Dachkovsky, Svetlana. 2022. Emergence of a subordinate construction in a sign language: Intonation ploughs the field for morphosyntax. *Glossa: a journal of general linguistics* 7(1). pp. 1–41. DOI: https://doi.org/10.16995/glossa.9074

Emergence of a subordinate construction in a sign language: Intonation ploughs the field for morphosyntax

Svetlana Dachkovsky, University of Haifa, Gordon College of Education, Israel, dachkov@yahoo.com

A central question in historical linguistics is how subordination emerges. Many linguists have hypothesized that diachronically subordinate constructions start off with intonational signals, and that these precede morphosyntactic markers of subordination (Givón 2012; Mithun 2009 *inter alia*). Contemporary spoken languages cannot provide a testing ground for this hypothesis because all of them have fully grammaticalized subordinate constructions. However, a young sign language, such as Israeli Sign Language (ISL), is perfectly suited for this purpose (Meir and Sandler 2008). In ISL, relative clauses are usually marked by squinted eyes and a forward head position, which have been shown to perform the functions of intonation (Sandler 1999; Dachkovsky, Healy and Sandler 2013), as well as by a manual demonstrative form appearing at the relative clause boundary.

Yet, consistent marking of relative clauses in the language is characteristic of the younger signers' but not of the older signers' language. This suggests that relative clause marking developed over time in the language, which leads us to ask how it emerged and developed. The present study tracks the emergence of the relative clause (RC) construction by investigating changes in intonational and morphosyntactic signals across three generations of ISL signers. The study demonstrates that these signals begin as pragmatic or, more specifically, as information structuring devices, and are transformed by a grammaticalization process into RC markers. Furthermore, we show that intonational cues in the newly emerging RCs pave the way for a morphosyntactic marker.

1. Introduction

When we see such a simple picture as the one below, we can describe it in several different ways. We can say that *The girl is swinging and eating ice-cream*, but we can also say *The girl who is swinging is eating ice-cream*. Or, *The girl who is eating ice-cream is swinging*.

The difference in the descriptions stems from our communicative need to anchor one event in terms of the other event, and to mark one event as presupposed and the other as asserted on the basis of the first one. The functional asymmetry between the events lies at the heart of the subordinate relation between the relative clause (specifying predication) and the main clause (main predication) in the relative clause (RC) construction (Croft 1995; Cristofaro 2003). Cross-linguistically, the function of relative clauses is signaled with a variety of means and signals, ranging from prosodic cues in a less syntactically integrated construction to highly embedded structures manifested by relative pronouns/relativizers and special verb forms.

Historical linguists have hypothesized that subordinate constructions start off with intonational signals, and that these precede morphosyntactic markers of subordination (Mithun 2009; Givón 2015, *inter alia*). Contemporary spoken languages cannot provide a testing ground for this hypothesis because most of them have fully grammaticalized subordinate constructions. However, a young sign language, such as Israeli Sign Language (ISL), is perfectly suited for this purpose (Meir & Sandler 2008). The present study tracks the emergence of the relative clause (RC) construction by investigating changes in intonational and morphosyntactic signals across three generations of ISL signers.

Section 2 of the present paper discusses the underlying communicative goal of the relative clause construction as the functional foundation of the study. The relative clause is defined as a clause which uses an event/state clause to identify a referent. The section overviews the cross-linguistic structural diversity of the relative clauses, with a special emphasis on the structural cues which are usually overlooked or neglected – prosodic signals. It culminates in a comparison of the existing hypotheses on the genesis of the relative clause constructions and their marking throughout the history of human languages, highlighting the scarcity of historic evidence.

While the origin and historical paths of the relative clause construction in spoken languages can be traced almost exclusively through internal reconstruction, **young** sign languages, like Israeli Sign Language (ISL), have a better chance to fill in this lacuna and to provide diachronic evidence. Section 3 demonstrates that sign languages, like other natural languages, display various subtypes of the relative clause constructions. In ISL, relative clauses are usually marked by squinted eyes and a forward head position, which have been shown to perform the functions of intonation (Nespor & Sandler 1999; Dachkovsky, Healy & Sandler 2013), as well as by a manual demonstrative form which often marks the boundary between the relative clause and the main clause. Yet, consistent marking of relative clauses in ISL is characteristic of the younger signers' but not of the older signers' production. This suggests that relative clause marking developed over time in the language, which leads us to ask how it emerged and developed.

Section 4, Method, reports on the way the emergence of the relative clause (RC) construction was traced in the study. Adopting Labov's (1963) Apparent Time hypothesis, which infers diachronic changes from synchronic data collected from different age groups, the ISL data were collected from three generations of signers through an interactive task designed to elicit relative clauses. In order to deduce, analyze and evaluate changes, the behavior of intonational signals and manual pointing signs was analyzed in accordance with two basic criteria of language change: (1) degree of obligatoriness, and (2) changes in the distribution of cues in relation to the major structural constituents of the RC construction (e.g., Hopper & Traugott 2003).

Section 5, Results, shows that the RC construction emerges through a gradual and consecutive transformation of two intonational components – 'forward head movement' (FHM) and 'squint'. FHM is the first to spread from the topic domain to the relative clause domain. A similar path is followed a generation later by squint. The manual pointing sign is the last one to change its distribution from a gesture-like signal to the RC boundary marker

Section 6, Discussion, interprets the results as indicators of the gradual crystallization of the RC construction in ISL. The non-manual signals begin as pragmatic or, more specifically, as information structuring devices, and become the markers of subordination asymmetry in relative clauses. Furthermore, intonational cues in the newly emerging RCs pave the way for a relative pronoun-like morphosyntactic marker. Section 7, Conclusions, highlights the fact

that the advanced stage of the RC construction formation is characterized by the clustering of multiple intonational and morpho-syntactic signals at RC boundaries, which reinforces the internal cohesion of the whole construction.

2. What is a relative clause construction, and how does it emerge?

Before the paper dives into the origin and emergence of the relative clause construction in a young sign language, I will define the target grammatical construction. In order to avoid circularity, the paper defines the construction *without* reference to particular formal values. For this reason, this paper opts for a semantic or functional definition of the relative clause construction (Hendery 2012).

2.1 The function of the relative clause construction

The functional definition of relative clauses that I adopt is based on insights from Keenan and Comrie (1977), Downing (1978), Cristofaro (2003), Givón (2009) and Hendery (2012). Functional equivalents of relative clauses – abbreviated as RCs – are characterized by the following features and exemplified in Example (1):

1. They contain some sort of predicate.
2. They are linked to another clause.
3. They delimit the reference of a noun phrase by specifying the role of the referent of the noun phrase in the situation described by the predicate of the relative clause.

(1) *The book I read was very interesting.*

The main function of the relative clause *I read* is singling out the referent, *book*, for further elaboration in the main clause, *was very interesting*. It thus fulfills the function of specification subserving the referential function. On the other hand, the property of being interesting is outside of this grouping, since it is expressed by the main-clause predicate at a higher level of grammatical organization.

The functional definition of the RC constructions rests on a more general functional definition of subordination, which involves a cognitive asymmetry established between two or more states of affairs (Croft 1995; Cristofaro 2003). In terms of the information structure, the subordinated event in RCs tends to present non-asserted, given information, whereas the non-subordinated event asserts, that is, provides new information (Cristofaro 2003; see also Lambrecht 1996). The fact that relative clauses subserve the referential function of the nominal might explain their major discourse functions. It has been observed that relative clauses often act as topics in discourse by presenting referents as anchors (Prince 1981: 236) for subsequent main predication.

In sum, somewhat simplified, (restrictive) relative clauses are used universally as modifiers of head nouns, to identify or further restrict the domain of reference. The relative clause performs this function by depicting an event – known to the hearer and thus 'presupposed' – in which the co-referent head noun was a participant as subject, object, indirect object. (Givón 2015). The functional scheme of the relative clause construction is summarized in **Figure 1** below. This scheme is going to be essential for the subsequent discussion (Sections 6 and 7) of the changes undergone by the structural cues of the RC construction in ISL, as well as for the motivation of those changes.

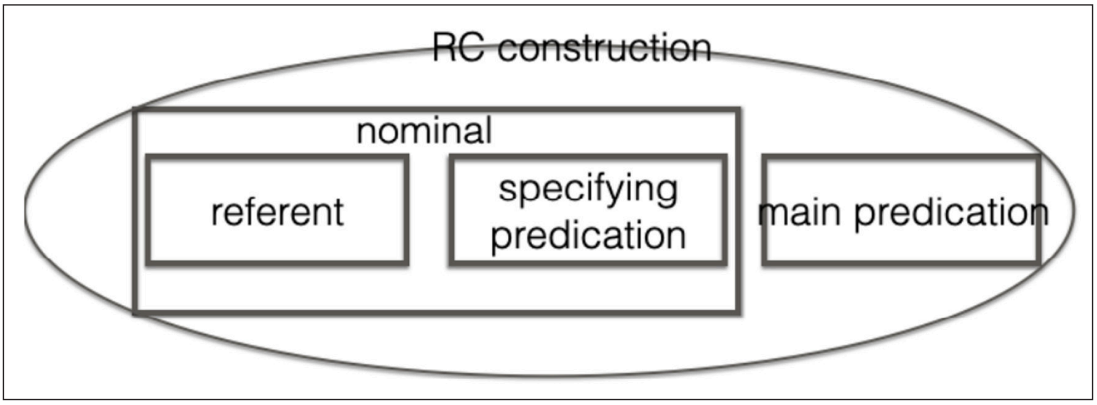

Figure 1: The functional scheme of the RC construction.

2.2 The structure of the relative clause construction: degrees of clause integration and their marking

Whereas the conceptual definition of the relative clause construction is relatively well-established in the literature, its form varies widely both cross-linguistically and diachronically (e.g., Keenan & Comrie 1977; Hendery 2012). Three major formational parameters are usually distinguished (see Hendery 2012 for a comprehensive overview): the degree of relative clause integration in terms of adjunction/ embedding; internal/external position of the nominal head in relation to the specifying predication; and prenominal/postnominal position of relative clauses in relation to the nominal head.

One of the most crucial RC dimensions is the degree of the syntactic integration between the specifying and major predication: the syntactic, formational relation between a relative clause and the matrix clause may vary from loosely connected (adjoined in *parataxis*) to closely integrated (embedded in *hypotaxis*) (e.g. Lehmann 1986, 1988; Hopper & Traugott 2003). The adjoined/ embedded parameter can be further broken down into formational features such as the presence/absence of subordination markers (e.g., relative pronouns, relativizers, etc.), balanced/deranked verb forms, special word order/main clause word order, etc.

Parataxis involves the juxtaposition of two autonomous clauses, neither of which is syntactically dependent on the other, **under a unifying intonation contour (**Hopper & Traugott 2003), as in Example (2) below. Even though the semantic relation between the two clauses is expressed by prosodic means only, the two autonomous clauses together constitute a complex sentence (cf. Givón 2015).

(2) *The girl is swinging, she is eating ice-cream.*

A construction is more integrated (hypotactic) when a clause is dependent on the main clause. At the right-hand end of the clause linkage continuum are complex sentences consisting of a main clause and an embedded clause. In English, relative clauses can be preceded by a head noun phrase followed by a relative pronoun (Ex. 3). In some contexts, a relative pronoun can be substituted with the invariant relativizer *that,* which corelates with the high level of embedding, as well as the use of non-finite verb forms (Ex. 4) (Bruyn 1995; Hopper & Traugott 2003; but see Romaine 1984).

(3) *The girl [who is swinging,] is eating ice-cream.*

(4) *The girl [that is swinging], is eating ice-cream.*

Apart from the presence and the nature of the grammatical connecting element, there is another type of structural components whose importance for the RC construction cannot be overestimated. The recent dynamic models of functional subordination (e.g., Langacker 2014) argue that **prosody** (rhythm, pauses and intonation) not only reflects functional aspects of subordination, but, at the same time, enhances or weakens the degree of clause integration, since intonation units are treated as basic units of thought packaging. Since prosodic constituents have special salience as the level we primarily attend to, they represent windows of attention (Du Bois 1985; Chafe 1994; Langacker 2014 *inter alia*). Yet, the contribution of prosody to the clause combining in subordination is often overlooked.

Moreover, prosodic characteristics do not constitute all-or-nothing phenomena: the degree of clausal integration might interact with the number (e.g., the presence of pauses, pitch reset, a type of a boundary tone or a pitch accent, etc.) and the intensity of prosodic characteristics (length of pauses, strength of pitch reset, etc.) (Cohen & t Hart 1965; Couper-Kuhlen 1996). Applying this idea to a wide range of relative clauses, Birkner (2008; 2012), checked the widely assumed correlation between semantic characteristics of RCs (e.g., restrictive/ non-restrictive scopes) with particular prosodic designs. The author demonstrated that the link between the semantics of the RC type and prosody is indeed very complex – although non-restrictive relative clauses occur more frequently as separate prosodic constituents, restrictive relative clauses also

exhibit this format quite often. The reason for the mismatch might be due to factors beyond the sentence itself, such as information structure and interaction.

Relative clauses can be classified further on the basis of the grammatical function of the head noun and the nominal gap into SS (subject-subject), SO (subject-object), OS (object-subject) and SO (subject-object) relative e clauses (e.g., Sheldon 1974). The present study focuses on subject-subject relative clauses, whereas the variation in other formational parameters is left completely open. In fact, it is the major goal of the study to determine which formational features vary in a young sign language diachronically, and how they interact with each other. In order to tackle this question, Section 2.3 will summarize which dimensions of the RC construction are usually modified in language change.

2.3 The origin and diachronic development of the relative clause construction: from information structure to subordination

In spite of the diversity of RC structural types outlined above, the following universal constraints have been hypothesized to shape the diachronic rise of all REL-clause types (e.g., Givón 2015): a) the communicative goal of using REL-clauses and b) the general developmental trend from juxtaposed clause linkage (parataxis) to syntactically integrated construction (hypotaxis). It has been a common assumption that complex constructions in modern languages have their roots in juxtaposition of independent clauses in an earlier stage of the language (Lehmann 1985; Hewitt 1987; Ramat 2000; Hopper & Traugott 2003; Givón 2009 *inter alia*), or, to put it in Hopper and Traugott's words (2003: 168), they are a "unidirectional cline from relatively free juxtaposition to syntactic and morphological bondedness".

Cross-linguistically there are two major ways in which clause subordination might arise: either via the integration of two independent sentences within one sentence or via expansion, that is, the reinterpretation of a thing-like (nominal) participant as a propositional (clausal) participant (Heine & Kuteva 2007, chapter 5; Givón 2009; 2015).[1] The integration pathway, or, in Givón's (2009) terminology, the clause-chaining pathway, involves a starting point where two chained clauses with separate intonation contours **become subsumed under a unifying intonation contour**, and is illustrated in (5), an example from Bambara, which is ambiguous between a chained construction and a relative clause.

(5) *n ye ce min ye, o ye muru san*
I PAST man REL/DEM see he PAST knife buy
'The man that I saw, he bought the knife'
'I saw that man, he bought the knife' (Givón 2009: 99, ex. 4b)

[1] The reader is referred to a number of publications by Givón (2009; 2015), which discuss a much wider range of more specific historical processes (e.g., WH-question pathway') than this paper is able to cover here and provide a coherent syntactic account of these processes.

The expansion pathway attempts to account for the process by which devices that first served to structure independent sentences come to assume functions of subordination. One specific instantiation of this pathway is the restructuring of a non-restrictive (parenthetical) relative clause (6a) into the restrictive relative clause (6b). Crucially, according to this pathway, the word order is **reorganized** and the demonstrative DIE **is grammaticalized** into the relative pronoun. In the process of grammaticalization, the demonstrative loses its strong contrastive focus semantics and becomes phonologically reduced.

(6) a. *Ich kenne die Frau, DIE hat dem Mann das Buch gegeben*
I.NOM know the woman.ACC DEM.NOM has the.DAT man the book.ACC given
'I know the woman, the one who gave the book to the man'
Historically: 'I know the woman. THAT one gave the book to the man.'
(Givón 2009: 104, ex. 15a)

b. *Ich kenne die Frau, die dem Mann das Buch gegeben hat*
I.NOM know the woman. ACC DEM.NOM the man.DAT the book.ACC given has
'I know the woman who gave the book to the man' (Givón 2009: 105, ex. 16a)

Unfortunately, historical information on this sort of grammatical change in the languages of the world is scanty (Givón 2009: 119), and many of the reconstructions proposed are based on applying the methodology of grammaticalization theory to synchronic linguistic data, even if a small number of the reconstructions are also supported by attested historical evidence (McConvell 2006; see Hendery 2012 for an overview).

One reason why the parataxis-to-hypotaxis hypothesis is so difficult to support empirically might come from the claim that the onset of either subordination pathway – integration and expansion – seems to involve one crucial and obligatory step – adjustment and **merger of intonation contours** (Sankoff & Brown 1976; Traugott & Hopper 2003; Givón 2009; Mithun 2009). The investigation of the RC genesis in young contact languages, such as pidgins and creoles (e.g., Sankoff & Brown 1976; Bickerton 2016) might provide a solution for this problem. Bruyn (1995) demonstrated that RCs in Sranan, a creole language spoken in Suriname, developed as a result of a complex interplay between several interrelated processes: (i) the development of relative markers from demonstrative pronouns, (ii) the grammaticalization of anaphoric relations in adjacent clauses, and (iii) gradual integration of the clauses from parataxis to full subordination.

Yet, due to the limitations of the writing systems and the scarcity of language documentation, diachronic changes of prosodic integration are not systematically reflected even in (relatively) young spoken languages. The lack of solid empirical evidence led a number of researchers to conclude that the parataxis-to-hypotaxis hypothesis should be abandoned altogether (Bednarczuk 1980; Harris & Campbell 1995; Roberts 2007; Weiß 2020 *inter alia)*. The discussion in the current section highlights what is missing to complete the argument: diachronic evidence supporting or

refuting proposed 'pathways of change', and the role of intonation in this process. The present study aims to provide exactly this sort of evidence.

3. Relative clauses in sign languages

The form and function of relative clauses have been studied in depth in a number of sign languages (American Sign Language (ASL): Liddell 1978; 1980; Israeli Sign Language (ISL): Dachkovsky & Sandler 2009; Italian Sign Language (LIS): Cecchetto et al. 2006; Branchini & Donati 2009; Branchini 2014; Cecchetto & Donati 2016; Turkish Sign Language (TİD): Kubus 2014; German Sign Language (DGS): Pfau & Steinbach 2006a; Hong Kong Sign Language (HKSL): Tang et al. 2010; also see Wilbur 2017, for an overview). Recently, new studies on other sign languages have joined the pool (Catalan Sign Language: Mosella 2012; French Sign Language: Hauser & Geraci 2018; Japanese Sign Language: Penner et al. 2019; Russian Sign Language: Khristoforova & Kimmelman 2020; and Sign Language of the Netherlands: Kimmelman & Vink 2017).

One common feature has been attested in the form of relative clauses in all sign languages studied so far: they are marked with grammatical facial expressions and other non-manual features (e.g., head and torso movements). There are two main issues in the discussion of non-manuals: a) specific non-manual signals co-occurring with relative clause constructions, and b) their scope in relation to relative clause constituents. Cross-linguistically, relative clauses are commonly marked by raised brows and/or decreased eye aperture, the latter realized as raised cheeks or squinted eyes (e.g., Liddell 1978; 2003; Branchini & Donati 2009; Dachkovsky & Sandler 2009; Kubus 2014 *inter alia*). In addition, particular head movements, such as backward or forward tilts, have been reported to co-occur with relative clauses (Liddell 1978; Aarons 1996; Dachkovsky & Sandler 2009). Thus, previous studies demonstrated that RCs in ISL are frequently associated with squinted eyes, and forward head movement (FHM) (Dachkovsky & Sandler 2009; Dachkovsky et al. 2013) (**Figure 2**).

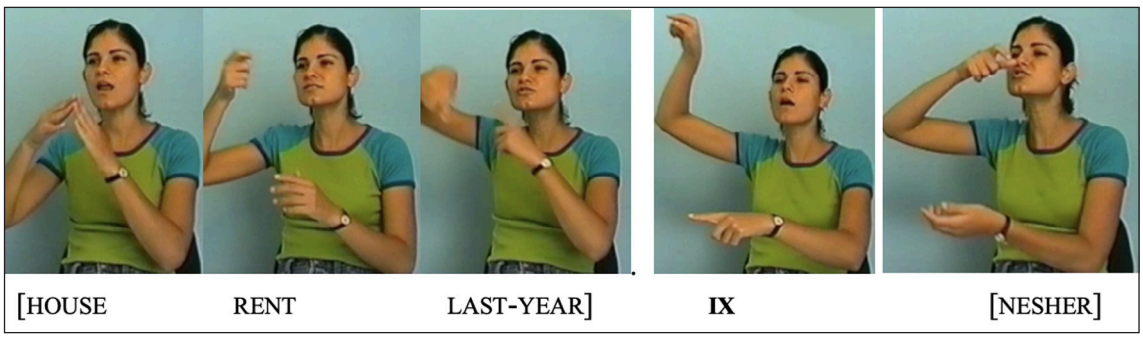

Figure 2: Non-manual marking and a pointing sign in the ISL relative clause construction *The apartment we rented last year* and the main clause *is in Nesher.*

Some recent studies, though, have demonstrated an intriguing variation in the non-manual cues of relative clauses (e.g., Kubus & Nuhbalaoglu 2018; Khristoforova & Kimmelman 2020). This apparent paradox between systematicity and variation might stem from the very nature of the non-manual marking in sign languages – facial expressions and head movements have been argued to be comparable to intonation in their characteristic structural and functional features (e.g., Nespor & Sandler 1999; Reilly 2000; Dachkovsky & Sandler 2009). While early work attributed non-manual markers of interrogatives, topics, and relative clauses, etc. to the syntactic level of analysis (Liddell 1978; 1980; Neidle 2000 among others), more recent studies have shown that facial expression and head movements align with intonational boundaries, which are not isomorphic with syntactic boundaries (Sandler & Lillo-Martin 2006; Sandler 2010).

Thus, instead of linking specific facial expressions and head movements directly with syntactic constructions, they can be better accounted for as intonational components which contribute distinct, albeit general, pragmatic meaning to the overall interpretation of an utterance (Nespor & Sandler 1999; Dachkovsky & Sandler 2009). For instance, squint is a marker of information status, and functions as an instruction to the addressee to retrieve information which is not readily accessible (Dachkovsky & Sandler 2009). It is by virtue of this function that it is commonly found with relative clauses and topics in ISL. Forward Head Movement (FHM), the other frequently occurring non-manual in relative clauses, systematically marks dependency relations between constituents in ISL, including topics and conditionals. **Figure 3** below presents a typical display of Low Accessibility topics in ISL, which combines both FHM and squint.

Figure 3: Intonational pattern of the (low accessibility) topic in ISL, consisting of FHM and squinted eyes. It appears in the sentence *'My friend <u>Yossi</u> died in a car accident'*.

Being closely related to pragmatic meanings and interactional functions, the non-manual marking of relative clauses might be especially sensitive to modifications in the information status of the specified referents, as well as to the context and elicitation procedures. For example, prior work on ISL has shown that relative clauses with generic referents (e.g., 'Students who received grades higher than 90 are allowed to pass to the next course') are more likely to be associated with raised brows than with squinted eyes (Dachkovsky 2005; Dachkovsky & Sandler 2009), as the implied meaning of the clausal relation here is closer to that of the conditional construction (Ziv 1997).

Another characteristic feature of intonation, both in spoken and signed languages, is its two-faced nature – the same intonational components convey both linguistic and affective/ attitudinal functions (Gussenhoven 2002). Thus, FHM, being a marker of grammatical dependency in signed languages, is also generally associated with elevated attention at the addressee both synchronically and ontogenetically (e.g., James 1932; Liu et al. 2013). As for squint, its usage in human interaction has been argued to stem from its basic meaning of concentration on something distant (Darwin 1965; Rosenberg & Ekman 2020; Navarro & Karlins 2008: 175-176) and, hence, its related ability to signal some distance in time or space, retrieval from the memory or common knowledge, and even incredulity or disbelief as part of the common ground negotiation process (Bavelas & Gerwing 2007).

Despite their apparent similarity, linguistic intonation is distinguished from affective or emotional expression in sign languages in a number of ways. In addition to its *systematic* presence in specific linguistic structures and constituents (e.g., relative clauses, topics, counterfactual conditionals, etc.), linguistic non-manual signals tend to be aligned with linguistic prosodic constituents, as in **Figure 3** below, where the scope of FHM and squint neatly corresponds to the prosodic constituents of the relative clause construction. In contrast, non-linguistic (affective/ emotional) signals do not need to be tied to the boundaries of linguistic constituents (Baker-Shenk 1983; Dachkovsky 2005; 2008). Thus, this aspect of the nonmanual behavior again highlights their prosodic, rather than syntactic, status.[2]

In addition to non-manual intonational markers, relative clauses are often accompanied by manual cues of relative clauses, usually in the form of pointing signs, reported to be obligatory only in some sign languages, such as DGS (Pfau & Steinbach 2006a), LiS (Branchini & Donati 2009) and HKSL (Tang et al. 2010). Manual markers of restrictive relative clauses are usually classified on the basis of their ability to show modification for R-loci; relative pronouns (e.g., in

[2] The present study adopts as a premise that syntactic and prosodic structure are not isomorphic (Sandler & Lillo-Martin 2006; Nespor & Vogel 2007; Sandler 2010), and assumes that syntactic and prosodic structure in sign languages interact with one another but are distinct.

DGS, Pfau & Steinbach 2006a, and in LiS, Branchini & Donati 2009), but not relativizers (e.g., THAT in ASL, Liddell 1978; 1980), display such modification.

As far as ISL is concerned, RC constructions frequently co-occur with pointing signs (**Figure 2** above), which often appear at the boundary between the relative clause (specifying predication) and the major clause (main predication) (Dachkovsky 2020). Since the pointing sign at the clausal boundary in ISL relative clauses in some cases appears as spatially modified, and in other cases its directionality is neutral and invariant, its grammatical status seems to be ambiguous between that of the relative pronoun and the invariant relativizer (Dachkovsky 2020).

Informal observation that motivated the present research was that the systematic non-manual and manual marking of RC is characteristic of younger ISL users but not of older signers. How does it emerge? What is the origin of the RC construction? The following section overviews the existing evidence for the emergence of subordination in different sign languages.

3.1 Emergence of relative clause constructions in sign languages: evidence

The field of emerging sign languages has laid important foundations for understanding how grammatical complexity in general and subordination in particular arise. Young sign languages provide a natural laboratory for investigating this question, both because they can emerge *de novo* at any time, and because the cues of linguistic organization are overtly visible. Importantly, findings imply that conceptual organization of communicative messages precedes linguistic organization, an implication that will be relevant for the present study. This section will first consider what we know about the emergence of manual relative clause markers, and then will proceed to a more global restructuring of subordinate constructions, including their non-manual marking.

3.1.1 Grammaticalization of pointing signs as subordination cues

Researchers have proposed that pointing signs enter the grammar of sign languages first as locative markers (e.g., Pfau & Steinbach 2006b; 2011), though their use in mature sign languages has grammaticalized to include many other functions, such demonstrative, personal and relative pronouns, to the even more grammatical forms of agreement markers and auxiliaries. Until recently this hypothesis has been supported mainly via internal reconstruction of the proposed path on the basis of synchronic variation (e.g., Khristoforova 2020).

Emerging sign languages can provide a unique window into the grammaticalization of demonstratives. In these young languages, diachronic changes can be inferred by studying different age groups of language users, based on the Apparent Time Hypothesis (Labov 1963). Although the number of such studies is relatively scarce, a few papers deserve to be mentioned in this respect. For examples, Coppola and Senghas (2010) convincingly argue for the grammaticalization of

pointing expressions in a young sign language, Nicaraguan Sign Language (NSL). In accordance with the demonstrative grammaticalization pathway, locative pointing signs appear to occur with older cohorts of NSL signers, while pronominal pointing signs appear later, in the language of the younger cohorts. Importantly, the authors examine the grammaticalization of demonstratives as a multi-channel process – they scrupulously quantify not only a variety of features related to the manual sign itself (e.g., frequency of occurrence, the presence and duration of movement) but also non-manual features (e.g., gaze alignment) as parameters of grammaticalization.

A recent study by Dachkovsky (2020) specifically aims to determine the steps in the grammaticalization of the pointing RC marker in ISL. Similarly to Coppola and Senghas' method, the diachronic changes are inferred there from three ISL generations' productions. The results reveal that the behavior of demonstratives in the data varied with the signers' ages along diagnostic criteria of grammaticalization (e.g., Hopper & Traugott 2003): frequency of occurrence, changes in the distributional and morphological patterns, and decrease in phonetic strength. The study shows that in the RC equivalents the demonstratives start as gestural locative pointing signs and then grammaticalize into relative pronouns connecting relative and main clauses and agreeing with referent loci. At a more advanced stage of ISL, the relative pronoun is shown to grammaticalize into an invariant relativizer.

3.1.2 Changes in non-manual marking and genesis of embedding in sign languages

A new perspective on the emergence of linguistic complexity has arisen in the investigation of Al-Sayid Bedouin Sign Language, a young sign language that began with four deaf children in a single family about 90 years ago in the Negev desert village, Israel (Aronoff et al. 2008 and Sandler et al. 2014, for an overview). The deaf population has since spread throughout the village, now numbering about 150 deaf people in a village of 4,000. Sandler et al. (2011) demonstrate the emergence of complexity in this language, by tracing the interaction between prosody and syntax in the narratives of two older and two younger signers. The authors find that younger signers produce prosodic cues to dependency and asymmetry between semantically related constituents, e.g., the two clauses of conditionals, revealing a type and degree of complexity in their language that is not frequent in that of the older pair. In these younger signers, several rhythmic and intonational cues are aligned at constituent boundaries, indicating the emergence of a grammatical system. There are no overt syntactic markers (such as complementizers) to relate clauses; prosody is the only clue. But this prosodic complexity is matched by syntactic complexity inside propositions in the younger signers, who are more likely to use pronouns as abstract grammatical markers of arguments, and to combine predicates with their arguments within in a constituent. As the prosodic means emerge for identifying constituent types and signaling dependency relations between them, the constituents themselves become increasingly complex. The study shows that the emergence of grammatical complexity is gradual, and that prosody is its first marker.

The issue of the origin of subordination was investigated on the basis of the data from another emerging village sign language in Israel – Kafr Qasem Sign Language (KQSL) (Kastner et al. 2014). The study identifies the earliest indications of embedding in this young language by using both semantic and prosodic criteria. The cases of embedding manifest in the form of phonologically reduced predicates which form a prosodic constituent with a preceding noun, functionally modifying the latter. The authors analyze these structures as instances of embedded predicates, which have been recruited as nominal modifiers into the pre-existing post-nominal slot, exhibiting what can be regarded as very early stages in the development of subordinate constructions. Furthermore, since the only clues for the embedded status of these predicates in KQSL are prosodic, this case bears important witness to the role that prosody plays in the emergence of embedding. The paper speculates that these developments might continue, with the embedded structures gradually allowing more elements and eventually leading to full-fledged relative clauses, in case all the types of predicates are integrated.

The aforementioned studies of the two young village sign languages of Israel rely on a small number of participants, due to the exigencies of fieldwork in a community of this kind. In contrast, Israeli Sign Language (ISL) offers a field that is much less limited, both in the size of the deaf population (estimated at about 10,000) and in their availability. Dachkovsky et al. (2018) demonstrate the asymmetrical relations across propositions – that is, typically, subordination – are significantly more common in the younger than in the older signers of ISL. Importantly, the study demonstrates the signals of asymmetry arise in the older signers' production first as the cues of information structure asymmetry (e.g., topic-comment) and later, in younger generations, are recruited for the asymmetry between clauses, i.e., subordination. These findings support the hypothesis that, cross-linguistically, information structure devices grammaticalize into the cues of subordination (e.g., Sankoff & Brown 1976; Haiman 1978 for spoken languages; Janzen 1999 for sign languages).

As far as the emergence of the specific subordinate construction – relative clauses – is concerned, Kocab in her dissertation (2017) demonstrates that all three age cohorts of Nicaraguan Sign Language have strategies to fulfill the discourse function of relative clauses. This is argued to indicate that the concept of a predicate embedded in a referential phrase (the NP) is available to signers from the outset. Yet, the linguistic expression of the relative embedding concept – the reduced duration of the embedded verb – does not appear until later in the language's development and manifests in the prosodic changes of the morphological aspectual verb patterns. These findings indeed corroborate the predictions toward the emergence of relative clauses envisaged in Kastner et al. (2014).

The studies overviewed in this section have a few caveats: a) they either focus on a specific type of RC cues (e.g., manual markers), or b) they investigate a broader spectrum of (semi) spontaneously produced subordinate structures, without controlled elicitation of the RC

equivalents, or c) their conclusions are based on the internal reconstruction of the synchronic data. The present study aims to overcome these limitations by tracing the changes of a wider range of cues in the RC equivalents produced in a tightly controlled communicative task by different age groups of ISL signers. Yet, the previous studies of the RC development in spoken and sign languages lay very important empirical and theoretical foundations for the present quest on the emergence of the RC construction in ISL. They also form the basis for the hypotheses entertained in the study and reviewed in the following section.

3.2 The present study: working hypotheses

The objective of the present study is to trace the changes that affect prosodic and morpho-syntactic cues in the RC equivalents produced in the three age groups of ISL signers. The following hypotheses will serve as reference points for the overall discussion in the present study:

1) The studies on emerging and young languages demonstrate that ***conceptual hierarchical structuring***, although often overtly reflected in linguistic structure, is not isomorphic with the latter. Crucially, conceptual subordination precedes its systematic linguistic manifestations in language emergence (Sankoff & Brown 1976; Sandler et al. 2011; Kastner et al. 2014; Kocab 2017; Dachkovsky et al. 2018; Dachkovsky 2020 *inter alia*).
2) The genesis of the RC construction in ISL is shaped by ***two main motivations***:
    a) by the general trend from juxtaposed clause linkage (parataxis) to syntactically integrated construction (hypotaxis) (Lehmann 1985; Hewitt 1987; Ramat 2000; Hopper & Traugott 2003; Givón 2009 *inter alia*);
    b) by the communicative goal of using RCs (Givón 2009)
3) The onset of the subordination pathway, either integration or expansion, involves adjustment and **merger of intonation contours** (Sankoff & Brown 1976; Traugott & Hopper 2003; Givón 2009; Mithun 2009; Sandler et al. 2011; Kastner et al. 2014 *inter alia*).

4. Methodology

4.1 The community and participants

ISL is the established language of the deaf community in Israel (Meir & Sandler 2008). It is a young sign language, roughly 90 years old, which arose with the formation of the deaf community around the 1930s, together with the establishment of the first Israeli School for the Deaf in 1932 in Jerusalem. Immigrants from all over the world further contributed to the emerging signing system. A conventional local sign language evolved, and today, ISL is used by roughly 10,000 people in a wide range of settings, including the educational system, deaf organizations,

interpreting programs, the media and even the parliament. The linguistic structure of ISL has been investigated in earlier work (e.g., Meir & Sandler 2008) and its emergence has more recently become the object of study (e.g., Meir 2016).

In this study, we recruited Deaf participants representing different generations of ISL users. The equivalents of relative clauses were videotaped from three age groups of ISL signers: 20–35, 36–50, and 51–72 (**Table 1**). The methodology relies on Labov's Apparent Time hypothesis, which assumes that a person's language does not change significantly after puberty and infers diachronic changes from synchronic data collected from different age groups (Labov 1963).

Group	Age	N	Characteristics
1	51–72	13	Not native signers Come from a variety of linguistic backgrounds Not exposed to a unified linguistic input
2	36–50	8	Six are native ISL signers[3] All the signers had linguistic models for ISL
3	20–35	8	Seven are native ISL signers All the signers had linguistic models for ISL

Table 1: Participants in the study, according to age group.

4.2 Elicitation task

The study used a communicative task created to fit all three age groups of signers. The task was built in such a way so that it would necessitate the use of Subject-Subject (S-S) relative clause equivalents on the one hand, and, on the other hand, would be free from spoken language interference.

The study employed the technique of referent identification, which builds on the insight of Zukowski's (2009) original design targeting the identification of referents with expanded noun phrases. In the task, two identical characters, distinguishable only by their participation in different events (e.g., a girl swinging vs. a girl rocking on a rocking horse), are introduced by a native deaf experimenter. Pictures of both characters engaging in an additional activity are then shown (e.g., in **Figure 4**, one girl is shown eating ice cream in addition to swinging, and the other one is shown drinking in addition to riding a horse).

The participant appointed as 'the director' examined the pictures on the cards, observed the changes that had occurred and told a deaf 'partner' from the same age group which character was doing which action. A native deaf experimenter asked a double question about the observed situation (e.g., ***Which girl is eating ice-cream and which girl is drinking***?). The director's answer

[3] The non-native participants had early exposure to ISL (under the age of 3).

to this double question enabled the partner to choose the appropriate picture from a set of fours cards containing mixed combinations of the referents and their actions. Due to the double question, the expected answer is the equivalent of a restrictive relative clause embedded into a full matrix clause "The girl who is swinging is eating an ice cream, and the girl who is riding the rocking horse is drinking." Signers received four sets of picture pairs. This means that each signer came up with a maximum of eight responses (eight equivalents of S-S restrictive relative clauses).

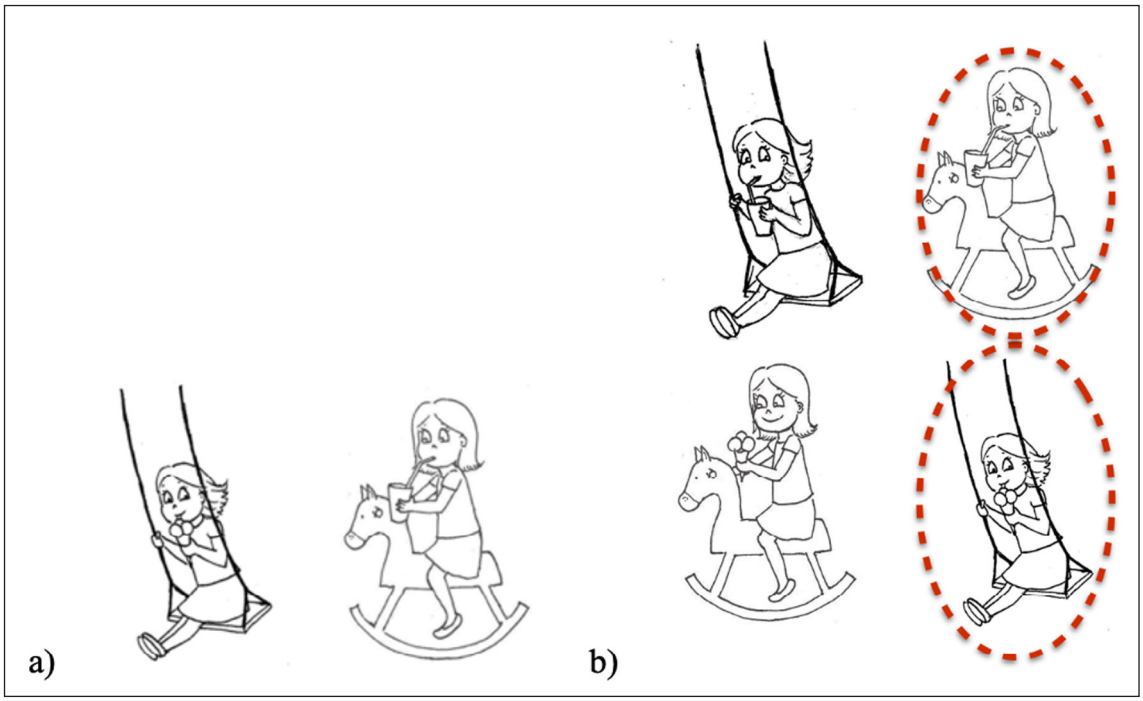

Figure 4: A set of pictures used a) for the elicitation of relative clauses via an interactive game and described by the game director; b) used by the communicative partner for the referent identification in the relative clause elicitation task.

4.3 Coding and analysis

The data were glossed and translated with the assistance of a native Deaf consultant. All coding was implemented using ELAN, a video annotation software (Crasborn & Sloetjes 2008). The relevant categories of coding included glosses produced by both hands, rhythmic cues of prosodic constituency (e.g., holds, reduplications, blinks, etc.), gaze direction, facial expressions (e.g., brow raise, lid tightening, cheek raise, etc.), head and torso movements (e.g., head movements forward and backward, nods), and others. Special importance was allotted to the coding of manual signals of prosodic constituency, because the analysis is dependent on the parsing of an utterance into prosodic units. The parsing of the signing stream into prosodic constituents is based on the presence or absence of such signals for prosodic boundaries as pauses and holds,

reiteration of the final sign, as well as slowing down or increasing the size of a sign, all at the end of prosodic constituents (Sandler 1999). Since the aim of the study was to provide empirical evidence for the emergence of the relative clause construction, the following criteria were chosen for the coding and analysis of the structural cues[4]:

1. *Correct identification of the intended referent:* The degree to which communicative partners were able to correctly identify the referent described by RC equivalents.
2. *The structure of the RC construction as a whole:* The presence or absence of the nominal head was coded and further analyzed, as well the order of the structural components – the nominal head, the specifying predication and the main predication – in relation to each other.
3. *Frequency as an indication of grammatical systematicity:* The degree of an item's systematicity was inferred from its frequency in the total number of the elicited responses for each signer.
4. *Distributional changes:* It is possible to infer the function of a language element from its distribution relative to the main structural elements of the construction (Eckardt 2006). The following four (a-d) possibilities of the cue distribution, schematically summarized in **Figure 5**, were entertained and checked:
   (a) **Prosodic alignment with linguistic constituents**: One goal of the study was to check whether the marker under discussion is incorporated into the linguistic system of ISL at all. For that sake, the non-manual cues (FHM and squint) were checked for their compliance with the major criterion of linguisticness – whether they align with prosodic constituents of the relative clause equivalent or spread regardless of the intonational phrase boundaries (Dachkovsky & Sandler 2009). The former type of the distribution is characteristic of the linguistic status of the non-manual cues, and the latter indicates that the cue is more likely to serve a non-linguistic function. As far as the pointing sign is concerned, the study checked whether it is prosodically integrated in intonational phrases making up relative clause equivalents. The absence of integration and the appearance as a separate intonational phrase would indicate that the pointing signal has a non-linguistic, gesture-like status.
   (b) **Alignment with the nominal referent:** One possibility of the alignment of the cue with the RC constituents is its co-occurrence with the nominal head of the relative clause equivalent, which would be indicative of the markers of a simple nominal

[4] One of the basic criteria of grammaticalization – phonetic reduction – is not discussed in the present paper due to space limitations. Moreover, since it usually occurs later in the grammaticalization process (see Dachkovsky 2018; 2020), it is less relevant for the discussion of the early stages of construction genesis.

topic and not of the whole relative clause construction. The function of the adnominal demonstrative modifying a simple nominal topic will pertain to the pointing sign in case both the pointing sign and the nominal head co-occur in the same intonational phrase.

(c) **Reset alignment:** The integration of the nominal head with the relative clause equivalent might be partial and not complete. In such case, the non-manual markers might be reset at the boundary between the nominal and the secondary predication. The manual pointing sign can simply appear in both structural positions – after the nominal, as well as after the right boundary of the relative clause.

(d) **Alignment over the referent and the RC:** The spread of the non-manual cue over the nominal referent and the relative clause, and the appearance of the pointing sign at the RC boundary can be interpreted as the full integration of the marker into the relative clause construction. So, the distribution of both non-manual and manual cues in the example presented in **Figure 1** above follows exactly this pattern.

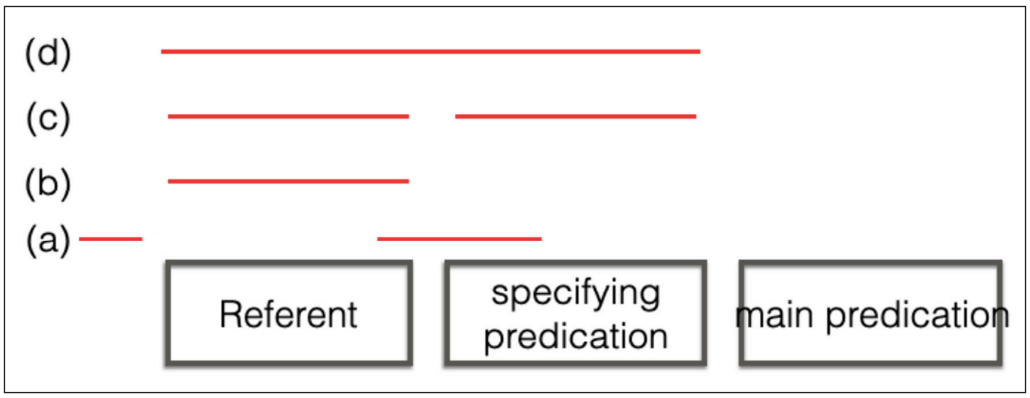

Figure 5: Options of the distributional patterns of the marking cues in relation to the RC structural components: (a) prosodically non-aligned scope; (b) the scope over the nominal referent only; (c) the scope re-activated after the nominal before the relative clause; (d) the scope over both the nominal referent and the relative clause.

5. Results

Below I present the findings for each RC dimension separately, in accordance with the analysis criteria outlined above in Section 4: felicitous recognition of the referents by communicative partners, structural complexity of RC equivalents, frequency, and distributional patterns. For the current study, I carried out multivariate statistical analyses of the data related to frequencies and distributional patterns using Rbrul (Johnson 2009), which can quantitatively evaluate the influence of multiple factors on variation. In addition, Rbrul uses mixed-effects modeling to group

individual responses accounting for the effects of individual differences. Appendix A presents the statistical values related to the results, including the log odds, number of tokens analysed, percentages of values under analysis and the centred weight for each factor.

5.1 Referent recognition by communicative partners

With no exception, all the communicative partners in the referent identification task were able to correctly identify the referents described by the relative clause equivalents.

5.2. The overall structure of relative clause equivalents

With no exception, in all the RC clause equivalents produced by the ISL signers, the clause which was intended to be presupposed in the task (specifying predication) preceded the clause with the main predication (the one which was intended to be asserted in the task). The nominal head appeared in the majority of the RC equivalents in the mid and younger ISL group (67% and 75% respectively). In contrast, older signers produced nominal heads less than in half of all the responses – 41% (**Table 2**). In addition, in all the age groups, all the responses where the nominal head was explicitly signed, it preceded the specifying predication. In other words, the RC equivalent appeared post-nominally for all age groups.

age group	**51 +**	**36–50**	**20–35**
Total number of responses	104	64	64
% of responses with nominal head	41%	67%	75%

Table 2: Frequency of headed relative clause equivalents across the three age groups of ISL signers.

5.3 Frequency of the RC marking cues

Forward head movement (FHM) in relative clauses is quite frequent with older signers and becomes even more frequent in the mid and younger age groups, which indicates its increasing systematicity as ISL develops. Points appear in only 15 per cent of the older signers' responses, whereas they appear in the majority of the mid age group and younger group responses (60 per cent and 68 per cent respectively). The scarcity of demonstratives in the older group production indicates a lower degree of their conventionalization. **Table 3** also demonstrates that in the raw data squint appears three times as often in the relative clause equivalents of the middle-aged and younger signers than in those produced by the older group. The multiple logistic regression analysis run for these data demonstrates that the frequencies of FHM, squint and pointing strongly correlate with signer's age group, with a p-value < 0.01.

age group	51 +	36–50	20–35
% of responses with FHM[6]	71%	89%	91%
% of responses with squinted eyes	29%	89%	89%
% of responses with points	15%	60%	68%
Total number of pointing tokens	16	55	58

Table 3: Frequency of relative clause markers across the three age groups of ISL signers.[5]

5.4 Distribution of RC markers in the relative clause equivalents

5.4.1. Alignment with prosodic constituents

In order to illuminate the integration level of the manual and non-manual cues into the linguistic system of the language, the study examines their alignment with the prosodic constituents included in the relative clause equivalents, summarized in **Table 4**.

Age group	51 +	36–50	20–35
FHM	96%	100%	100%
Squint	72%	93%	100%
Pointing signs	6%	50%	85%

Table 4: Alignment of FHM, squint and pointing signs with prosodic constituents as an indication of "linguisticness".

5.4.2 Alignment of the cues with the relative clause constituents

Figure 6 shows significant differences in the distribution of the cues – FHM, squint and pointing signs – in relation to the relative clause constituents across the three age groups of signers. Whereas the **simple nominal referent (nominal head)** is the initial alignment scope for all the three cues in at least half of all the tokens, the scope of FHM changes to include the specifying predication already in the mid-age group of signers. Squint takes another generation to spread over the relative clause. The behavior of the pointing sign in the youngest, 20-35 year-old group, is similar to that of squint in the mid-age group – the minority of the pointing tokens of this group align with the boundary of the constituent which includes the nominal referent together with the specifying predication.

[5] The number of pointing signs does not match the number of responses, since there might be more than one pointing sign in a response.

[6] The alignment of the cues was calculated only in relation to the constituents of the head relative clause equivalents in the dataset.

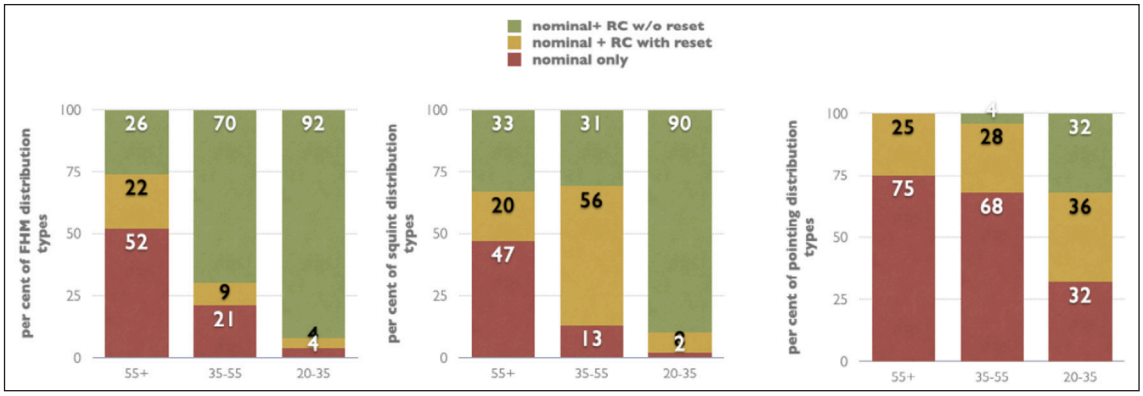

Figure 6: Distribution of FHM, squint and pointing across the three age groups of ISL signers.

5.5 Results: Interim Summary

In sum, the results of the analysis indicate that ISL signers of all the three age groups were able to identify the referents regardless of the linguistic structure of RC equivalents. Yet, the age groups differed in the degrees of the structural integration of the RC equivalents. Older signers' equivalents included fewer structural cues and they were less likely to align with the RC constituents than those produced by the younger signers. As a result, the distributional scope of squint diachronically stays behind the distributional scope of FHM, whereas the distributional scope of the pointing is, in turn, one generation behind the scope of squint. In other words, the signals of the RC in ISL gradually change towards a tight and unambiguous mapping with the RC structure.

6. Discussion: Crystallization of the relative clause construction through a gradual grammaticalization of the relative clause cues across the age groups

In order to understand the emergence of the relative clause construction, we need to interpret the findings reported in Section 5 as profile pictures for each age group under discussion. One important generalization that characterizes all the three age groups is the ISL signers have distinct strategies to convey the discourse functions of RCs. That is, all signers provided descriptions that identified a specific member from the set of referents. And, crucially, their communicative partners felicitously identified the referents described by the RC equivalents. This finding indicates that the concept of a specifying predication subserving the referencing function is available to signers from the outset of the language emergence. Yet, in order to express that referencing function, the three age groups of the ISL signers used different constructions, which will be discussed in the following.

6.1 Age Group 1: 51–72

The feature that strikes at the first sight at the RC equivalents produced by the older age group is that many of them look choppy and disintegrated. This overall impression can be accounted for by several objective measures presented in the section 5 above. First of all, almost half of them (45%) are free – produced without the nominal head, as in **Figure 7** below.[7] Importantly, pointing signs tend to substitute the nominals in many older signers' relative clause equivalents, and appear utterance-initially in a separate intonational phrase, as in the example below. As a result, the RC equivalent constitutes at least three disintegrated intonational phrases.

Figure 7: The equivalent of the relative clause *The boy who is riding a bike is holding a kite* produced by a Group 1 ISL signer. The utterance lacks the nominal head, which is substituted by the prosodically independent demonstrative.

Forward head movement (FHM) is very frequent in the RC equivalents produced by the older ISL signers – more than 70 per cent of older signers' responses display this intonational component. This fact already indicates a high degree of FHM conventionalization in this context in the older age group, which comes into a sharp contrast with a low frequency of squint and demonstratives in this age group – 29% and 16% of the responses respectively.

The distributional patterns of the structural cues – FHM, squint and pointing – in relation to linguistic prosodic constituency in RC equivalents might explain varying degrees of their conventionalization. According to the first distributional parameter – 'linguisticness', FHM is highly integrated into the linguistic system of ISL: in 96% of all the FHM tokens, the scope of FHM is aligned with prosodic constituents as determined by the manual cues, such hold, reduplication, or sign size. In contrast, squint produced by older signers in a quarter of all the

[7] It should be pointed out that the nominals are not dropped because the older signers cannot access or produce the corresponding lexical items – the nominal heads refer to the most widespread and frequent animate nouns, such as MALE or FEMALE. Rather, it appears that signers from the older age group cannot combine the nominal and the specifying predication into one unified constituent.

cases does not obey prosodic constituency and appears to be not aligned with boundaries of corresponding intonational phrases. This happens, when squint crosses prosodic boundaries or occurs in the middle of an intonational phrase.

A similar conclusion can be drawn about pointing signs. As demonstrated in **Figure 7** above, in those rare cases when points do appear in the older signers' responses, they usually constitute a separate prosodic unit. In such cases, the demonstrative sign is not integrated prosodically and is used in a gesture-like way, by pointing to a real-life object in the signer's environment (e.g., a card). In this sense, its linguistic status is borderline.

The FHM distribution in headed RC equivalents and the patterns of FHM alignment for the older signers presented in Section 5, Results, demonstrate that this intonational marker most often co-occurred with the nominal head of RC equivalents at the early stages of ISL development, as in **Figure 8** below. In the responses produced by the older signers, the FHM toward the addressee co-occurring with the nominal signals that the lexical material marked by this nonmanual cue serves as an anchor for subsequent material. Furthermore, as pointed out in the previous research, FHM is the most frequent marker of ISL topics (Dachkovsky & Sandler 2009; Dachkovsky et al. 2013). This function of FHM is also corroborated by the basic attention anchoring function of FHM in human communication in general (Lynn 2013). In sum, in the older age group, FHM mostly serves the information structuring function of the marker of topic/comment asymmetry. Thus, in **Figure 8**, the topic of the utterance, the referent 'man', is first introduced, and then the predication of watching is anchored to this topic.

Figure 8: Co-occurrence of FHM and squint with the prosodic constituent corresponding to the nominal referent in the older signer's utterance *The man who is watching TV, is combing his hair*.

The link suggested here between clausal dependency and information structure categories, such as topic-comment, is not novel. As explained above, under the functional approach the

notion of subordination is related to two basic discourse distinctions, foreground/ background and figure/ ground,[8] and referred to as the Asymmetry Assumption by Cristofaro (2003) and Langacker (2014). It rests on the assumption which assumes an asymmetrical cognitive relation between two events, such that one event imposes its own profile over the other.

Figure 8 also demonstrates that, apart from FHM, squint co-occurs only with the nominal constituent of the relative clause equivalent, which appears to be the topic of the utterance. Squint co-occurring with the topic constituent indeed represents a default scope of squint in the older age group, in those rare cases when squint appears in the oldest age group's relative clause equivalents at all. Since topics serve as anchors that help to relate new information to what is already known (accessible) to the addressee, it makes sense that topics themselves may be known to different degrees, that is, that they can have different accessibility rankings (Krifka 2008; Dachkovsky et al. 2013). The Low Accessibility topic (Ariel 1991) in the present example stands in explicit competition with the other referent on the second card of the task. Therefore, the squint here "points" to the less automatically accessible item in the discourse, and instructs the addressee to focus on it.

The most common distributional pattern of the cues in the older age group is schematized in **Figure 9** below. It illustrates the fact that older signers' RC equivalents are very fragmented and disintegrated, since the non-manuals cues usually span only over the nominal referent, so that the specifying predication is prosodically not related to the nominal. Moreover, the pointing sign often appears in a separate intonational unit, resulting in a disjoint sequence of 3–4 intonational phrases.

Figure 9: The most common distributional pattern of the non-manual intonational cues (FHM and squint) and the pointing sign in the older age group.

6.2 Age group 2: 36–50

The mid age group's RC equivalents present a drastic change in some parameters of the RC construction and the entrenchment of the previous changes for other parameters. The most

[8] Although the dichotomies of foreground/ background and figure/ ground have different origins and are theoretically distinct, the distinctions they make are similar in nature (and, in fact, as Reinhart (1984) argued, are closely related), so that the minor differences between them should not bother us here.

striking difference between the older age group and the mid age signers' RC equivalents is the increase in the RC complexity. The overwhelming majority of the RC equivalents in this age group are preceded by the nominal head, which contrasts sharply with the half of the free RC responses in the older age group. The frequency and the distribution of the RC cues can, at least partially, account for integration of the nominal head.

FHM becomes even more frequent in this age group – approximately 90 per cent of RCs produced by the middle-aged signers had FHM. This indicates that FHM has become completely conventionalized and tightly associated with the RC construction. Unlike FHM, squint undergoes an abrupt change in its frequency – it increases from 29 to 89 per cent of the responses. The usage of the pointing demonstratives also increases sharply – they appear in the majority (60%) of the total number of RC equivalents, but they are still not as widespread as squint or FHM.

In terms of linguisticness, the mid age group signers align all the three signals with linguistic prosodic constituents, which differs from the older group's behavior of squint and pointing signs. The most common (70 %) distribution of FHM in the mid age group is the co-occurrence of FHM with the whole RC together with the nominal under one unifying contour. This means that at this stage the signers are able to unify the nominal and the specifying predication into one constituent by the virtue of FHM spread over both of them, as in **Figure 10**, where FHM spreads both over the nominal GIRL IX and over the specifying predication SWING IX. At this stage the specifying predication loses the status of an independent predication and becomes reanalyzed as the property of the nominal. This change is encoded by the alignment of FHM both with the nominal topic and the specifying predication.

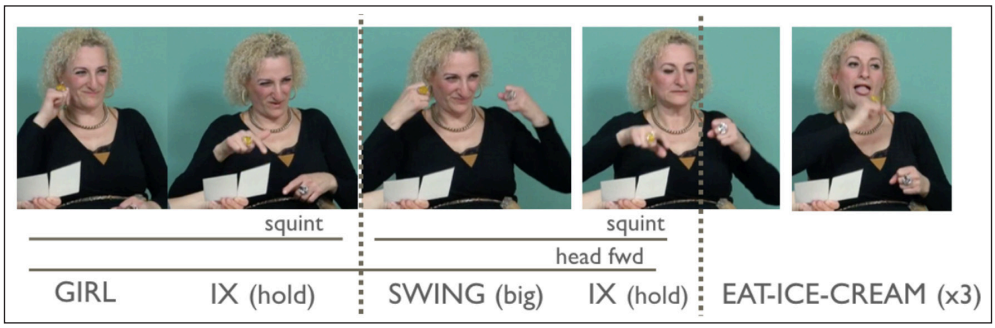

Figure 10: Alignment of FHM with the RC equivalent and a reset of squint and pointing signs after the nominal in the mid-group signer's utterance *The girl who is swinging is eating ice-cream.*

Starting with the middle-aged group, FHM ceases to be a marker of merely the (nominal) anchoring point and becomes a marker of the dependence and asymmetry between the whole RC equivalent (together with its nominal) and the main predication, thereby moving toward a closer correlation with the functional schema of the RC construction. In other words, FHM becomes

the signal of dependency at a higher, constructional level, rather than a mere marker of topic anchoring at the level of information structure.

Changes in the squint distribution do not exactly match the changes in its frequency. As demonstrated in **Figure 10** above, squint in the middle-aged signers tends to exhibit the following peculiar pattern: first, it is aligned with the nominal referent of the relative clause; then it relaxes; and afterwards it re-activates and aligns with the specifying predication. In other words, the distribution of squint in this age group is transitional between a Low Accessibility reading attributed to the topic constituent and a marker of the nominal together with the specifying predication. I propose that a reset and a further spread of squint over the specifying predication contributes to the reading under which the action performed by the referent is re-analyzed and interpreted as the property belonging to the referent, providing its specification and assisting its unique identification. Nonetheless, for the middle-aged signers this process of the reanalysis is still not completed, and the partial termination of squint after the nominal and its further reset is the evidence of the fact that the meaning change is still on its way. Thus, the distribution of squints in the middle-aged group demonstrates a gradual drift from the marker of a Low Accessibility topic to the specification marker associated with the function of the RC as the property specifying the referent.

Unlike a dramatic increase in the frequency, the distribution of the pointing signs in relation to the structural RC constituents has not changed significantly in comparison with the older group. Although a quarter of the pointing sings in the mid age group occur both immediately after the nominal referent and at the prosodic boundary between the clauses, as in **Figure 10** above,[9] still the majority of the pointing tokens (68%) appear after the nominal head only (BOY, GIRL, WOMAN, MAN), as in **Figure 11** below.

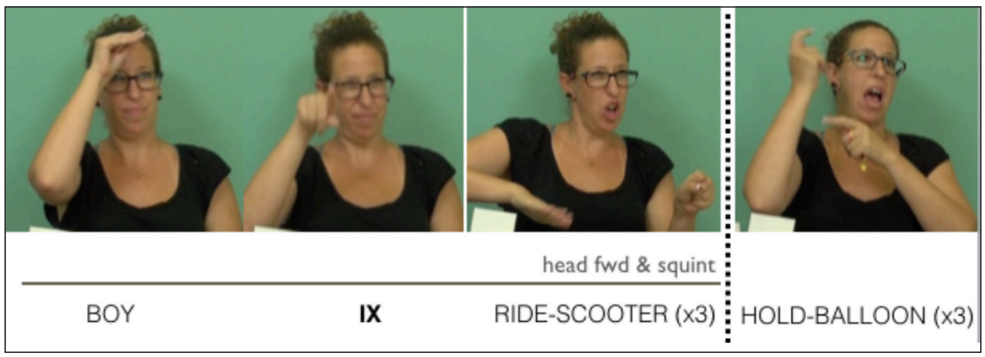

Figure 11: The adnominal use of pointing in the sentence *The boy who is riding a scooter is holding a balloon,* produced by a mid age group signer.

[9] The manual rhythmic cues (holds) and the non-manual signals (a squint reset and a blink) discussed above delineate the boundaries of the prosodic constituents (Nespor & Sandler 1999).

In this example, the pointing sign modifies the nominal BOY and immediately follows it within the boundaries of the same intonational phrase delineated both by rhythmic cues (reduplication) and by the spread of the non-manual signals (head movement forward and squinted eyes). This kind of distribution suggests that the function of the pointing is still adnominal – it modifies the noun and identifies the referent expressed by the noun.

In sum, in the mid age group, the FHM function approximates the functional profile the restrictive relative clause, while the usage of the pointing sign lags behind and still modifies the nominal referent itself. The distribution of the squint indicates that occupies the intermediate position between those two functions. The scheme in **Figure 12** summarizes the most common distribution of the RC cues in the mid age group.

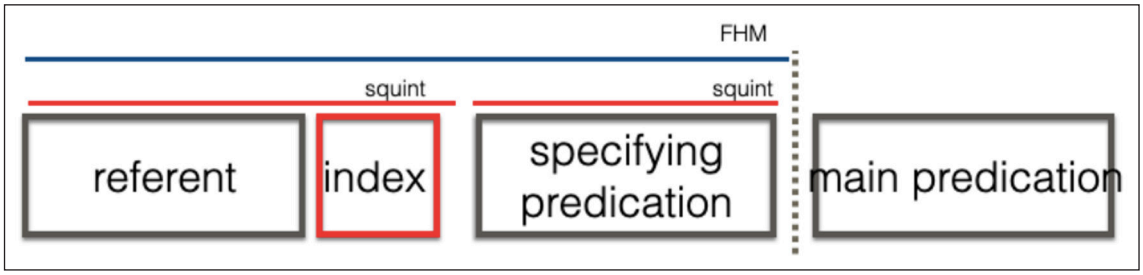

Figure 12: The most common distributional pattern of the non-manual intonational cues (FHM and squint) and the pointing sign in the mid age group.

6.3 Younger signers: intonational contours integrate the nominal referent and the relative clause

In the 3rd, youngest age group, the intonational non-manual cues continue their drift toward a close matching with the functional profile of the RC construction. First of all, the overwhelming majority of the RC equivalents in this age group appear with the nominal referent – the nominal head precedes the specifying predication in 80% of the responses, indicating that structurally complex referents can be integrated as part of the construction.

FHM appears in the overwhelming majority of the RC equivalents. Its scope systematically spreads between the nominal referent and specifying predication. The tendency of FHM to group together the nominal with the specifying predication, as a unifying contour, observed with the middle-aged signers, becomes even stronger with younger signers (92% of all the responses with the nominal referents) and points at the conventionalization of this type of distribution as the language matures. This type of distribution encodes that the specifying predication corresponding to the RC has been fully integrated into the nominal constituent, has lost its independent predication status and has acquired the status of the property of the nominal. As

a result, the complex nominal constituent containing the RC predication is in the asymmetric relations with the main predication. In sum, the FHM has become a subordination signal in the newly emerging RC construction in ISL. The example in **Figure 13** demonstrates a typical pattern of FHM movement observed with the younger signers.

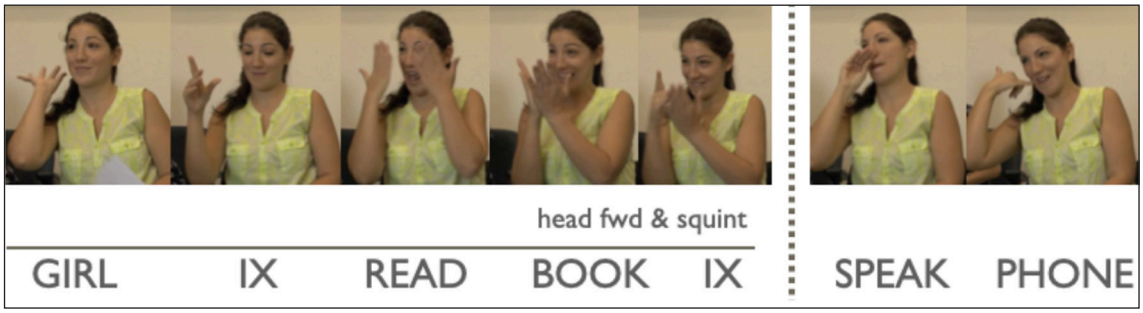

Figure 13: The intonational cues FHM and squint span the nominal referent and the specifying predication as one integrated unit, whereas the pointing signs occur at the RC boundaries in the younger signer's utterance *The woman who is reading a book is speaking on the phone.*

The scope of the second intonational component, squint, also adjusts itself to the functional profile of the RC construction in the youngest age group. **Figure 13** also demonstrates that, in contrast to the middle-aged signers' distributional pattern, the behavior of squint in the youngest group parallels that of FHM – it tends to span the nominal and the specifying predication together, without a reset, taking the whole construction into its scope. In such cases, squint does not mark the referent only, but spans over the whole nominal constituent, similarly to the function of the definite article in English, which acts as a determiner for the whole noun phrase and not only the referent (noun). That is, the function of squint in the youngest group has been reanalyzed from the signal cuing the information structure status of the referent to the one subserving the constructional function of referent specification.[10]

Although the span of the intonational cues – FHM and squint – in the youngest group integrates the nominal referent with the specifying predication into one intonational phrase, the distribution of more than a third of pointing signs has still a double valence – they can occur after the nominal head and at the boundary between the clauses, as in **Figure 13** above. In this sense, the distribution of the morpho-syntactic marker of the RCs lags behind the functional changes

[10] The reanalysis of the squint function as part of the overall constructional mapping is emphasized also by the appearance of the deictic, characteristically nominal, element at the end of the entire relative clause, at the boundary with the main clause in the majority of RCs produced by younger signers.

of the intonational cues. This interaction of the manual and non-manual cues is summarized in **Figure 14** below:

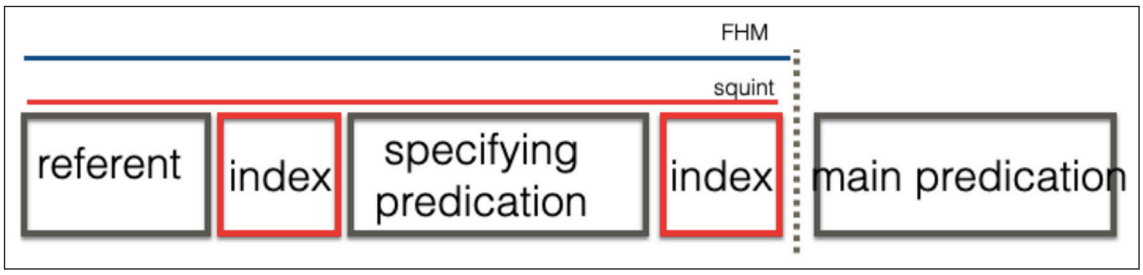

Figure 14: The young age group's common distributional pattern, where the non-manual intonational cues (FHM and squint) spread over the nominal and the specifying predication and the pointing sign "frames" the RC.

Yet, a different, more integrative pattern of the demonstrative emerges in a third of all the cases of pointing in the youngest group. In this type of distribution, the pointing sign appears exclusively at the right boundary of the relative clause, thereby finalizing the integration of the nominal referent with the specifying predication into one complex nominal constituent, as in **Figure 15** below.

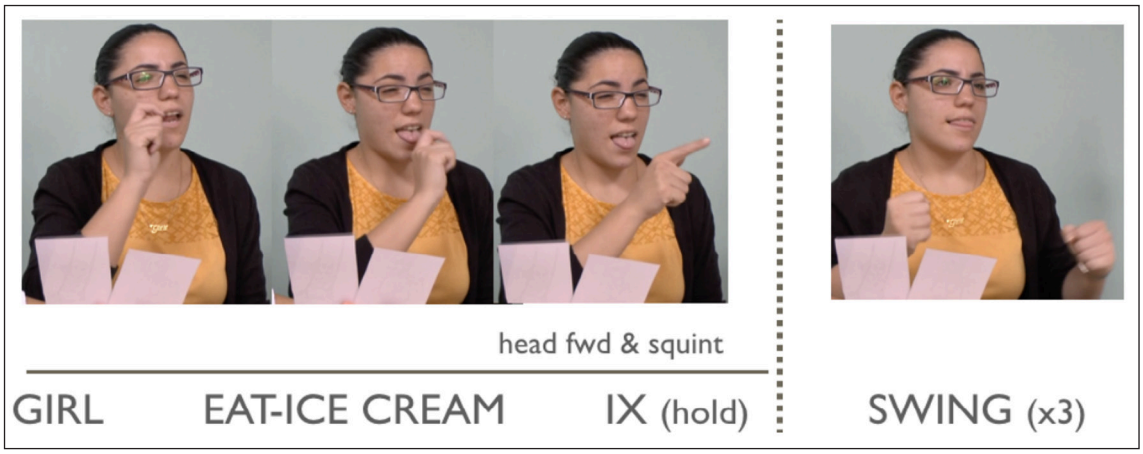

Figure 15: Co-occurrence of the intonational and morphosyntactic cues with the relative clause as one integrated unit in the younger signer's utterance *The girl who is eating ice-cream is swinging*.

Thus, we are observing the reorganization of the whole relative clause construction where various structural devices – facial expressions, head movements and manual signs – obtain more and more constructional functions, thereby establishing and highlighting the constructional boundaries (**Figure 16**).

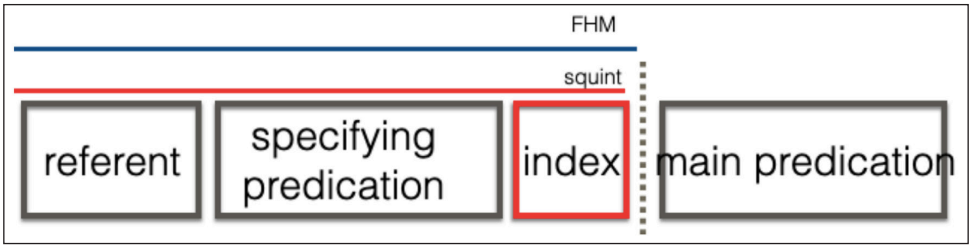

Figure 16: The young age group's common distributional pattern, where the non-manual intonational cues (FHM and squint) spread over the nominal and the specifying predication and appears at the right boundary of the RC as an invariant relativizer.

6.4 General discussion: summary of the constructional changes in RCs

The discussion of the individual stages in the changes of all the RC structural components in ISL demonstrates that we are observing a gradual and incremental genesis of the relative clause construction where various structural devices – facial expressions, head movements and manual signs – are reorganized and gradually obtain more construction-related functions. The complex of the non-manual signals act as a skeleton framing the whole construction and uniting the referent and the specifying predication into one nominal component. The reorganization of the structural cues and the crystallization of the RC construction can be summarized by the following scheme in **Figure 17**. The hypotheses entertained in Section 3.4 will be considered below in the light of this scheme.

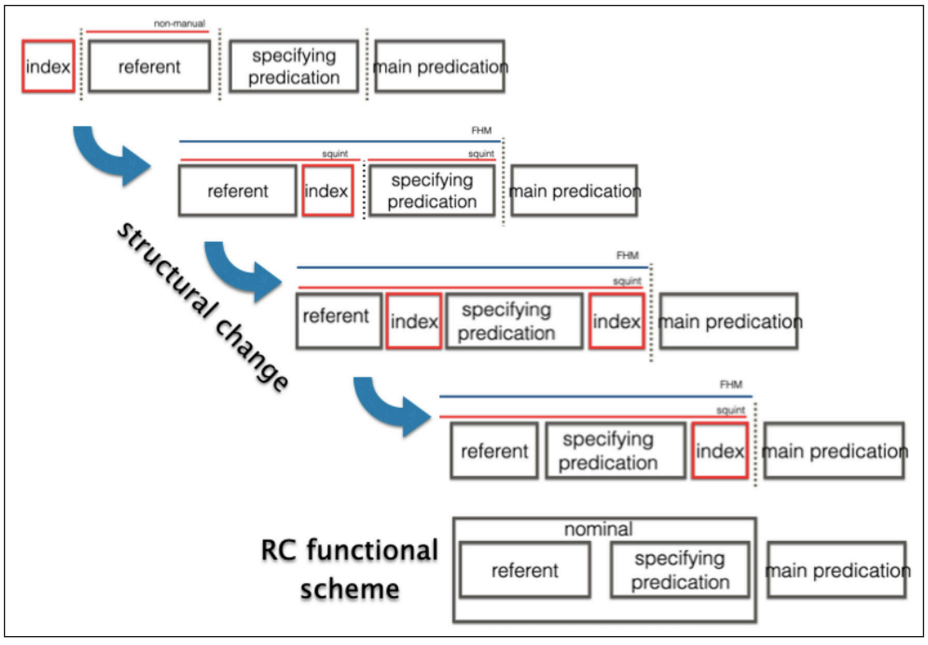

Figure 17: Changes in the non-manual and manual cues leading to the genesis of the RC construction, as motivated by its functional scheme.

Hypothesis 1: The felicitous task completion by the three age groups of ISL participants, where they correctly identified the referents of the RC equivalents, clearly points at the early availability of the functional RC equivalents. Furthermore, the nominal referent (if present) and specifying predication uniformly appear before the main predication in all the age groups. This generalization highlights the information-structure properties of the nominal referent being an anchoring element and of the specifying predication conveying the presupposed information. Thus, a well-known preference of sign languages to produce post-nominal relative clauses (see e.g., Branchini 2014; Cecchetto & Donati 2016 for a similar tendency in LIS and Mosella 2012 in LCS) might be accounted for by the origin of relative clauses in extended information-anchoring topics (Sankoff & Brown 1976; Prince 1991; Fox & Thompson 1990). The complex cascade-like reorganization of the RC construction discussed above is only possible provided the conceptual basis of the relative clause construction is there from the very early stages of the language development.

Hypothesis 2: The RC construction in ISL "grows" from the incremental changes from loosely conjoined constituents to a more integrated structure. In the process of the change, the specifying predication stops being an independent constituent and becomes part of the expanded nominal constituent. As a result, the newly emergent expanded nominal constituent is asymmetrically related to the main predication.

a) The examination of the incremental changes demonstrates that the hypothesized processes of integration and expansion appear here as the facets of one and the same coin: While the specifying and the main predications are **integrated** into one tightly connected construction, the manual and non-manual cues **expand** their scope and **extend** their functions from the signals that regulate joint attention and information flow to the markers of inter-clausal asymmetry and interconnectivity.

b) The trajectory of the incremental changes and their final outcome univocally indicate that the force underlying the observed changes is the functional impetus to match the formational structure of the emerging RC construction to its conceptual scheme.

Hypothesis 3: The intonational non-manual cues – FHM and squint – are recruited into the grammatical system of ISL prior to the pointing, which later develops into the morpho-syntactic marker of the relative clause construction. Intonation, as the device most strongly associated with thought units and information packaging (Chafe 1994), acts here as a bridge between the conceptual structure and the morpho-syntactic structure proper. It enables the process of the construction genesis by delineating the unified scope the nominal referent together with its specifying predication, and contrasts the newly emerging nominal constituent with the main predication. In other words, the intonational signals delimit the scope of the asymmetry as the

basis of clause subordination and create a flexible, yet firm, skeleton of the future relative clause construction. The grammaticalization of the pointing sign into a morphosyntactic marker – RC relativizer – is predetermined by the formation of the intonational skeleton and appears as a climax of the clausal integration.

6.5 Limitations of the study

The present study has a number of limitations. One important caveat is that the paper focuses on only one type of relative clauses – subject-subject relative clauses, leaving other types of relative clauses for future research. This fact leads to an obvious difficulty in determining certain aspects of syntactic structure of relative clauses.

Another caveat concerns the choice of participants in the three age groups: the participant's age of acquisition and the generation order might be confounding factors. Specifically, the older signers in the study are not native signers, most of them having acquired ISL later in life. On the one hand, this situation truly represents the first generation of ISL users. On the other hand, the contribution of each factor in language emergence cannot be clearly determined. In order to overcome this limitation, I am planning a follow-up study that would investigate non-native deaf signers' production of relative clauses across the three age groups matched for the age of ISL exposure.

7. Summary and conclusions: Prosodic integration of structural components into the relative clause construction

The findings of the present study show that in the process of the RC gradual emergence in ISL, its markers have been reanalyzed from the signals regulating information flow and joint attention – intonational cues and demonstratives – into signals of clausal dependencies. The relative clause construction is emerging in front of our eyes in the young sign language, though the first steps of its genesis do not manifest in any major syntactic changes. The primary re-analysis of the source information structure categories is rather subtle: the expansion of the FHM scope signals the integration of the specifying predication as part of the nominal anchor and, as a consequence, the structural asymmetry between the expanded nominal constituent and the main predication. Only at that stage the pragmatic value of the emerging RC clause is reassigned from assertion to presupposition, which is reflected in the spread of another intonational component – squint. The rest of the structural machinery – the pointing sign – is carried over into the new RC construction, and gets re-analyzed as part of the syntactic marking of a new nominal constituent.

The present findings underline the importance of prosody in general and intonation in particular for the synchrony and diachrony of subordination. Paraphrasing Deutscher's claim about nominalization as "the unsung hero in the story of subordination" (2009), this study

demonstrates empirically that prosody and intonation are indeed the unsung heroes in the subordination story. The developments in intonational systems, usually overlooked and poorly documented, serve both as a binding mechanism, and as a flexible skeleton, for the gradual self-organization of the restrictive relative construction and its further syntactization. Moreover, the sophisticated orchestration of changes demonstrated in the study emphasizes a crucial point – a language item does not change in isolation. It is not only the case that language items (e.g., demonstratives, non-manual features) grammaticalize in particular communicative contexts, which has been pointed out by multiple investigators (König 1999; Hopper & Traugott 2003, *inter alia*), but that their changes are tightly contingent on other concomitant changes and are constrained by the properties of an emergent construction as a whole.

Additional file

The additional file for this article contains supplementary materials including Rbrul results, and can be found here. DOI: https://doi.org/10.16995/glossa.9074.s1

Funding information

This research has received funding from the European Research Council (ERC) under the European Union's Seventh Framework Programme, grant agreement No. 340140. Principal Investigator, Wendy Sandler.

Acknowledgements

I am grateful to Prof. Wendy Sandler for her PhD guidance and valuable suggestions on earlier versions of the paper. I wish to thank Dr. Rose Stamp for her help with statistics, Shai Davidi for video and other technical assistance, and Debi Menashe for her ISL expertise. Special thanks go to all of the deaf participants who were involved in the study.

Competing interests

The author has no competing interests to declare.

References

Aarons, Debra. 1996. Topics and topicalization in American sign language. *Stellenbosch Papers in Linguistics*, 30. 65–106.

Ariel, Mira. 1991. The function of accessibility in a theory of grammar. *Journal of pragmatics* 16(5). 443–463. DOI: https://doi.org/10.1016/0378-2166(91)90136-L

Aronoff, Mark & Meir, Irit & Padden, Carol & Sandler, Wendy. 2008. The roots of linguistic organization in a new language. *Interaction studies* 9(1). 133–153. DOI: https://doi.org/10.1075/is.9.1.10aro

Baker-Shenk, Charlotte Lee. 1983. A Microanalysis of the Nonmanual Components of Questions in American Sign Language. University of California, Berkeley.

Bavelas, Janet B. & Gerwing, Jennifer. 2007. Conversational hand gestures and facial displays in face-to-face dialogue. In Fiedler, Klaus (ed.), *Social communication*, 283–308. New York, NY: Psychology Press.

Bednarczuk, Leszek. 1980. Origin of Indo-European parataxis. *Linguistic Reconstruction and Indo-European Syntax*, 145–154. DOI: https://doi.org/10.1075/cilt.19.11bed

Bickerton, Derek. 2016. Roots of language. Language Science Press. DOI: https://doi.org/10.26530/OAPEN_603354

Birkner, Karin. 2008. Relativ(satz)konstruktionen im gesprochenen Deutsch: Syntaktische, prosodische, semantische und pragmatische Aspekte. Berlin: Mouton de Gruyter.

Birkner, Karin. 2012. Prosodic formats of relative clauses in spoken German. In Bergmann, Pia & Brenning, Jana & Pfeiffer, Martin & Reber, Elisabeth (eds.) *Prosody and embodiment in interactional grammar*, 19–39. Berlin/Boston: De Gruyter. DOI: https://doi.org/10.1515/9783110295108.19

Branchini, Chiara. 2014. On relativization and clefting: An analysis of Italian Sign Language. Berlin: Mouton de Gruyter. DOI: https://doi.org/10.1515/9781501500008

Branchini, Chiara & Donati, Caterina. 2009. Italian Sign Language relatives: a contribution to the typology of relativization strategies. In Liptak, Anikó (ed.), *Correlatives: Theory and typology* (North Holland Linguistic series 68), 157–191. Amsterdam: Elsevier. DOI: https://doi.org/10.1075/lfab.1.07bra

Bruyn, Adrienne. 1995. Grammaticalization in creoles: The development of determiners and relative clauses in Sranan. University of Amsterdam dissertation.

Cecchetto, Carlo & Donati, Caterina. 2016. Relativization in Italian Sign Language: the missing link of relativization. In Pfau, Ronald & Steinbach, Markus & Herrmann, Annika (eds.), *A matter of complexity*, 182–203. Berlin: De Gruyter Mouton. DOI: https://doi.org/10.1515/9781501503238-008

Cecchetto, Carlo & Geraci, Carlo & Zucchi, Sandro. 2006. Strategies of relativization in Italian Sign Language. *Natural Language and Linguistic Theory* 24. 945–975. DOI: https://doi.org/10.1007/s11049-006-9001-x

Chafe, Wallace. 1994. Discourse, Consciousness, and Time: The Flow and Displacement of Conscious Experience in Speaking and Writing. University of Chicago Press.

Cohen, Antonie & Hart, Johan. 1965. Perceptual analysis of intonation patterns. In 5e Congres international d'acoustique, Liège 7–14 septembre, 1965.

Coppola, Marie & Senghas, Anne. 2010. Deixis in an emerging sign language. In Brentari, Diane (ed.), *A Cambridge language survey*, 543–569. Cambridge: Cambridge University Press. DOI: https://doi.org/10.1017/CBO9780511712203.025

Couper-Kuhlen, Elizabeth. 1996. Intonation and Clause Combining in Discourse: The Case of Because. *Pragmatics* 6(3).

Crasborn, Onno & Sloetjes, Han. 2008. Enhanced ELAN functionality for sign language corpora. Proceedings of 3rd Workshop on the Representation and Processing of Sign Languages: Construction and Exploitation of Sign Language Corpora, 39–43. Paris: ELDA.

Cristofaro, Sonia. 2003. Subordination. Oxford University Press.

Croft, William. 1995. Autonomy and functionalist linguistics. *Language* 71(3). 490–532. DOI: https://doi.org/10.2307/416218

Dachkovsky, Svetlana. 2005. Facial expression as intonation in Israeli Sign Language: the case of conditionals. Haifa University MA Thesis.

Dachkovsky, Svetlana. 2008. Facial expression an intonation in Israeli Sign Language. The case of neutral and counterfactual conditionals. In Quer, Josep (ed.), Signs of the time: Selected papers from TISLR 2004, 61–82. Hamburg: Signum.

Dachkovsky, Svetlana. 2018. Grammaticalization of intonation in Israeli Sign Language: From information structure to relative clause relations. University of Haifa dissertation.

Dachkovsky, Svetlana. 2020. From a demonstrative to a relative clause marker: grammaticalization of pointing signs in Israeli Sign Language. *Sign Language & Linguistics* 23(1–2). 142–170. DOI: https://doi.org/10.1075/sll.00047.dac

Dachkovsky, Svetlana, Healy, Christina & Sandler, Wendy. 2013. Visual intonation in two sign languages. *Phonology* 30(2). 211–252. DOI: https://doi.org/10.1017/S0952675713000122

Dachkovsky, Svetlana & Sandler, Wendy. 2009. Visual intonation in the prosody of a sign language. *Language & Speech* 52(2–3). 287–314. DOI: https://doi.org/10.1177/0023830909103175

Darwin, Charles. 1965. The Expression of the emotions in man and animals. University of Chicago Press. DOI: https://doi.org/10.7208/chicago/9780226220802.001.0001

Deutscher, Guy. 2009. Nominalization and the origin of subordination. In Givón, Talmy & Shibatini, Masayoshi (eds.), *Syntactic complexity*, 199–214. Amsterdam: John Benjamins. DOI: https://doi.org/10.1075/tsl.85.08nom

Downing, Bruce T. 1978. Some universals of relative clause structure. *Universals of Human Language*, 4. 375–418.

Du Bois, John W. 1985. Competing motivations. *Iconicity in syntax* 6. 343–365. DOI: https://doi.org/10.1075/tsl.6.17dub

Fox, Barbara A. & Thompson, Sandra A. 1990. A discourse explanation of the grammar of relative clauses in English conversation. *Language* 66(2). 297–316. DOI: https://doi.org/10.2307/414888

Givón, Talmy. 2009. The genesis of syntactic complexity: diachrony, ontogeny, neuro-cognition, evolution. John Benjamins Publishing. DOI: https://doi.org/10.1075/z.146

Givón, Talmy. 2015. The diachronic genesis of synchronic syntax. In MacWhinney, Brian & O'Grady, William (eds.), *The handbook of language emergence*, 201–14. Chichester, West Sussex, UK; Malden, MA, USA: Wiley Blackwell. DOI: https://doi.org/10.1002/9781118346136.ch9

Gussenhoven, Carlos. 2002. Intonation and interpretation: phonetics and phonology. In Speech Prosody 2002, International Conference.

Haiman, John. 1978. Conditionals Are Topics. *Language* 54(3). 564–589. DOI: https://doi.org/10.1353/lan.1978.0009

Harris, Alice C. & Campbell, Lyle. 1995. Historical syntax in cross-linguistic perspective. Cambridge University Press. DOI: https://doi.org/10.1017/CBO9780511620553

Hauser, Charlotte & Geraci, Carlo. 2018. Relative clauses in French Sign Language (LSF): some preliminary results. FEAST. Formal and Experimental Advances in Sign Language Theory.

Heine, Berndt & Kuteva, Tania. 2007. The genesis of grammar: A reconstruction (Vol. 9). Oxford University Press.

Hendery, Rachel. 2012. Relative clauses in time and space: A case study in the methods of diachronic Typology. John Benjamins Publishing. DOI: https://doi.org/10.1075/tsl.101

Hewitt, Brian G. 1987. The typology of subordination in Georgian and Abkhaz. Walter de Gruyter. DOI: https://doi.org/10.1515/9783110846768

Hopper, Paul J., & Traugott, Elizabeth C. 2003. Grammaticalization. Cambridge University Press. DOI: https://doi.org/10.1017/CBO9781139165525

James, William T. 1932. A study of the expression of bodily posture. *The Journal of General Psychology* 7(2). 405–437. DOI: https://doi.org/10.1080/00221309.1932.9918475

Janzen, Terry. 1999. The grammaticization of topics in American Sign Language. *Studies in Language* 23(2). 271–306. DOI: https://doi.org/10.1075/sl.23.2.03jan

Johnson, Danial Ezra. 2009. Getting off the GoldVarb standard: Introducing Rbrul for mixed-effects variable rule analysis. *Language and Linguistics Compass* 3(1). 359–383. DOI: https://doi.org/10.1111/j.1749-818X.2008.00108.x

Kastner, Itamar & Meir, Irit & Sandler, W. & Dachkovsky, S. 2014. The emergence of embedded structure: insights from Kafr Qasem Sign Language. *Frontiers in Psychology* 5. 525–525. DOI: https://doi.org/10.3389/fpsyg.2014.00525

Keenan, Edward L. & Comrie, Bernard. 1977. Noun phrase accessibility and universal grammar. *Linguistic Inquiry* 8(1). 63–99.

Khristoforova, Evgeniya. 2020. The emergence of relative clauses in Russian Sign Language. In Семнадцатая конференция по типологии и грамматике для молодых ис-следователей. Тезисы докладов (Санкт-Петербург, 19–21 ноября 2020 г.)/ Ред. ЕА Забелина, НН Логвинова. СПб.: ИЛИ РАН, 2020. (p. 142).

Khristoforova, Evegniya. A. & Kimmelman, Vadim I. 2020. Syntax of relativization in Russian Sign Language: Basic features. *Voprosy Jazykoznanija* 6. 48–65. DOI: https://doi.org/10.31857/0373-658X.2020.6.48-65

Kimmelman, Vadim & Vink, Lianne. 2017. Question-answer pairs in Sign Language of the Netherlands. *Sign Language Studies* 17 (4). 417–449. DOI: https://doi.org/10.1353/sls.2017.0013

Kocab, Annemarie. 2017. Language Emergence: Evidence from Nicaraguan Sign Language and Gestural Creation Paradigms. Doctoral dissertation.

König, Ekkehard & Siemund, Peter. 1999. Intensifiers as targets and sources of semantic change. In Koch, P. & A. Blank (eds.), *Historical semantics and cognition*, 237–57. Berlin: Mouton. DOI: https://doi.org/10.1515/9783110804195.237

Krifka, Manfred. 2008. Basic notions of information structure. *Acta Linguistica Hungarica* 55(3–4). 243–276. DOI: https://doi.org/10.1556/ALing.55.2008.3-4.2

Kubus, Okan. 2014. Relative clause constructions in Turkish Sign Language. Hamburg: University of Hamburg dissertation.

Kubus, Okan & Nuhbalaoglu, Derya. 2018. The challenge of marking relative clauses in Turkish Sign Language. *Dilbilim Araştırmaları Dergisi* 29. 139–160. DOI: https://doi.org/10.18492/dad.373454

Labov, William. 1963. The social motivation of a sound change. *Word* 19(3). 273–309. DOI: https://doi.org/10.1080/00437956.1963.11659799

Lambrecht, Knud. 1996. Information structure and sentence form: Topic, focus, and the mental representations of discourse referents. Cambridge University Press.

Langacker, Ronald W. 2014. Subordination in a dynamic account of grammar. In Laura Visapää, Laura & Kalliokoski, Jyrki & Sorva, Helena (eds.), *Contexts of subordination: Cognitive, typological and discourse perspectives*, 17–72. Amsterdam & Philadelphia: John Benjamins. DOI: https://doi.org/10.1075/pbns.249.02lan

Lehmann, Christian. 1985. Grammaticalization: Synchronic variation and diachronic change. *Lingua E Stile* 20. 202–218.

Lehmann, Christian. 1986. On the typology of relative clauses. *Linguistics* 24. 663–680. DOI: https://doi.org/10.1515/ling.1986.24.4.663

Lehmann, Christian. 1988. Towards a typology of clause linkage. Clause combining in grammar and discourse 18. 181–225. DOI: https://doi.org/10.1075/tsl.18.09leh

Liddell, Scott K. 1978. Non-manual signals and relative clauses in ASL. In Siple, Patricia (ed.), *Understanding language through sign language research*, 59–90. New York: Academic.

Liddell, Scott K. 1980. American Sign Language syntax. The Hague, The Netherlands: Mouton. DOI: https://doi.org/10.1515/9783112418260

Liddell, Scott K. 2003. Grammar, gesture and meaning in ASL. Cambridge: Cambridge University Press. DOI: https://doi.org/10.1017/CBO9780511615054

Liu, Chaoran & Ishi, Carlos T. & Ishiguro, Hiroshi & Hagita, Norihiro. 2013. Generation of nodding, head tilting and gazing for human–robot speech interaction. *International Journal of Humanoid Robotics*. 10(01). 1350009. DOI: https://doi.org/10.1142/S0219843613500096

Lynn, Richard. 2013. Attention, arousal and the orientation reaction. *International Series of Monographs in Experimental Psychology* (Vol. 3). Elsevier.

McConvell, Patrick. 2006. Grammaticalization of demonstratives as subordinate complementizers in Ngumpin-Yapa. *Australian Journal of Linguistics* 26(1). 107–137. DOI: https://doi.org/10.1080/07268600500531669

Meir, Irit. 2016. Grammaticalization is not the full story: a non-grammaticalization account of the emergence of sign language agreement morphemes. In *Mediterranean Morphology Meetings* 10. 112–124.

Meir, Irit & Sandler, Wendy. 2008. A language in space: The story of Israeli Sign Language. Taylor & Francis. DOI: https://doi.org/10.4324/9780203810118

Mithun, Marianne. 2009. Re(e)volving complexity: Adding intonation. In Givón, Talmy & Shibatini, Masayoshi (eds.), *Syntactic complexity*, 53–80. Amsterdam, Chicago: Bemjamins. DOI: https://doi.org/10.1075/tsl.85.03ree

Mosella Sanz, Marta. 2012. Les construccions relatives en LSC [Relative clause construction in LSC]. University of Barcelona dissertation.

Navarro, Julia & Karlins, Marvin. 2008. What every body is saying. New York, NY, USA: HarperCollins Publishers.

Neidle, Carol & Neidle, Judy & MacLaughlin, Dawn & Bahan, Benjamin & Lee, Robert G. 2000. The syntax of American Sign Language: Functional categories and hierarchical structure. MIT Press.

Nespor, Marina & Sandler, Wendy. 1999. Prosody in Israeli Sign Language. *Language and Speech* 42(2–3). 143–176. DOI: https://doi.org/10.1177/00238309990420020201

Nespor, Marina & Vogel, Irene. 2007. Prosodic phonology: With a new foreword. Walter de Gruyter. DOI: https://doi.org/10.1515/9783110977790

Penner, Mark & Yano, Uiko & Terasawa, Hideya. 2019. Relative clauses in Japanese Sign Language. *Minpaku Sign Language Studies* 2. 1–24.

Pfau, Ronald & Steinbach, Markus. 2006a. Relative clauses in German Sign Language: Extraposotion and reconstruction. In L. Bateman & C. Ussery (eds.), *Proceedings og the North East Linguistic Society (NELS 35)*, Vol.2, 507–521. Amherst, MA: GLSA.

Pfau, Ronald & Steinbach, Markus. 2006b. Modality-independent and modality-specific aspects of grammaticalization in sign languages. *Linguistics in Potsdam* 24. 5–98.

Pfau, Ronald & Steinbach, Markus. 2011. Grammaticalization in sign languages. In Narrog, Heiko & Heine, Bernd (eds.), *The Oxford Handbook of Grammaticalization*, 683–695. Oxford: Oxford University Press. DOI: https://doi.org/10.1093/oxfordhb/9780199586783.013.0056

Prince, Ellen F. 1981. Toward a taxonomy of given-new information. In Cole, Peter (ed.), Radical pragmatics. 223–56. New York: Academic Press.

Ramat, Anna Giacalone. 2000. Typological considerations on second language acquisition. *Studia Linguistica* 54(2). 123–135. DOI: https://doi.org/10.1111/1467-9582.00054

Reilly, Judy S. 2000. Bringing affective expression into the service of language: Acquiring perspective marking in narratives. In Emmorey, Karen & Lane, Harla (eds.), *The signs of language revisited: An anthology in honor of Ursula Bellugi and Edward Klima*, 415–432. Hillsdale, NJ: Erlbaum.

Reinhart, Tanya. 1984. Principles of Gestalt perception in the temporal organization of narrative texts. *Linguistics* 22. 779–809. DOI: https://doi.org/10.1515/ling.1984.22.6.779

Roberts, Ian. 2007. Diachronic syntax. Oxford University Press.

Romaine, Suzanne. 1984. Relative clauses in child language, pidgins and creoles. *Australian Journal of Linguistics* 4(2). 257–281. DOI: https://doi.org/10.1080/07268608408599327

Rosenberg, Erika L. & Paul Ekman. 2020. What the face reveals: Basic and applied studies of spontaneous expression using the Facial Action Coding System (FACS). Oxford University Press.

Sandler, Wendy. 1999. The medium and the message: Prosodic interpretation of linguistic content in Israeli Sign Language. *Sign Language & Linguistics* 2(2). 187–215. DOI: https://doi.org/10.1075/sll.2.2.04san

Sandler, Wendy. 2010. Prosody and syntax in sign languages. *Transactions of the Philological Society* 108(3). 298–328. DOI: https://doi.org/10.1111/j.1467-968X.2010.01242.x

Sandler, Wendy & Aronoff, Mark & Padden, Carol & Meir, Irit. 2014. Language emergence. In Enfield, Nick J. & Kockelman, Paul & Sindell, Jack (eds.), *The Cambridge Handbook of Linguistic Anthropology*, 250–284. Cambridge: Cambridge University Press. DOI: https://doi.org/10.1017/CBO9781139342872.012

Sandler, Wendy & Lillo-Martin, Diane. 2006. Sign language and linguistic universals. Cambridge University Press. DOI: https://doi.org/10.1017/CBO9781139163910

Sandler, Wendy & Meir, Irit & Dachkovsky, Svetlana & Padden, Carol & Aronoff, Mark. 2011. The emergence of complexity in prosody and syntax. *Lingua* 121(13). 2014–2033. DOI: https://doi.org/10.1016/j.lingua.2011.05.007

Sankoff, Gillian & Brown, Penelope. 1976. The origins of syntax in discourse: A case Study of Tok Pisin relatives. *Language* 52(3). 631–666. DOI: https://doi.org/10.2307/412723

Sheldon, Amy. 1974. The role of parallel function in the acquisition of relative clauses in English. *Journal of Verbal Learning & Verbal Behavior* 13(3). 272–281. DOI: https://doi.org/10.1016/S0022-5371(74)80064-2

Tang, Gladys & Lau, Prudence & Lee, Jafi. 2010. Strategies for relativization in HKSL. Paper presented at the conference Theoretical Issues in Sign Language Research (TISLR)10, Purdue University, West Lafayette, IN, 30 September – 2 October 2010.

Weiß, Helmut. 2020. Where do complementizers come from and how did they come about?: A re-evaluation of the parataxis-to-hypotaxis hypothesis. *Evolutionary Linguistic Theory* 2(1). 30–55. DOI: https://doi.org/10.1075/elt.00014.wei

Wilbur, Ronnie. 2017. Internally-headed relative clauses in sign languages. Glossa: A Journal of General Linguistics 2(1). 1–34. DOI: https://doi.org/10.5334/gjgl.183

Ziv, Yael. 1997. Conditionals and restrictives on generics. In Athanasiadou, Angeliki & Dirven, René (eds.), *On conditionals again*, 223–241. John Bejamins. DOI: https://doi.org/10.1075/cilt.143.12ziv

Zukowski, Andrea. 2009. Elicited production of relative clauses in children with Williams syndrome. *Language and Cognitive Processes* 24(1). 1–43. DOI: https://doi.org/10.1080/01690960801966118