	FEEL-PHYSICALLY	IMG	INT	IMG	INT	AMB	INT	ABD	SPF	INT	
5	LIGHT	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	INT	
6	HARD	IMG	INT	IMG	INT	GES	INT	ABD	SPF	INT	
7	DRY	IMG	INT	AMB	INT			AMB	SPF	INT	
8	HOT(BB)	IMG	INT	IMG	INT	GES	INT	ABD	SPF	INT	
9	HOT(forehead)	IMG	INT	IMG	INT			ABD	SPF	INT	
10	COLD	IMG	INT	IMG	INT			ABD	SPF	INT	
11	WARM	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	INT	
12	WET	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	INT	
13	GET-GOOSEBUMPS	IMG	INT	GES	INT	AMB	INT	ABD	SPF	INT	
14	HUNGRY	IMG	INT	AMB	INT	IMG	INT	ABD	SPF	INT	
15	HEAVY	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	INT	
16	BE-FREEZING	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	INT	
17	SOFT	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	INT	
18	SPIKE	IMG	INT	GES	INT	IMG	INT	ABD	SPF	INT	
19	PAIN	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	INT	
20	HURT(sideways)	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
21	ACHE	XXX	XXX	DIA	XXX	DIA	XXX	ABD	XXX	XXX	
22	TACTILE-SIGNING	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	INT	
23	BALANCE(touch)	IMG	INT	DIA	INT	DIA	INT	ABD	SPF	INT	
24	SHARP	IMG	INT	GES	INT	IMG	INT	ABD	SPF	INT	

(continued)

No.	Glosses in English	Non-manuality		Dominant hand		Non-dominant hand		Sign			Sign
		Iconicity	Modality	Iconicity	Modality	Iconicity	Modality	Index	Contiguity	Modality	Metaphor
25	TIGHT	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
26	FEEL(B)	IMG	INT	IMG	INT			ABD	SPF	INT	
27	FEEL(HH)	IMG	INT	IMG	INT	AMB	INT	ABD	SPF	INT	
28	A-FEEL	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	INT	
29	STRONG	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	INT	
30	EMPOWER	IMG	INT	DIA	INT	DIA	INT	ABD	SPF	INT	
31	EXHAUSTED	IMG	INT	DIA	INT	DIA	INT	ABD	SPF	INT	
32	TREMBLE	IMG	INT	IMG	INT			ABD	SPF	INT	
33	TIRED(BcBc)	IMG	INT	GES	INT	GES	INT	ABD	SPF	INT	
34	TIRED(FF)	IMG	INT	GES	INT	GES	INT	ABD	SPF	INT	
35	COUGH	IMG	INT	GES	INT			AMB	SPF	INT	
Sound											
36	SILENT(BqBq)	XXX	XXX	DIA	CRO	DIA	CRO	AMB	SPA	CRO	
37	HARD-OF-HEARING	IMG	INT	DIA	CRO			XXX	SPF	CRO	
38	SHOUT	IMG	INT	XXX	XXX	XXX	XXX	XXX	SPF	CRO	
39	SHOUT(gesture)	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	CRO	
40	HEAR(B)	IMG	INT	IMG	INT			ABD	SPF	CRO	
41	HEAR(G)	IMG	INT	DIA	CRO			PER	SPF	CRO	
42	HEAR(L)	IMG	INT	DIA	INT			ABD	SPF	CRO	
43	DEAF(ear)	IMG	INT	IMG	INT			ABD	SPF	CRO	
44	DEAFENING	IMG	INT	DIA	CRO			ABD	SPF	CRO	
45	NOISE	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
46	MUTE(neck)	IMG	INT	IMG	INT			ABD	SPF	CRO	
47	BANG	XXX	XXX	GES	INT	GES	INT	ABD	SPA	CRO	

(continued)

No.	Glosses in English	Non-manuality		Dominant hand		Non-dominant hand		Sign			Sign
		Iconicity	Modality	Iconicity	Modality	Iconicity	Modality	Index	Contiguity	Modality	Metaphor
48	SPEAK(B)	IMG	INT	IMG	INT			ABD	SPF	CRO	
49	SPEAK(BqBq)	IMG	INT	GES	INT	GES	INT	ABD	SPF	CRO	
50	SPEAK(G)	IMG	INT	DIA	INT			AMB	SPF	CRO	
51	SPEAK(L)	IMG	INT	GES	INT			ABD	SPF	CRO	
52	SOUND	IMG	INT	AMB	INT			AMB	SPF	CRO	
Smell											
53	SMELL(sideways)	IMG	INT	GES	INT			ABD	SPF	CRO	
54	SMELL(Lq)	IMG	INT	IMG	INT			ABD	SPF	CRO	
55	SMELL(nose)	IMG	INT	GES	INT			PER	SPF	CRO	
Taste											
56	DELICIOUS	IMG	INT	XXX	XXX			ABD	SPF	CRO	
57	TASTE	IMG	INT	GES	INT			ABD	SPF	CRO	
58	SALT	IMG	INT	DIA	XXX			ABD	SPF	XXX	
59	SUGAR	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
60	DISGUSTING	IMG	INT	GES	INT			ABD	SPF	CRO	
Emotion											
61	GUESS	IMG	INT	XXX	XXX			ABD	SPF	CRO	
62	ANXIETY	IMG	INT	DIA	AMB	DIA	AMB	ABD	SPF	CRO	
63	GREEDY	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	CRO	
64	WANT	IMG	INT	XXX	XXX			ABD	SPF	CRO	
65	SENSITIVE	IMG	INT	IMG	INT	AMB	INT	ABD	SPF	CRO	
66	RELIEVED	IMG	INT	XXX	XXX			ABD	SPF	CRO	
67	RELAXED	IMG	INT	IMG	INT			ABD	SPF	CRO	
68	SMILE	IMG	INT	GES	INT			ABD	SPF	CRO	
69	GOOD-FEELING	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	

(continued)

No.	Glosses in English	Non-manuality		Dominant hand		Non-dominant hand		Sign			Sign
		Iconicity	Modality	Iconicity	Modality	Iconicity	Modality	Index	Contiguity	Modality	Metaphor
70	BE-AMAZED(55)	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	CRO	
71	BE-AMAZED(eyes_open)	IMG	INT	GES	INT	GES	INT	ABD	SPF	CRO	
72	BE-AMAZED(eyes_fall)	IMG	INT	GES	INT			ABD	SPF	CRO	
73	BE-AMAZED (mouth)	XXX	XXX	GES	INT	GES	INT	ABD	SPF	CRO	
74	BE-AMAZED(nose)	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
75	BE-ASHAMED	IMG	INT	IMG	INT			ABD	SPF	CRO	
76	FACIAL-EXPRESSION-SURLY	IMG	INT	DIA	INT			ABD	SPF	CRO	
77	HAPPY	IMG	INT	XXX	XXX	XXX	XXX	ABD	SPF	CRO	
78	CRY(GG)	IMG	INT	GES	INT	GES	INT	ABD	SPF	CRO	
79	CRY(XX)	IMG	INT	GES	INT	GES	INT	ABD	SPF	CRO	
80	NERVOUS(5c5c)	IMG	INT	XXX	XXX	XXX	XXX	ABD	SPF	CRO	
81	NERVOUS(F)	IMG	INT	IMG	INT			ABD	SPF	CRO	
82	NERVOUS(LcLc)	XXX	XXX	GES	INT	GES	INT	ABD	SPF	CRO	
83	STIFF	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	CRO	
84	JEALOUS	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
85	REGRET(hand)	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
86	REGRET(head)	IMG	INT	IMG	INT			ABD	SPF	CRO	
87	INTERESTING	IMG	INT	DIA	CRO	DIA	CRO	ABD	SPF	CRO	
88	TOUCHING(emotion)	IMG	INT	IMG	INT			ABD	SPF	CRO	
89	GET-BORED	IMG	INT	GES	XXX			ABD	SPF	XXX	
90	SUFFER	IMG	INT	XXX	XXX			ABD	SPF	CRO	
91	DEPRESSION	IMG	INT	DIA	CRO	DIA	CRO	ABD	SPF	CRO	
92	ENJOY	IMG	INT	XXX	XXX	XXX	XXX	ABD	SPF	CRO	
93	CONSCIENCE(emotion)	IMG	INT	GES	INT			PER	SPF	CRO	
94	ADDICT	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	CRO	MET

(continued)

No.	Glosses in English	Non-manuality		Dominant hand		Non-dominant hand		Sign			Sign
		Iconicity	Modality	Iconicity	Modality	Iconicity	Modality	Index	Contiguity	Modality	Metaphor
95	BE-SCARED(5)	IMG	INT	XXX	XXX			ABD	SPF	CRO	
96	BE-SCARED(G)	IMG	INT	DIA	INT			ABD	SPF	CRO	
97	BE-AFRAID(F)	XXX	XXX	XXX	XXX			XXX	XXX	XXX	
98	BE-AFRAID(L)	XXX	XXX	XXX	XXX			XXX	XXX	XXX	
99	BE-DISAPPOINTED	XXX	XXX	XXX	XXX			XXX	XXX	XXX	
100	MAKE-LAUGH	IMG	INT	GES	INT			ABD	SPF	CRO	
101	LOVE	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	CRO	
102	FALL-IN-LOVE	IMG	INT	DIA	CRO			ABD	SPF	CRO	
103	HEAVY(emotion)	IMG	INT	AMB	INT	AMB	INT	ABD	SPF	CRO	
104	PEACEFUL	IMG	INT	GES	INT	GES	INT	ABD	SPA	CRO	
105	RELAXED	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	CRO	
106	SHOCK	IMG	INT	DIA	CRO	DIA	CRO	ABD	SPF	CRO	
107	STRESS	IMG	INT	XXX	XXX	XXX	XXX	ABD	SPF	CRO	
108	CLOSE-MOUTH(emotion)	XXX	XXX	GES	INT	GES	INT	ABD	SPF	CRO	
109	SAD	IMG	INT	XXX	XXX			ABD	SPF	CRO	
110	CORNERS-OF-MOUTH-DOWN	IMG	INT	GES	INT	GES	INT	ABD	SPF	CRO	
111	GET-ANGRY	IMG	INT	IMG	INT	IMG	INT	ABD	SPF	CRO	
112	FEEL-LIKE	IMG	INT	GES	INT			ABD	SPF	CRO	
113	BE-FRUSTRATED(palm)	IMG	INT	DIA	CRO	DIA	CRO	ABD	SPF	CRO	
114	BE-FRUSTRATED(chest)	IMG	INT	DIA	CRO	DIA	CRO	ABD	SPF	CRO	
115	SATISFIED	IMG	INT	XXX	XXX			ABD	SPF	CRO	
116	NOT-DARE	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
117	ANGRY	IMG	INT	XXX	XXX	XXX	XXX	ABD	SPF	CRO	
118	HATE	IMG	INT	IMG	INT			ABD	SPF	CRO	

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