Central Taurus Sign Language: A Unique Vantage Point into Language Emergence

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Central Taurus Sign Language is a village sign language that naturally emerged in the absence of an accessible linguistic model in an isolated remote area in south-central Turkey, primarily as a result of recessive deafness in the community. Due to cultural, geographical and financial circumstances, deaf villagers did not have the opportunity to receive formal education and learn Turkish Sign Language (TID). As verified by a native TID signer, CTSL has developed without the influence of TID, and it is quite distinct from it. Named after the mountains in the region, today it spreads over three small neighboring villages.

In this thesis, I present evidence for the emergence of argument structure of distinct verb classes and the development of handshape classifiers in CTSL. The primary goal of these studies is to investigate how the semantic complexity in various different scenarios is realized on the surface structure of such a young language.

Like all village sign languages, CTSL is a unique vantage point into language emergence. It can provide us with a window into the human capacity for language and can help answer the question: What is it that humans are capable of creating from scratch in absence of a linguistic tradition? As one of a growing number of village sign languages that have been identified, CTSL represents an opportunity to draw comparisons among village sign languages and to begin to make modest generalizations about language emergence and evolution.

Keywords: CTSL, language emergence, language development, argument structure, verb classes, handshape classifiers

To that little girl who did not believe

the world ended at the last fence of the village.

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With respect and gratitude, my doctoral dissertation is dedicated to *my mother*, who, at the age of 11, opposed the social dogma in the village that prevented girls from attending school beyond mandatory primary education, and jumped into an ocean of uncertainty in pursuit of standing on her own feet.

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CHAPTER 1

HOW DOES A LANGUAGE COME ABOUT?

1.1. Introduction

Language is so tightly woven into human experience that it is an indispensible piece of the integrity forming the human existence. There is no human community discovered on the planet so far that is not using a language as a means of communication. It comes to us to so naturally and so effortlessly that we often take it for granted and fail to recognize how special it is. It is special because we can express thoughts on an unlimited number of topics using an unlimited number of novel sentences composed from a finite set of words and rules. There is no other natural communication system of equivalent expressive power in the entire animal kingdom.

It is a clear fact that we are not the only species using mutually intelligible signals in order to convey meaning. All animals communicate: some of them by using primitive methods (e.g., insects release a pheromone as a mating strategy) and some of them by using more advanced methods (e.g., complex vocal songs produced by birds). Many others communicate by using multiple modalities. For instance, dogs make use of various different vocalizations (e.g., barking, growling, whining) and visual cues (e.g., play bow), as well as olfactory cues in urine. In addition, vervet monkeys generate functionally

referential alarm calls distinct from one another depending on the type of the predator, which allows other members of the group take action accordingly (Fitch, 2010, p.24). Chimpanzees produce food calls, that are also functionally referential, so that the type of the food can be correctly inferred by the listeners of these calls (Slocombe & Zuberbühler, 2005). Primates are not alone in that respect: some alarm calls of bird species and also dolphins might be referential. Furthermore, several fish species communicate through rapid color changes, others through currents that they produce, and elephants through infrasounds that we cannot recognize (Fitch, 2010, p.24), and etc.

We, humans, also use non-verbal signals to convey meaning in multiple modalities such as visual displays (e.g., facial expression, body language) or various vocalizations other than speech (e.g., laughing, crying, screaming). In addition to these mutually comprehensible non-verbal cues, we use *language*. At the bottom, what we call "language" is a *symbolic code* with a primary function of conveying meaning. What makes our symbolic code so distinct and unique from all other systems is the fact that we manage to transfer the nuances in meaning and virtually any thought we have in our minds with some degree of precision into another person's mind (Jackendoff, 1994). We can convey information about events happening out of our sight, or about events that happened before the moment we speak and events that have not taken place yet, or about hypothetical situations that may never take place. Our ability to express specificity in meaning and flexibility to use language in novel situations are the hallmarks of our communication system. The crucial questions here are: *What are the essential ingredients of this code? How does a language come about? How did we create it? How do the properties of human language get their start from scratch*? *How do they work?*

No one knows for sure how or when the first human language arose. The road to a modern human communication system was almost certainly a long and a circuitous one with many turns and twists along the way (Tomasello, 2010). Yet, it has not deterred researchers from various disciplines like linguistics, psychology, anthropology and primatology from offering answers to these questions depending on their own perspectives. Studies on *language evolution* (e.g., Bickerton, 1990, 2007; Christiansen & Kirby, 2003; Fitch, 2010; Jackendoff, 1999; Pinker & Bloom, 1990), *linguistic typology* (e.g., Comrie, 1989; Croft, 2002; Dryer, Gil, Comrie, Jung, & Schmidt, 2005; Greenberg, 1963), *language acquisition* (e.g., Chater & Christiansen, 2010), *spoken varieties of pidgin and creoles* (e.g., Bickerton, 2015; McWhorter, 1998; Romaine, 1988; Todd, 2003) and *primate communication* (e.g., Berwick & Chomsky, 2011; Hewes et al., 1973; Rizzolatti & Arbib, 1998; Tomasello, 2010) have so far addressed these issues.

1.2. Theories on Language evolution:

Solving the puzzle regarding the origins of the human communication system is one of the hardest questions of science because there are no fossil records revealing why and how human languages came about. There are fossils of skulls but these skulls cannot tell us anything further than the overall shape and size of hominid brains. Yet, lack of such hard evidence does not necessarily mean that we cannot or we should not try to understand *why* and *how* languages might have emerged, and how they might have evolved.

Some of the researchers propose that language emerged primarily for communicative purposes; thus, it emerged as a socially learnt tool. For instance, the 'mother tongues' hypothesis, proposed by Fitch (2004), suggests that human language came about as a communication device between the mothers and their biological offspring, which then extended to relatives. According to this hypothesis, the genetic interests of speakers and listeners coincide with each other for speech signals (i.e., words) to lead to sufficient trust and cooperation, and to lead to the emergence of language[1]. Others proposed that language emerged not for cooperation, such as to inform others, but to manipulate and deceive them, basically because of the competition for limited resources (e.g., Dawkins, 1983). Yet, another hypothesis, proposed by Dunbar (1998), suggests that gossip was the main motivation for the language to emerge. Just as manual grooming helps primates maintain a relationship among alliances on the basis of a "if you scratch my back, I'll scratch your back" principle, Dunbar (1998) claims that language serves the same purpose among human beings. As the social groups increased in size, manual grooming for humans started to become time-consuming; therefore, unaffordable. As a solution to this, humans developed a cost-free system in terms of the amount of time and effort invested in this practice: vocal grooming, which then slowly evolved into a vocal language –as suggested by Dunbar (1998), first in the form of 'gossip'.

Another school of thought proposes that language emerged, not primarily as a social tool for communicative purposes, but to allow us to think. For instance, Bickerton (1990) puts forward that language is the representational medium for propositions, and without such medium, it is not possible to think at human levels of conceptual complexity. Similarly, Chomsky (2002) points out that we spend more time talking to

[1] Critics of this hypothesis argue that kin selection is not unique to our species (e.g., Tallerman, 2013).

ourselves than to others. Thus, the primary function of language is to provide a ground for 'thought', not for communication[2]. Critics of this this school of thought argue that much of the tools of grammar would be redundant if language was mainly for internal representation of information (e.g., Pinker, 2007).

With respect to *how* languages emerged, *first*, there are distinct opinions regarding the *modality* in which the first human language appeared. For instance, some researchers propose that human language originated first in the manual modality[3], but had to be abandoned because of the disadvantage caused by distance and the darkness at night (e.g., Hewes et al., 1973; Corballis, 1992; Pika & Mitani, 2006; Tomasello, 2010). There are others speculating that language evolved in the vocal domain from early human capacity for song (e.g., Cross & Woodruff, 2009; Mithen, 2006). *Second*, there are different theories regarding the time frame of language emergence: Some scholars (e.g., Chomsky, 1997, 2005) think that language came about as an outcome of a macromutation (i.e., discontinuity theories), which created the complete system in the brain all at once. Then humans started expressing complex concepts through combinations of speech signals. Others think that distinct components of language evolved in stages (i.e., continuity theories), perhaps over many millennia (e.g., Bickerton, 1990; Jackendoff, 1999; Pinker & Bloom, 1990).

Among the continuity theories, Bickerton's (1990) proposal involves two stages of language evolution: *protolanguage* and *modern language*. Protolanguage is basically the early form of the modern language without syntax –what a language would have been like before it was linguistic. In Bickerton's (2009) own words, "language combine

[2] These theories are strong forms of Whorfian hypothesis (i.e., 'thought' completely depends on 'language'). See Pinker (1995) and/or Pinker (2003) for a counterargument.
[3] Gestural and/or signed systems take place in the manual modality.

lawfully and protolanguage combine lawlessly" (p.40). Bickerton (1990) suggests that protolanguage is still present in the modern human/ape mind, and surfaces itself in the linguistic mode shared by four groups of speakers: trained apes, children under two, adults who have been deprived of language in their early years, and speakers of pidgin. In the systems used by these groups, many arguments might be omitted; thus, the listener has to rely on the overall meaning of the utterance, knowledge of the context and sheer common sense (Bickerton, 1990).

The protolanguage proposed by Bickerton (2009) is a compositional one: individual words are created first, and then they combine into larger units over time. Wray (1998), on the other hand, proposes a holistic protolanguage: Instead of starting with words and building them into sentences, sentences (or rather the semantic equivalent of sentences) are created first and then they are broken down into words –mainly because the inventory of holistic signals would become so big that it would impose a heavy burden on memory.

Jackendoff (1999) takes the idea of protolanguage one step further and proposes possible stages of development of human language. According to Jackendoff (1999), a complex system evolved incrementally, and protolanguage was one of the intermediate stages of language evolution. Rather than a two-stage evolutionary process that involves an abrupt change from protolanguage to modern language, Jackendoff (1999) suggests the following stages:

1. The emergence of phonology and lexicon:
    a. Use of symbols in a non-situation-specific fashion
    b. Concatenation of symbols

    c. Development of a phonological combinatorial system to enlarge open, unlimited class of symbols

2. Protolanguage starts about here
3. The emergence of hierarchical phrase structure:
    a. Developing a system of grammatical relationships to convey semantic relations
    b. Final additions: adding grammatical devices like plural markers, tense markers, relative clauses to make the "protolanguage" structurally richer
4. Modern Language

These are some of the possible explanations for some parts of the puzzle. How/when we changed from protolanguage to modern language, or from no language to protolanguage and then to modern language is still a mystery. We do not know whether our Neanderthal cousins spoke a language, or a protolanguage, or a form of language like sign language, and we may never know what happened. However, posing these questions can help us develop a better empirical understanding of how human language might have looked in its initial stages.

1.3. In Pursuit of Hard Evidence

Linguistic Typology

While some researchers offered theoretical explanations for language emergence, others tried to find concrete evidence. One way of tackling this question would be to trace

the development of all of the existing human languages back to their origins and investigate their essential ingredients in the ancient times. Adopting such a method would only take us to a dead end because spoken languages have mostly evolved from older languages very slowly over many millennia and we do not have the fossil records of any of these languages. We have very early written records of spoken languages: e.g., Sumer, Hittite cuneiforms (Glassner, Bahrani, & Van de Mieroop, 2003; Ünal, 1998; Walker, 1987). However, for thousands of years, spoken languages seem to have had pretty much the same complexity that they have today (e.g., Hittite: Hoffner & Melchert, 2008).

Another way to address language origin might be to compare the structure of as many modern languages as possible with one another and see if there are certain structures that all of the existing human languages share (i.e., linguistic universals). If there are universal patterns that all human languages have in common, then these patterns may potentially help us gain insight about the starting points for languages to emerge and evolve from. However, there are somewhere between 5000-8000 distinct spoken languages in the world today and less than 10% of these languages have detailed descriptive analysis (Evans & Levinson, 2009). In practice, a much smaller sample size is used for typological studies. For instance, the language universals suggested by Greenberg (1963) was based on a sample size of 30. Not only the size of the sample but also the pool that samples are taken from poses another obstacle for a meticulous analysis of linguistic universals. As pointed out by Evans and Levinson (2009), the number of distinct phylogenetic groupings found across the world's languages is highly controversial. For a typological analysis to serve its purpose, it is essential to select maximally independent samples of languages in a principled way. Assuming that

linguistic diversity is represented by 7000 distinct languages falling into 300-400 phylogenetic groups in the modern world, optimistically speaking, we get a non-random sample of around 5% of linguistic diversity. However, prior to Western colonization within the last five centuries, there were probably twice as many languages that are extinct today (Evans & Levinson, 2009). If we traveled through time, it would not be an exaggeration to estimate the number of languages having ever been used on the surface of our planet as at least half a million (Pagel, 2000). These factors leave us with a non-random sample of much less than 5% of linguistic diversity, which poses a challenge to trace back to the very first common ingredients of a language.

Even if the methodological hardships are overcome to study linguistic universals, detailed cross-linguistic analysis of many languages over the last half century has proved that they diverge from one another to a great extent in all of the basic components forming a human language (e.g., Evans & Levinson, 2009; Kiparsky, 1968)[4]:

Phonology: some of the languages may use less than a dozen distinct sounds: e.g., 11 in Rotoka (Robinson, 2006)s, spoken in Bougainville island in the east of New Guinea, and 12 in Piraha(Everett, 1982), an Amazonian language in Brazil, whereas others use tens of them: e.g., 141 in !Xun (Heine & Honken, 2010), used in southern Angola, northern/north-eastern Namibia and north-western Botswana, and signed systems do not use them at all.

[4] Although spoken languages differ from each other in all components forming a language, it is important to acknowledge the fact that there are statistically significant universals. For instance, 86% of the world languages rely on word order as a syntactic strategy in order to clarify who is doing what to whom (Dryer et al., 2005). I'd like to emphasize that I am not arguing against the universality of certain linguistic structures, but I am arguing that using linguistic universals as a method to track the basic ingredients of a language might be misleading.

Syntax: Even the noun-verb distinction, which is a widely accepted language universal (e.g., Hawkins, 1988; Hopper & Thompson, 1984), is not uncontested. It has been reported to be absent in Riau Indonesion (Gil, 2014) and in Straits Salish (Jelinek & Demers, 1994).

Morphology: Both derivational and inflectional morphology are completely absent in isolating languages, such as Chinese (Packard, 2000). They do not even use the rudimentary inflectional morphology of English words (e.g., like-*s*, boy-*s*, walk-*ed*). On the one hand, English is rich in terms of its morphology when compared to Chinese. On the other hand, it is impoverished when compared to the staggering morphological complexity of Turkish (Hankamer, 1989).

Semantics: Languages diverge not only in their surface structure, but also in the concepts that are encoded in their grammar and lexicons. Despite the persistent school of thought in favor of universal concepts –an innate 'language of thought' or 'mentalese' (e.g., Fodor, 1975; Pinker, 1995)–, languages fundamentally differ from each other in the semantic concepts they express. For instance, almost all languages have a linguistic method to express exact quantity, but Piraha; because Piraha speakers do not have this concept (Frank, Everett, Fedorenko, & Gibson, 2008). In addition, Turkish has a concept called 'evidentiality'[5] (Aksu-Koç & Slobin, 1986; Ozturk & Papafragou, 2008), which is unexpressed morphologically but can only expressed phrasally (i.e., "I hear that S", "I guess that S" *vs*. "I saw S" and "I know S").

[5] While reporting the source of the past events in Turkish, there is an obligatory choice between the following two morphological markers: a) If the event is actually witnessed by the speaker, the past tense marker *–DI* is used, b) if the information about the event is acquired through hearsay, or through inference with the help of some other clue, the evidential marker *–mIş* is used.

In brief, it is literally impossible to track the origin of the human communication system through spoken languages because of methodological obstacles. Besides the challenge posed by the methodology, there is mounting evidence suggesting that spoken languages differ from each other to a great extent both in form and content, which makes it hard through linguistic universals to determine how our symbolic code might have looked at the very beginning of its existence.

Pidgins and Creoles

One exception to the time depth of spoken languages is pidgins and creoles: These are the only known spoken languages that are new (McWhorter, 1998). *Pidgins* emerge when speakers of two or more mutually unintelligible languages end up living in the same place and need a common language to communicate with one another. As defined by Bickerton (2009), a pidgin is built from ready-made words that are borrowed from one, or many, of the languages and the syntax, such as it is, from other languages. These systems may potentially portray the initial stages of a new language as they lack conventionalized syntactic and morphological rules. For instance, languages have word order constraints that determine which words go first, but pidgins do not obey such constraints. Anything can come in any order as long as the whole unit is meaningful in some way (Bickerton, 2009).

According to some accounts, pidgins develop into *creoles*[6] when children born into pidgin-speaking communities acquire these systems as their native languages (McWhorter, 1998). An important distinction between a pidgin and creole language is the

[6] Note that there are arguments suggesting that creoles do not necessarily originate from pidgins (e.g., Mufwene, 2008).

complexity of these systems: A pidgin is highly simplified in structure and it naturally emerges as a means of communication, but a creole is a complex natural language that is used for day-to-day communication. It is a fully developed system[7] (e.g., Degraff, 1992; Mufwene, 1997).

Researchers argue that pidgins and creoles can shed light on language emergence, as these systems provide evidence for a language to evolve from having a simpler to more complex structure (Bickerton, 2015; Romaine, 1988; Todd, 2003). It is certainly true that they would provide us with valuable insight into how a brand-new system would come about and evolve from other systems. However, pidgins and creoles are actually not the best possible models for the early stages of language creation from scratch, because they are not entirely new. They are mixed languages that originate from existing models and they cannot be considered independent from their source languages. Therefore, it is not possible to pull apart the facilitatory or inhibitory effect of the prior knowledge of the source languages on the creation of a new language in the form of a pidgin variety (I. Meir, Sandler, Padden, & Aronoff, 2010; D. Slobin, 2002).

Language acquisition by human infants

One may think that language acquisition by children is another important source as a window on the human capacity for language creation. It is a clear fact that children (but not dolphins, dogs, birds, or not even chimpanzees and bonobos) bring certain innate abilities with them to make language learning possible. The environmental evidence alone is considered to be insufficient for a child to construct a grammar because much of

[7] Within the last five centuries, about a hundred creoles have emerged. These are predominantly based on European languages because of Atlantic slave trade and age of discovery (McWhorter, 1999).

the actual speech that is observed by the child consists of fragments and deviant expressions of a variety of sorts. Moreover, there is no feasible way of exposing a child to each and every utterance of the target language as there are infinite number of them, and it is actually redundant because the child is already endowed with the innate capacity to "invent" a generative grammar based on the "poverty of stimulus" (Chomsky, 1965). Children readily go beyond the input provided to them, and they gain productive control of the language that they learn (Goldin-Meadow & Mylander, 1990).

By doing so, every child *internally develops* a system of rules (Jackendoff, 2002) and, in a sense, it is a unique mental system within each individual (see the discussion on I-language by Chomsky, 1986; Chomsky, 2005). In the process of developing a tool for the external manifestation of this mental system, children go through a certain developmental path. For instance, while acquiring syntax, they start with one-word utterances and then two-word utterances (syntax begins here), then they achieve combining single words into larger units. They go through a period of overgeneralization of the rules they pick from the environment, but in the end, they successfully generalize the linguistic patterns and use them productively in novel contexts (e.g., Clark, 2009; Lust, 2006; O'Grady, 2005)[8].

The initial stages of language acquisition by human infants can certainly be thought to be analogous to the initial stages of language creation, and this line of research would provide us with valuable insight into the developmental path that children follow while acquiring this uniquely human system. However, remember that the question we

[8] The *interlanguage* of the second language (L2) learners is also a unique system of each learner. In these systems the L2 learners preserve some of the features of the first language (L1). Just as children acquiring L1, L2 learners also go through developmental stages (Selinker, 1972). These systems may also be considered to give a hint about the initial stages of language creation, but L2 learners are also provided with a language model just like L1 learners.

are tackling within the scope of this thesis is language creation and basic ingredients of a natural human language in its initial stages. During the language acquisition process, a child is surrounded by a linguistic community and provided with a language model, with the guidance of simplified caregiver speech and with a lot of positive/negative environmental feedback. Considering that any normal child in a typical language-learning environment eventually acquires at least one language, the linguistic input and feedback coming from the environment is apparently "sufficient" for the child to go beyond the input they receive and to make accurate generalizations. Therefore, when researchers observe a pattern in a child's language learning trajectory, it is not possible to measure whether it is a natural contribution of the child learner, or of the providers of the model, or whether that pattern entered the child's system some other way (Senghas, 2011). To understand the individual contribution of the child using his own internal resources and dispositions, we have to abstract away the environmental effects, which is simply not possible (Feldman, Goldin-Meadow, & Gleitman, 1978).

Primate communication

Another line of research that has made an attempt to address language evolution is the studies conducted on the communication system of our biologically closest ancestors: *Apes*. Starting in the early 1900s, repeated experiments conducted on the apes showed that chimpanzees raised by humans and trained for language universally failed to acquire a human language (Hayes & Hayes, 1951; Kellogg & Kellogg, 1933; Yerkes & Yerkes, 1929). For instance, Kanzi, a male bonobo, acquired aspects of both Yerkish (an artificial language that was developed for the use of non-human primates. It contains symbols,

called *lexigrams*, corresponding to objects and/or ideas (Glasersfeld et al., 1974)) and spoken English as an infant. Greenfield and Savage-Rumbaugh (1990) report that Kanzi mostly produced one-word utterances (using lexigrams) and occasionally produced two- or three-lexigram utterances, which appeared to be novel utterances of Kanzi's rather than parroting the input, and recognized regularities in the order of the signs. Although he acquired and used lexigrams for communicative purposes, somewhat productively, and he was surprisingly proficient in perceiving and correctly interpreting a spoken human language, Kanzi neither displayed an ability of producing speech nor communicated about diverse concepts (e.g., things that he remembers, likes, dislikes, imagines, thinks, etc.). His abilities with a spoken human language did not go beyond requests for food and play (Savage-Rumbaugh et al., 1993).

In brief, previous studies focusing on training apes for a spoken human language found no suggestive evidence in favor of a complex vocalizations like speech or song in the learning capacity of any non-human primates (Crockford, Herbinger, Vigilant, & Boesch, 2004; Hauser, 1996). In addition, there is no evidence for the ability of non-human primates using a symbolic system "combinatorially" –combining one-word utterances into larger meaningful units in novel contexts (Corballis, 1992).

The experiments focusing on training apes on a manual system (i.e., using a signed system like ASL, or clicking on icons on a computerized keyboard) revealed far better competence for communication (e.g., Corballis, 2003; Hewes et al., 1973; Premack, 1971; Terrace, Petitto, Sanders, & Bever, 1979). For instance, Gardner and Gardner (1969) trained a wild-caught infant chimpanzee, Washoe, who mastered around

250 recognizable hand signs[9]. In the 1970s, Terrace (1979) studied another infant chimpanzee, Nim Chimpsky. Like Washoe, Nim managed to master many individual signs, and sometimes combine them into larger units. However, most of the data showed that these seemingly syntactic constructions were merely the imitations of human utterances produced before. Nim did not acquire anything even approaching human syntax (Terrace et al., 1979).

In brief, any normal child will acquire languages with little or no explicit training merely based on rather sparse input from the environment within the first couple of years of their lives, and they will freely express whatever they think, imagine, remember, etc. But even the smartest non-human primate, even with intensive training, will not (Deacon, 1997; Kako, 1999). Studies on non-human primate communication have helped us understand what is unique about human language but they have not contributed to our understanding of how a human language emerges and gains its generative expressive power, and what the basic ingredients of a language are in the initial stages of the development of the human symbolic code.

The ideal case study

The ideal language to study would be one in its infancy, a pure language developed with no outside influence and not yet sunk under the weight of its complex grammar accumulated over centuries. One way to do this would be to put *the forbidden experiment*, termed by Shattuck (1994), into practice. The literary work, *The Forbidden Experiment: The Story of the Wild Boy of Aveyron*, tells the story of a twelve-year-old boy, Victor, who apparently had grown up all alone in the wild with no human company

[9] Similar ape projects: Koko the gorilla (Patterson, 1978), and Chantek the orangutan (Miles, 1990).

(Shattuck & Candland, 1994). The title of the book is inspired by the earliest recorded psychological experiment reported by Herodotus around 429 BC (Colman, 2015). According to Herodotus, the Egyptian Pharaoh Psammetichus I (664–610 BC) conducted an experiment in order to discover the original human language. He ordered two infants to be raised by a shepherd in a remote place, and the shepherd was not allowed to speak to these infants. The main purpose was to investigate human nature without any social intervention. After two years, the children began to speak and repeated the word "becos", the Phrygian word for "bread". Psammetichus concluded that human capacity for language was innate and Phrygian was the natural language of human beings –but it is extinct today. Needless to say, such an experiment is *clearly unethical* in the modern world because acquiring or inventing a language requires cooperation through social interaction. It is completely inhuman to deprive people of these integral pieces of their existence.

1.4. Concrete evidence from signed systems:

Another line of research on signed systems has made an attempt to provide concrete evidence for language emergence without resorting to unethical methods like the forbidden experiment. Instead, researchers have been investigating the linguistic organization of very young sign languages to track the developmental path that a natural human language takes at its initial stages.

These young sign languages are different from the established sign languages of urban areas in that well-established sign languages have been shown to have grammatical complexity, regularity, systematicity and productivity just as spoken languages do (e.g.,

Bellugi, Poizner, & Klima, 1989; Corazza, 1990; R. Meier, 1990; Özyürek, Zwitserlood, & Perniss, 2010; C. Padden, 1988, 1990; Stokoe, 1978; Supalla, 1982; Sutton-Spence & Woll, 1999). They are used by reasonably large linguistic communities and they are used in all aspects such as education, politics, science, sports, worship, entertainment etc. Some of the mature sign languages date back to the 1700s: e.g., American Sign Language (C. Padden & Humphries, 1990), French Sign Language and British Sign Language (Kyle, Woll, & Pullen, 1988). Many others are younger: e.g., Israeli Sign Language is around 80 years old (I. Meir, 2010).

Emerging signed systems, on the other hand, are brand-new languages that emerge in the absence of a language model. They come closer to the forbidden experiment than any other circumstance in that they provide us with an atypical language learning environment –actually a language creation environment—, in which learners are presented with much sparser language input, something that has not been built up and shaped by generations of learners. They are so young that their development and histories can be traced in a way that cannot be done in spoken languages. Moreover, the grammar of these languages is the pure product of the signers' minds using them. By documenting the linguistic system of different age groups of signers, not only can we track the development of a language at its infancy but also we can more easily measure learners'/creators' contribution to the emergence and development of a language without worrying about the influence of prior knowledge coming from an existing model. Thus, these languages can shed light on the initial stages of a language, under what conditions a language develops and what sort of developmental paths they follow.

One may argue that it would not be possible to understand what the innate human capacity for language creation was like by looking at signed systems, mainly because signed and spoken languages are completely distinct from each other. It is true that these two systems operate in different domains (i.e., auditory *vs*. visual domains). However, both of them spring from the very same mental machinery. Furthermore, they are both acquired by following a developmental timetable by children who come to world with the same endowment for language and many aspects of their organization is the same (e.g., Bellugi & Klima, 1982; Emmorey, 2001; Lillo-Martin; Mayberry, 1993; Newport & Meier, 1985; D. I. Slobin, 1985).

Nothing goes without a drawback, or a limitation. These languages are created by deaf individuals who are surrounded by spoken languages. Therefore, the contribution of the hearing people in the community to the development of an emerging signed system cannot be underestimated. These languages will not tell us the very beginning of language emergence, mainly because there was not a linguistic community at all when the very first seeds of the human communication system were planted. We will not be able to see the default settings of the human mind, which realized the need for a conventionalized communication system and initiated language creation process. However, these languages will still provide us with a window into the capacity of modern human brain, and how it became optimized to generate a language.

1.4.1. Types of emerging signed systems

Homesign

This is a basic communication system created by individual deaf children being born into hearing families. The obvious distinction between such a system and sign language is the number of people using this system. In homesign, there is frequently a solitary brain creating a unique individual grammar, while in either a village or a deaf community sign language it is many creating the system as a product of joint interaction. In the absence of a linguistic community and linguistic feedback, home-signers communicate through gestures that become systematic over time. However, these systems usually do not go beyond a rudimentary tool for communication For instance, homesigners rarely produce all of the arguments of a predicate in a sentence and their utterances are often short sentence-like strings (e.g., a point gesture to a toy grape combined with the sign for *eat* would mean "grapes can be eaten") (Goldin-Meadow & Mylander, 1983). Yet, rather than simply involving mime-like displays, a homesigner's lexicon involves discrete units corresponding to particular meaning (Morford & Goldin - Meadow, 1997) and hearing family members demonstrably do not command the system (e.g., Goldin-Meadow & Feldman, 1977; Mylander & Goldin-Meadow, 1991).

Emerging Sign Languages

There are two types of emerging sign languages: *village sign languages* and *deaf community sign languages* (I. Meir et al., 2010; Woll & Ladd, 2003). These differ from each other through the social conditions of their formation. Village sign languages come into existence in small closed communities when a number of deaf children are born into

the community. Even a small group of deaf children may give rise to the emergence of a language without any contact with other sign languages. Deaf community sign languages, on the other hand, emerge when a group of deaf individuals with their own homesign systems are brought together in a forum for interaction (frequently for educational purposes,) and form a signing community by converging on a common sign language over time. Nicaraguan Sign Language (NSL) is the most well-known sign language of this kind. In the case of NSL, homesigners who did not have any organic connection with one another were brought together in a formal setting when the first school for the deaf that was established in the 1970s in Managua, Nicaragua. This school functioned as a magnet to bring these homesigners together. Each of these homesigners brought their own unique grammars to Managua, which rapidly turned into a –reasonably– standardized shared system over the last 40 years (e.g., Senghas, 1995, 2011; Senghas & Coppola, 2001; Senghas, Kita, & Özyürek, 2004).

In the case of a village sign language, a sign language naturally emerges because of recessive deafness in small isolated communities (De Vos & Zeshan, 2012). There are about a dozen village sign languages that have been reported so far (see Appendix 2 for a full list)[10]. In these settings, the size of the group is smaller than the one using a community sign language. Signers intimately share the same cultural, social and physical context from the very beginning because there is a preexisting stable social group. This possibly makes it easier for them to communicate intended messages with one another than it is for people from diverse backgrounds. Familiarity with the context may result in

[10] These very young languages, reported from different parts of the world within the last decade or two, imply that language creation of this type has likely occurred many times throughout history. All of these village sign languages are not only naturally emerging languages but they are also highly endangered, usually because of pressure from larger urban sign languages (De Vos & Zeshan, 2012).

abbreviated expression of language with other signers in the village community than it would be with those who do not share the context. Despite lack of explicit articulation, it helps with effective communication on a variety of topics as long as the context is provided (I. Meir et al., 2010).

Senghas (1995) suggests that the difference in community size and growth rate may have an impact on rapid language development and language change. Previous studies on NSL showed that the language changes very quickly between cohorts of school children in Nicaragua (Senghas, 1995; Senghas, Newport, & Supalla, 1997). Senghas (2005) argues that the regular influx of new signers into the NSL community leads to more rapid change in a community sign language than what might be observed in a village sign language setting.

Family sign

An intermediate case between homesign systems and deaf community sign languages is the *family sign languages* of the families involving at least two or more deaf members. These systems emerge as a joint effort of the deaf members in the household without a linguistic model. One such case has been observed in Amami Island, Japan (Osugi, Supalla, & Webb, 1999). Another one has been observed in a single household of Zinacantec Indians from highland Chiapas, Mexico (Haviland, 2014).

Gesture

Note that gesture is a distinct phenomenon from signed systems. Although it is tightly connected with speech, and frequently accompanies speech, gesture alone does

not stand as a system (Brentari & Coppola, 2013). In situations like a foreign-language setting or when separated by distance/by a soundproof barrier, spoken language may not be an option. As humans, we still communicate through nonverbal behavior like body language, facial expressions and/or hand gestures. As there are not any priori set of established conventions in these situations, such nonverbal behavior may potentially reveal clues about the fundamentals of human communication system by helping researchers make inferences about the pressures shaping people's gestural responses. Recent research has indeed shown that gestures communicate substantial information and provide insight into speakers' mental representations of the world (e.g., Goldin-Meadow, McNeill, & Singleton, 1996; Kendon, 1980; McNeill, 1985, 1992).

The gestures of hearing people can be thought to function as a source for some of the raw materials used in creating a homesign system or emerging sign language. However, previous research has found no evidence in favor of mothers' gestures forming the basis of the homesign systems of the deaf children (Goldin-Meadow & Mylander, 1983). There are apparently many idiosyncratic gestures used only by single individuals. Hence, investigating the beginning of a linguistic system through gestures is not a very reliable method.

In what follows, I assume that there is a distinction among the populations that are covered within the scope of this thesis: *gesturers, homesigners, users of emerging sign languages* and *established sign languages*. They are distinguished primarily by conventionalization and systematicity, which are influenced by the characteristics of the communities using these systems.

1.5. The Scope and the Organization of this Thesis

This thesis documents a newly discovered village sign language, which is called Central Taurus Sign Language (CTSL). It is a very young village sign language that emerged within the last half century. I have been documenting the linguistic properties of CTSL in collaboration with sign language experts from various universities[11]. This thesis is a compilation of some of the projects I have been conducting during my doctoral studies.

Within the scope of this thesis, I will make an attempt to address the following research questions:

- How does the psychological infrastructure for linguistic structure emerge in the absence of a linguistic model? Which factors caused CTSL to emerge?
- What does CTSL look like? How does CTSL accomplish the basic functions of a human language? What does it tell us about the initial stages of the human communication system?
- How did linguistic complexity –if any– arise and develop in CTSL? Has it been following a similar developmental pattern to the one in the other emerging signed systems? Or, does it have its own developmental path?
- Is the human capacity to invent a language so hard-wired that language will arise full-blown in all its complexity in a single generation?
- Or do interaction and experience over time play a crucial role in the emergence and development of language?

[11] Prof. Carol Padden from UCSD, Profs. Irit Meir and Wendy Sandler from University of Haifa, Prof. Diane Brentari from UChicago, Prof. Ann Senghas from Barnard College, Prof. Lila Gleitman from UPenn, Dr. Deniz Ilkbasaran from UCSD

- What is the relation between language and the characteristics of the community? How has the social structure of CTSL affected the development of this language?

Chapter 1 reviewed the theories regarding the beginning of a linguistic system and the attempts to collect concrete evidence to investigate the initial stages of human language. Chapter 2 introduces the social structure in which CTSL emerged and portrays what CTSL looks like in spontaneous conversations. Chapter 3 explores the argument structure in intransitive, transitive and ditransitive constructions. Chapter 4 presents evidence for the emergence of verb classes, more specifically, the distinctive features of reciprocal and symmetrical verbs in comparison to transitive and intransitive constructions. Chapter 3 and Chapter 4 are cross-linguistic studies that are conducted in comparison with gesture, family sign systems and spoken Turkish. Chapter 5 investigates the morphological properties of CTSL by looking at hand shapes classifiers in agentive versus non-agentive contexts. Chapter 6 discusses the possible contributions of our findings to the general theoretical discussion.

CHAPTER 2

A UNIQUE VANTAGE POINT

2.1. Central Taurus Sign Language

Central Taurus Sign Language (CTSL) is a village sign language that naturally emerged within the last half century in a mountainous remote area in southern central Turkey. It has developed in three tiny neighboring villages with little or no influence of Turkish Sign Language (TID), and is distinct from it, as evaluated by a deaf native TID signer[12].

One of the two main reasons for such a language to develop on its own is the high population of deaf individuals in these communities as an outcome of a hereditary deafness. The deafness in the CTSL community is preserved up until today, due to the prevalence of consanguineous marriages in families with deaf individuals. The other reason for CTSL to emerge naturally without the influence of any other language is the financial, geographical and cultural conditions in the region. It is a labor-intensive community on top of one of the most mountainous regions of Turkey and the villagers rely on agriculture and animal husbandry in order to meet their own basic needs. Because

[12] Okan Kubuş, PhD, viewed several different videos involving CTSL spontaneous conversations and confirmed that this language is completely distinct from TID (personal communication).

of this self-sufficient way of life, until the last couple of decades, sending children away for education was not only unaffordable but also irrelevant to the lives of the villagers. Moreover, human labor has always been very precious in the community and children were not exempt from working for their families. Sending children away represented a loss of human labor; thus, it was not desirable.

Hearing children were able to receive compulsory elementary school education for five years in the village school. However, most of the children were not able to go beyond this basic five-year primary school education, as it was neither compulsory nor readily accessible to the villagers before the 1990s. The nearest middle school was located in a town approximately 10 miles away from the village and it was reached through a rugged mountain trail either by walking or on donkeys. Because of these difficult geographical and financial conditions, and lack of immediate practical benefits of education for the lives of the villagers, most of the villagers did not send their hearing children to school after compulsory five-year education, let alone sending their deaf ones. Until the early 2000s, these factors inevitably led to the isolation of the deaf individuals from the facilities of the modern world and prevented them from having access to the formal education for the deaf in Turkey. As a natural consequence of these circumstances, CTSL has developed on its own in the absence of an accessible language model as the primary (and only) means of communication for the deaf individuals.

CTSL is named after the Central Taurus mountain range in the region. Today it spreads over three tiny villages: Village 1 with a population of 326 including 15 deaf individuals, Village 2 with a population of 1,955 involving 14 deaf individuals and Village 3 with a population of 182 involving 1 deaf individual (deaf population in each

village: 4.6%[13], .7%, .5%, respectively)[14]. All three of these villages are located within a 15-mile radius and most of the deaf individuals in these villages are connected to each other from birth or through marriage.

The data presented in this thesis mainly comes from Village 1. Thus, the demographics in Village 1 are elaborated on in this section. The deafness in this village is within a single family involving 23 deaf members and it can be traced back to 7 generations (See Figure 1 for family tree). I am a hearing member of this family from the 6th generation. My family has been living in this village since Ottoman times[15]. Based on interviews with the elder members of the family, the first known deaf member was born before the 1900s. Since then, every generation has produced at least one deaf member. Before the 5th generation, there was only one deaf member in each generation. None of them are alive today. The oldest deaf signer who is alive today is from the 4th generation and he is in his 60s. One of the striking observations in the family tree is that the 5th generation comprised 12 deaf members (+4 deaf spouses), which is evidently a big enough group to get the language going. This possibly enabled vertical and horizontal social contact among the members of the same and different generations and possibly facilitated the development of the language. My best guess is that CTSL started to come into existence within this generation. Today, three generations of deaf members exist simultaneously in the community and they still contribute to the formation and

[13] Considering .1% deaf population in the US (Emmorey, 2001), and .4% in Turkey (Demir & Aysoy, 2002) this is a very high proportion of deafness within a tiny community.
[14] These are official numbers based on 2011 population count (Retrieved on 10/2/2016 from http://www.yerelnet.org.tr/koyler/koy.php?koyid=248633).
[15] We do not have any written records regarding the ages of the family members born in Ottoman times. We are relying on the interviews with one of the oldest members of the family who passed away in 2014 during our second field trip.

development of the language. In addition to the deaf individuals, hearing members of the community can sign CTSL at varying proficiency levels.

Before 2000, the closest school for the deaf was approximately 170 miles away from the village in the city of Adana. As an outcome of industrialization in those years, the increasing attractiveness of urban areas in providing economic and social opportunities encouraged several families from the village to work in newly established factories as factory workers. One of these families moving to Adana in the 1970s had two deaf children and sent them to the school for the deaf there. These two deaf sisters from the 5th generation were exposed to another deaf culture as of the 1970s and acquired TID as a second language[16].

Another school for the deaf was founded in Mersin in the late 1990s. Mersin is a closer city to the village (approximately 110 miles away). In addition to the founding of this new school, the highways built after 2000 improved public transportation, and also new laws and regulations passed by the government to provide citizens with equal education rights irrespective of their restrictions made it easier for the deaf villagers to have access to the formal education of the country. Thanks to these improvements in various areas, two of the deaf members from the 6th generation were sent to the school for the deaf in Mersin. Except for these two 6th generation members and the two deaf siblings from the 5th generation, the other deaf members of the CTSL community did not have this opportunity. As a result, most of the deaf villagers were neither able to learn any other languages nor how to read and write.

[16] In 1953, as a consequence of proponents of the oralist methods constituting the majority, the use of TID as a means of education in schools was banned in Turkey. Even today, in 2017, Turkey is still using oralist methods to educate deaf individuals by hearing teachers. Moreover, teachers working at the schools for the deaf are unfortunately not TID-trained. There is not a standard curriculum and curriculum implementation materials. As a result, every school for the deaf uses a different version of TID (Akalın, 2013).

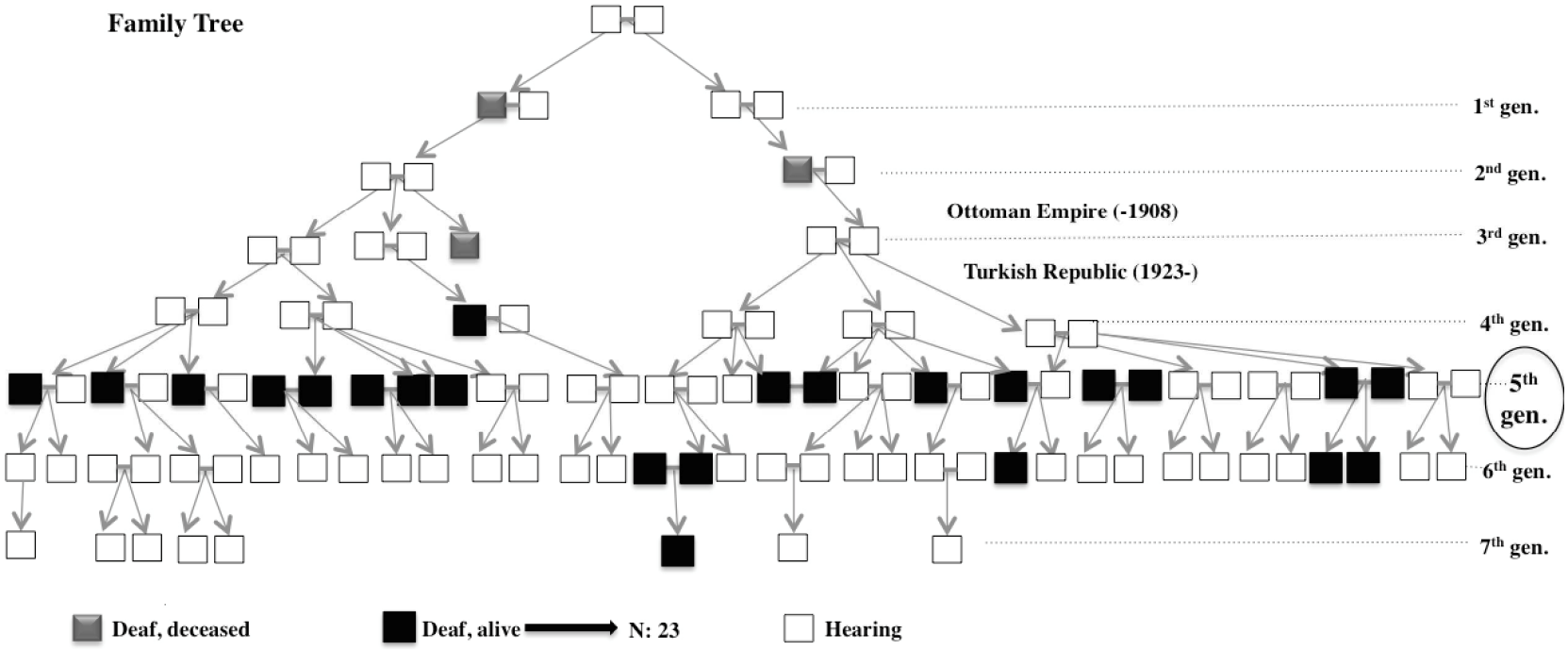


Figure 1: The family tree is illustrated. The grey, black and white boxes represent the deaf and deceased, deaf and alive, and hearing members of the family.

The two sisters from the 5th generation visit the village only during holidays; they do not live in the village any more. Actual contact with TID began only within the last decade. Two of the 6th generation signers had varying degrees of exposure to TID: One of them between the ages 7-11, and the other one between 9-19. However, the amount of exposure is not strong enough to dominate CTSL. Except for a few signs (e.g., woman, man) borrowed into CTSL, TID has had no detectable influence on the development of CTSL. These four bilingual signers of TID and CTSL use TID among one another but they switch to CTSL to communicate with everyone else in the village.

In order to determine the age of CTSL, I take the year when my mother left the village as a reference point. My mother is one of the oldest members of her generation (60 years old). She left the village in 1968 at the age of 11 in order to continue her education[17]. Before she left, the very first inventors of CTSL had already been born into the community but they were only toddlers. In other words, when my mother was still in the village, CTSL did not exist yet. As a consequence, despite having three (younger) deaf siblings, my mother has never acquired fluency in CTSL and she frequently needs an interpreter in order to communicate with the deaf members of the community. Her 50-year-old sister, who is hearing, on the other hand, is a fluent signer and can hold a

[17] My mother was the first girl in the village to go beyond five-year compulsory education. When she was a fourth grader in the village school, a female teacher came to teach them for a while as a substitute teacher. My mother was so surprised to see that a woman could work outside the house and be a teacher. She took this teacher as a role model for herself and started dreaming of being a teacher. After she finished the primary school, she fought against all of the social pressure in the village dictating that girls should be assigned only domestic roles. She won! My grandfather and two of his brothers rented a house in town. My mother and two of her male cousins attended the middle school there. Then, she sat a nation-wide exam and managed to get into a boarding high school in an Eastern city. My grandfather had to sell one of his cows to find money for her travel expenses. She now holds a college degree. She always dreamt of being a teacher but ended up being a nurse and served the country as a nurse for 37 years until she retired in 2014.

flawless conversation with the deaf members of the community. I therefore believe that CTSL is younger than my mother; hence, not older than half a century.

In some rural signing communities, deaf members were unfortunately stigmatized, which forced them to become isolated from those communities. As an outcome of this social dogma, the development of a sign language in those societies was hampered (e.g., Adamorobe Sign Language in Ghana: Nyst, 2007). This is luckily not the case for the CTSL community. Deaf members are fully integrated into the community. They are not stigmatized at all. They take part in all of the social gatherings, and they work together with the other villagers in their fields. Deaf individuals hold occupations similar to those of the hearing members of the community. The deaf marry hearing members as well as other deaf members. They attend all of the social gatherings in the village. This social structure contributes to the full integration of the deaf individuals into the community and keeps CTSL alive as another language in the village. As the deafness and sign language are inextricably woven into the entire village, hearing children with deaf family members or relatives acquire CTSL as well along with spoken Turkish.

De Vos and Zeshan (2012) report that 12 other village sign languages have been discovered so far in the world (Appendix A). All of these languages are very young systems that emerged at a specific point in time. Like other village sign languages, CTSL provides yet another vantage point about how a language develops systematic patterns over time in the absence of an accessible language model.

2.2. CTSL at First Sight

When we look at the use of CTSL in spontaneous conversations, what we observe is a language with simpler grammar: As suggested by Jackendoff and Wittenberg (2014), the language comes in a "linear order", the utterances frequently involve a list of predicates, word order mainly follows the temporal order, and there are no clear overt structures. Instead, signers frequently produce unanalyzed whole units and one-word utterances. There is some structure in two-word utterances such as in "I + SQUEEZE", and there are prosodic breaks defining the boundaries of the units and regularities in the order of the arguments (i.e., the doer of the action occupies the initial position in the unit); however, when it comes to understanding the whole story, it is mostly based on the inference that the addressee makes.

A traditional linguistic analysis would not be able explain CTSL data because languages like CTSL have been unforeseen by the mainstream understanding of linguistic analysis. This may lead researchers to thinking that CTSL is "not a language". Simply because CTSL does not have a complex linguistic structure as spoken languages or well-established sign languages do, it does not mean that it is not a real functioning language. CTSL is a *real natural language* that is used as the primary, and only, means of communication of a *real community*.

2.2.1 Raw Data

Over the last four years, I and my research assistant Leyla Kursat compiled over 1000 CTSL sentences (defined by prosodic breaks) from spontaneous conversations in order to investigate the sources of meaning that are conveyed in the most natural

environment of language use. We translated these conversations into Turkish, sentence by sentence, with the help of three hearing native signers of CTSL. Then, we transcribed and glossed the utterances sign by sign. Finally, we listed possible interpretations of the CTSL sentences in English as in the example below:

(1) *Actual utterance in CTSL:*

WOMAN + I + TAKE / RING + TAKE & POINT(to an absolute location)

Interpretation in English:

"I brought (the) woman" *or* (I) brought (the) woman (against her will).

"(We) (got) married there" *or* "(We) (got) married (and) moved there"

In (1), and in the rest of the examples given in this section, '+' indicates that the signs are sequentially signed; "&" indicates that they are simultaneously signed and "/" indicates that there is a prosodic break between units. The information presented in "()" in the English translations does not come from the sign but from context. CTSL utterances involving a "." between the words indicate that those are unanalyzed whole units expressed with a single sign in CTSL but, for translation purposes, they are expressed with multiple words separated with "." while being transcribed in English (e.g., PUT.INTO.POCKET). Finally, CTSL utterances in "[]" indicates the words that go together (e.g., [AUNT.DURANA + DONKEY]; *Eng*. Aunt Durana's donkey).

Below are some further CTSL utterances extracted from three different stories, each of which are spontaneously told by three different signers from three different age groups:

A deaf man (age=55) from the 5th generation telling about his life and daily routines:

(2) SELL + GOAT / MONEY.SAVE / BRACELET + MANY

"(I) sell (the) goat(s). (I/We) save money. (I/We buy/bought) many (gold) bracelet(s)" *or* "(I/We invest in gold) bracelet(s)"

(3) GOAT + HERE + SLEEP + HUNGRY + GOD.HIT.ME.WITH.STONE

"(If the) goat(s stay) here (and if they) sleep, (they get) hungry, (and if they get) hungry, God (punishes) me (by) hitting me (with a) stone."

"(If the) goat(s stay) here (they will) sleep, (and if they) sleep (they will get) hungry, (and if they get) hungry, God (punishes) me (by) hitting me (with a) stone."

(4) TOGETHER + POINT(to his wife) + POINT(to himself) + MILKING

"(I) (and my) wife milk (the goats) together"

(5) MILK + STIR + PUT + PILE + SQUEEZE / I + SQUEEZE / MONEY + GOOD / CHEESE / MONEY + TWO + TEN + TWO

"(I) stir (the) milk. (I) make (cheese). (I) make (it). (It) pay(s) well. (I) (sell) (the) cheese (for) 10-12 liras"

(6) SUNFLOWER + SQUASH + PLANTING

"(I/We) plant sunflower (and) squash." *or* "(I/We) grow sunflower (and) squash."

(7) MONEY + GOAT + MONEY + SELL / 600-400-450 MONEY + PUT.INTO.POCKET

"(I) sell (the) goat(s). (I) make 600-400-450 lira(s). (I) put (the money) into (my) pocket."

(8) CROP + MONEY + SELL / 5-6-10 TL

"(I) sell (the) crop(s) (for) 5-6-10 lira(s).

A young deaf woman (age = 34) from the 5th generation telling us about her wedding day:

(9) CRYING / WEDDING.DRESS / CURLY.HAIR

"(I) cri(ed)." *or* " I (was) cry(ing)".

"(I put my) wedding dress (on)" *or* "(I was wearing my) wedding dress".

"(I did my) hair curly" or "(I had my) hair (done) curly"

(10) POINT(to the addressee) + SHH + GO INSIDE / RUN.INSIDE

"You (said) "Shh, go inside". (I) ran inside".

(11) CAR + SIT / GO.AWAY / GO + BLOCK / GO + NOT

"(We) got on (the) car (and) went away."

"We were going, the road was blocked, we couldn't pass."

(12) WALKING / KNEES.TREMBLING / EVERYBODY + LOOK + POINT(to herself) / HEART.BEATING / WALKING + NO / DANCING

"(While we were) walk(ing), (my) knees (were) tremble(ing). Everybody (was) look(ing at) me. (My) heart (was) beat(ing), (I could) barely walk. (We) danced."

(13) ESE + BAG + FIND / BAG + LEAVE & POINT(an absolute loc.) / REMEMBER + NOT / LEAVE

"Ese found (the) bag. (I) left (the) bag there, (I) forgot, (I) left." *or* "...(I) forgot (that I) left (the) bag there" *or* "…(I) forgot (that I) left (the) bag there (and I) left"

A deaf female teenager (age = 15) from the 6th generation signer telling us about a personal story:

(14) POINT(to herself) + PAST + KID / POINT(to herself) + SIT.ON.DONKEY / CIRCULAR.PATH + GRANDFATHER + POINT(here)

"(When) I (was a) kid (in the) past, I (was traveling) on (a) donkey. (My) grandfather (brought me) here (from the longer) circular route."

(15) [AUNT.DURANA + DONKEY] + TAKE

"(We) borrow(ed) Aunt Durana('s) donkey".

(16) POINT(to herself) + SIT.ON.DONKEY + TIE + FALL + NOT

"(I) sat on (the) donkey. (My grandfather) tie(d me) (so I would) not fall"

(17) SHOE + SMALL + STONE + GO.INSIDE / GET.STUCK + WOUND + BLEED + BLEED + BLEED

"(A) small stone went inside (my) shoe. (It got) stuck (there). (I got) wound(ed). (It was) bleed(ing) a lot" *or* "(It) bled (for a while)".

In a fully developed language, linguistic meaning typically comes from the words and the structures that determine how these words combine with each other. In languages like CSTL, obviously there are words; however, it is hard to find clear evidence in the spontaneous conversations for linguistic structure that signals clauses as dependent and for functional categories that signers rely on in order to communicate the intended messages. Concatenated units may have a semantic relation with each other such as a causal relation, but there is not much evidence for overt syntactic cues explicitly indicating those relations in the spontaneous conversations.

Rather than mainly relying on syntactic cues, CTSL signers convey their messages by making use of some additional resources:

a. Non-Manuals: Sometimes there is little in the hands and meaning is conveyed through facial expressions, sometimes through posture, sometimes through a blink of an eye or the shake of head. These non-manual devices indicate which words go together semantically.

b. Prosody: Prosody is one of the cues to define clause boundaries in signed systems. It may not always be a clear indication of how units are related to or different from each other, but it is frequently an overt marking of dependency between the units. In other words, prosody helps with segmentation but it does not tell us how those segments are related with each other.

c. Semantics: In some utterances, there may not be clear prosodic breaks, or the other prosodic cues may not help enough to make the correct inferences regarding the intended message. Thus, the boundaries between units can only be determined through semantics in some utterances like (3).

The signer conveys a very complex message in (3) in terms of its semantic content. There are four different predicates produced successively and each of these predicates are causally/conditionally dependent on each other. Say, HERE is predicate #1 (P1), SLEEP is predicate #2 (P2), HUNGRY is predicate #3 (P13) and GOD.HIT.ME.WITH.STONE is predicate #4 (P4). In this scenario, P1 is the cause of P2, P2 is the cause of P3 and the consequence of P1, P3 is the cause of P4 and the consequence of P2, P4 is the consequence of P3 or maybe the ultimate consequence of all of the previous predicates.

In (3), there are neither any clear prosodic breaks between these predicates nor anything clearly expressed through the facial expressions of the signer. In other words, there is nothing so complicated on the surface; however, it is semantically a very complex utterance because each unit is successively in a conditional/causal relation with each other (i.e., *semantic embedding*). What we see in (3) is that it is the semantic structure alone that accomplishes to convey how clauses are connected with each other without resorting to complex syntax.

d. Context: In the CTSL utterances listed in this section, many of the syntactic/semantic arguments are not mentioned. The agents of the actions are almost never explicitly stated. However, we still retrieve/reconstruct them based on the contextual clues. For instance, in (16) the agent of the action "tie" is not mentioned. However, it can easily be inferred that it is the grandfather because he was mentioned in (14). Likewise, the doers of the actions are not mentioned in (2), (5-8), and (9-12), but they can still be retrieved from context. In a fully developed language, these empty slots would have been interpreted based on a set of formal criteria, but here those slots can only be inferred from context.

e. Shared knowledge: Shared knowledge may consist of knowing the relations in the social or geographical context, community structure, customs, rituals, etc. For instance, in (11), the signer is trying to express a memory from her wedding day. It may not make much sense for people from other cultures that the road gets blocked on a wedding day. However, it will sound very familiar to anyone from the rural areas of Turkey. It is a very common tradition to block the road of the wedding car (frequently by children) to ask for tip/presents from the newly wedded couple. Similarly, in (9), the

bride reports that she cried on her wedding day because the brides in Turkey are expected to cry on the wedding day in order not to give a happy impression about leaving her own family. In addition, the signer signs a circular path in (14) to refer to the route they took. There are two different routes in the village to the house of the signer: one of them is shorter and the other is longer. She apparently took the longer route with her grandfather. To be able to understand what the signer is expressing in (14), the addressee needs to be familiar with the same geographical context.

f. Pointing: Making use of the actual referents in the signing space, pointing to absolute locations or pointing to objects/people in the immediate physical environment is a very common strategy for CTSL signers to convey their messages.

To sum up, mechanisms like non-manuals, prosody, semantics and pragmatics (i.e., context, shared knowledge, pointing) enrich CTSL in spontaneous conversations. By merely looking at the spontaneous conversations, it would not be unfair to suggest that CTSL is a structurally sparse language that relies on minimal tools in order to compensate for lack of structure. To those unfamiliar with these simpler systems, CTSL data may look like nothing beyond "linguistic anarchy". However, detailed analysis of CTSL structure that is elaborated on in the following three chapters has revealed the emergence of structural tendencies. These studies may potentially shed light onto the roots of linguistic organization in a brand-new language that has started to emerge at a specific point in time and that is still at its initial stages.

CHAPTER 3

ARGUMENT STRUCTURE

3.1. Argument Structure in CTSL

This chapter explores how CTSL express semantic roles of the characters in one-argument, two-argument and three-argument constructions. It is important to investigate the argument structure in a very young language, because to communicate *who is doing what to whom* is one of the very basic functions of human communication systems. To understand how such a fundamental mechanism emerges and develops without being influenced by any other existing models can provide us with valuable insight into the human language faculty.

Literature on the argument structure of spoken languages suggests that there are three main linguistic devices that function as markers of semantic roles in a sentence: *word order*, *case marking* and *verb agreement* (e.g., Culicover, 2009). It may be argued that overt grammatical marking is redundant to clarify semantic roles, as these roles can actually be inferred from the meaning of the words and supplementary contextual clues and world knowledge. For instance, in an unmarked string like "BREAD-MAN-CUT", irrespective of the order of the constituents, it is not hard to plausibly interpret the agent (i.e., MAN) and the patient (i.e., BREAD) roles because the reverse scenario is logically not

possible. However, in a semantically *reversible* scenario like "WOMAN-MAN-KISS", it might be the woman kissing the man, or it might be the man kissing the woman, or they might be both kissing each other. In brief, the semantic properties of the individual words do not help to make correct predictions about the event structure of the intended message in such scenarios –unless very specific contextual clues and shared background knowledge are provided in advance.

While some proportion of the world's languages primarily rely on a rigid word order (e.g., English) as a rule of grammar, in order to pose constraints on how we interpret semantic roles in a sentence and to eliminate alternative interpretations, others rely on case marking and verb agreement. No matter which strategy they favor, every language has a systematic and standardized mechanism to convey the semantic complexity in the intended message. This is one of the fundamentals of the human communication system.

In this chapter, I address *i*. how these basic mechanisms emerge and develop in CTSL; *ii*. whether it takes time for such systems to emerge and develop *or* whether they are present from the very beginning; *iii*. whether there are universal patterns in the emergence and development of these mechanisms *or* whether each language follows its own developmental path; and, finally, *iv*. what the developmental patterns in a very young language can tell us about human capacity for language.

In order to address these questions, first, I present a literature review to provide some background for the behavior and distribution of these mechanisms both in spoken and signed languages. Then, I present data from various systems:

a. CTSL, a young village sign language

b. spoken Turkish, a well-established spoken language

c. family sign, a rudimentary signed system

d. silent gesture produced by Turkish speakers, not a language

The reason to present data from five different systems is to discuss the argument structure of CTSL in comparison with other systems and see where CTSL falls in this spectrum in terms of its status as a developing system.

3.2 Literature review

3.2.1. Word order as a marker of argument structure

Word order as a marker of argument structure in spoken languages:

Natural languages have systematic patterns that signal semantic relations among characters in a sentence, providing necessary cues regarding who is doing what to whom (or what). One of the basic syntactic resources to express argument structure is word order. Perhaps the most important manifestation of word order in linguistics is the order of three "core grammatical functions" (Culicover, 2009, p. 70) in transitive constructions: subject (S), object (O) and verb (V). Dryer (2005) reports that 86% of the spoken languages rely on word order as a strategy in order to encode syntactic and semantic arguments in a given proposition. The default order of grammatical functions in spoken languages appears to be SOV (e.g., Gell-Mann & Ruhlen, 2011; Givón, 1979; Newmeyer, 2000a, 2000b). However, it shows variation across languages (e.g., Greenberg, 1963; Haspelmath, Dryer, Gil, & Comrie, 2005).

All possible permutations of these three core grammatical functions provide us with theoretically six possible word orders: SOV, SVO, VSO, VOS, OVS and OSV.

Among those languages relying on word order to encode argument structure, a majority of the world languages use SOV (e.g., Japanese: Shibatani, 1990), SVO, (e.g., English) and VSO (e.g., Welsh: Williams, 1980) orders – 48%, 41%, 8% respectively. A small proportion of world languages use VOS (e.g., Malagasy spoken in Madagascar: Potsdam, 2010), OVS (e.g., Hixkaryana spoken in Brasil: Kalin, 2014), and OSV (e.g., Tobati spoken in Jayapura Bay in Indonesia: Donohue, 2002)–2%, .8%, .3%, respectively.

Word order as a marker of argument structure in signed systems:

This is true not only in spoken languages: Numerous studies conducted on the order of functional units in well-established sign languages also show that word order is a frequently used syntactic resource to express argument structure in signed systems. These studies provide evidence for flexible word order in American Sign Language (e.g., ASL: Fischer, 1975; Liddell, 1980; C. A. Padden, 2016; Wilbur, 1997); in Bolivian Sign Language (LSB De Quadros, 1999), in British Sign Language (Deuchar, 2013; Sutton-Spence & Woll, 1999), in Danish Sign Language (Engberg-Pedersen, 1994), etc. Despite their flexibility, some of the established sign languages have predominant word order tendencies. For example, ASL and LSB seem to have adapted SVO as the basic word order (Quadros & Lillo-Martin, 2010). These languages seem to have standardized a certain order to disambiguate the semantic roles in a given proposition[18].

As mentioned earlier, SOV and SVO are by far the most frequent word orders across spoken languages (Dryer, 1992, 2005). Similar to the findings in spoken

[18] Note that there is no suggestive evidence that the fact that ASL and English share the same order is beyond coincidence. Several recent studies conducted on the word order of sign languages verify such distinction: The order of the core grammatical functions of a sentence in a sign language is not influenced by the dominant word order of the surrounding spoken languages (e.g., Kimmelman, 2012; Leeson & Saeed, 2012; Napoli & Sutton-Spence, 2014).

languages, Napoli and Sutton-Spence (2014) point out that a) SOV and SVO are the basic word order also across sign languages based on the data analyzed from 42 different sign languages (SL) including village SLs, community SLs and established SLs; and b) SOV is grammatical in all of these 42 sign languages. There is so far no evidence in sign languages for VSO –the third most frequent word order in spoken languages– (De Vos & Pfau, 2015). These studies indicate that the predominance of the S>O pattern in spoken languages is also observed in sign languages. There is evidence only in restricted contexts for the remaining three orders, in which objects precede the subject (i.e., OSV, OVS, VOS) from ASL and LSB (Quadros & Lillo-Martin, 2010).

Studies conducted in naturally emerging sign languages also indicate cross-linguistic similarities and variations in terms of the word order preferences of signers. One of the rural sign languages that has been well investigated for its linguistic structure is Al-Sayyid Bedouin Sign Language (ABSL), a village sign language that developed naturally in a small town in the Negev desert in Israel. Based on the findings of a controlled elicitation task[19], Sandler et al. (2005) report that ABSL exhibits SOV as the predominant word order despite SVO order in both Hebrew and the Arabic dialect that is spoken in the area. A recently discovered rural sign language in a neighboring region in Israel –but in a different community unrelated to the one using ABSL– is Kafr Qasem Sign Language (KQSL). The signers of this language also predominantly show a preference for SOV in their sentences (Kastner, Meir, Sandler, & Dachkovsky, 2014) in the same elicitation task that was used in order to test ABSL signers. The mismatch

[19] Deaf signers view 30 short clips that involve intransitive, transitive, and ditransitive events and describe these events to a deaf or hearing signer, who then identifies a matching image (Sandler, Meir, Padden, & Aronoff, 2005). The same task is used in this study, too.

between the spoken languages and the sign languages in the region implies that these languages function separately from spoken languages.

Furthermore, in another sign language that emerged in Providence Island Colombia, Washabaugh (1986) reports absence of a consistent word order. In Nicaraguan Sign Language (NSL), Senghas et al. (1997) report variation in word order preferences across different age groups without clear convergence on a certain order. In Israeli Sign Language, which emerged in a pidgin-like situation about 75 years ago, a tendency for SOV as a consistent word order preferences started appear in younger generations (Meir, 2010). In other emerging sign languages that have been so far investigated for word order, SVO order seems to be another general tendency: Shuman (1980) reports SVO for Yucatec Mayan Sign Language in Mexico[20]; Marsaja (2008) also suggests that Kata Kolok in Indonesia has a strict SVO order (p.168)[21].

In addition to urban and rural sign languages, homesign systems reveal a preference for OV word order irrespective of the dominant spoken language around the deaf child. Both American and Chinese homesigners display a preference for OV (Goldin-Meadow & Mylander, 1998). They frequently omit the subject argument. Argument omission is also observed in the utterances of the signers from older generations of ABSL (e.g., Sandler et al., 2005), which implies that it is common to push some of the information into context in rudimentary communication systems in the early stages of language development.

To wrap up, word order preferences in sign languages appear to be similar to those in spoken languages. Irrespective of modality, there is an overwhelming inclination

[20] The exact numbers regarding the frequency of this order are not available.
[21] This finding could not be replicated.

for SOV and SVO order in world languages. In general, there is so far robust evidence for the S>O pattern. As an explanation for this tendency, Jackendoff (2002) suggests an "agent first" principle that requires the agent to come prior to the patient. I. Meir, Aronoff, Börstell, Hwang, Ilkbasaran, Kastner, Lepic, Basat, Padden, & Sandler (2014), on the other hand, argues that word order in young communication systems are not driven by either semantic or syntactic roles but it is the salience of the arguments in terms of their animacy/human properties –it is the *human character* that comes first no matter what semantic role is assigned to it (i.e., agent or patient).

So far, word order preferences have been reviewed in communication systems that we define as "language". Languages evolve and become systematic very slowly in time in terms of establishing a conventionalized mapping of meaning to certain forms. As we do not have any fossil records providing evidence for how unwritten languages change over time, it is not easy to investigate the degree to which these tendencies manifest themselves as a part of a linguistic system and/or as a part of a general cognitive tendency. So if we wish to determine whether these word order preferences are governed by a linguistic system or by a general problem-solving ability for organizing information in a given proposition, it is useful to look at the order of the characters and the actions in the productions of gesturers who are trying to convey meaning without relying on a linguistic system, not only by language users.

Word order as a general cognitive tendency in gesture systems:

Goldin-Meadow, So, Özyürek, and Mylander (2008) suggest that the word order preference of a person in gesturing is independent from that person's native language[22]. Speakers of different native languages (Italian, Chinese, Turkish, English and Spanish) with no experience of signed systems were tested in a task in which they were asked to gesture an event (i.e., they described the events in the stimulus set without using any verbal cues). The results revealed that not only the participants speaking an SOV language (like Turkish), but the others also displayed a preference for SOV while gesturing the events in the stimulus set. Goldin-Meadow et al. (2008) interpret these results as SOV being cognitively the basic sequencing of information, and a natural order for reporting information, rather than being an outcome of communicative efficiency of a language user.

Similar to the findings presented by Goldin-Meadow et al. (2008), Gibson et al. (2013) also report that gesturers are inclined to produce the agent of the action before the patient. However, this pattern is valid only in those cases involving an animate and an inanimate character (i.e., "irreversible" as in "MAN-BREAD-CUT"). In animacy dependent cases (i.e., "reversible" as in "WOMAN-MAN-KISS"), Gibson et al. (2013) present data supporting an SVO pattern even for the speakers of SOV languages (like Japanese and Korean). They explain this tendency with what they call "the noisy-channel hypothesis". According to this hypothesis, adjacency between the agent and the patient is a source of ambiguity, and inserting the action between the agent and the patient decreases the noise caused by such ambiguity.

[22] These results bear on the Sapir-Whorf hypothesis (Sapir, 1921; Whorf, 1956). According to this hypothesis, the language we speak shapes the way we conceptualize the world. However, word order data presented by Goldin-Meadow et al., (2008) does not seem to be supporting this hypothesis.

In brief, gesture studies indicate that SOV is the basic cognitive tendency for sequencing information while producing an utterance in an irreversible event. However, in reversible cases, people have a tendency to make a shift to SVO in order to avoid ambiguity.

3.2.2 Other argument structure markers

Case assignment as a marker of argument structure in spoken languages:

Besides word order, case marking is an additional linguistic device to clarify the semantic and syntactic roles in spoken languages. The functional-typological literature identifies two main functions of case marking: indexing and discriminating functions. The first is used to encode semantic roles and the latter is used to distinguish between the subject and the object as the two core arguments (e.g., Comrie, 1989; Hopper & Thompson, 1980; Kibrik, 1985; Mallinson & Blake, 1981). Those languages that do not merely rely on word order as a strategy to signal syntactic and semantic roles in a sentence typically make use of case marking.

Turkish is an example of a language that makes use of a case marking system:

(1) Araba ağac – a çarptı. (SOV)
Car tree – DAT hit.
"The car hit the tree".

Although the most frequent word order in Turkish is SOV (Erguvanlí, 1984; Lewis, 1967) as illustrated in (1), all of the other remaining 5 possible word orders – despite not being so frequent as the canonical order SOV– are also grammatical as well and are unambiguous in terms of semantic and syntactic roles attributed to the characters. In (1), the subject is marked with the nominative (i.e., bare form) and the object is

marked with the dative case. The case marker attached to the object disambiguates the agent and the patient role in Turkish sentences, which in turn allows arguments to be flexibly scrambled.

There are studies showing that case marking and word order as disambiguation strategies interact with each other. Gibson et al. (2013) state that it is often the SOV languages that make use of case marking due to the adjacency of the subject and the object arguments. Especially in reversible utterances involving two animate characters, SOV order may fail to disambiguate between agent and patient roles. Thus, case marking plays a crucial role to mitigate the possible confusion of these arguments in SOV order. Languages with a rigid word order like English handle such confusion by relying only on word order, placing the action in between the agent and the patient. However, for languages with an SOV or flexible word order like Turkish, an additional morphological strategy usually becomes a necessity. Based on the descriptions of 502 languages in his database, Dryer (2002) report that 72% of the SOV languages (181 out of 253) are case marked while only 14% of the SVO languages (26 out of 190) are so.

Previous studies investigating case-marking mechanisms also reveal that various semantic factors play a central role in case assignment by the verb. Animacy is one of them. Animacy is often considered as a three-step scale in the functional-typological literature: human > animals (animate) > inanimate. For instance, objects that are higher on the animacy/definiteness hierarchy tend to be marked with a case while the ones lower in the hierarchy are not (e.g., Aissen, 2003; Bossong, 1985; Lazard, 1998). Hindi is one of these languages: animate objects are marked by the accusative/dative case but the inanimate ones are not marked unless they are definite (Mohanan, 1990). Malayalam is

another example. The accusative case is reserved for animate objects and the inanimate ones are left unmarked as illustrated below (Asher & Kumari, 1997, p. 203)[23]:

(2) Avan oru pauvine vāṅṅi
he a COW.ACC buy.PST
'He bought a cow.'

(3) Avan pustakaṁ vāyiccu.
he book read.PST
'He read the book.'

To summarize, literature on word order typology indicates an overwhelming tendency for SOV and SVO orders both in spoken and sign languages. In reversible scenarios involving two animate characters, SVO presents an advantage over SOV in disambiguating the semantic roles. To compensate for a possible confusion, SOV and flexible word order languages are inclined to make use of case marking. Functional-typological studies suggest that case assignment is rule-governed partly by semantic factors (e.g., animacy hierarchy), and that it plays a central role in discriminating between the agent and patient arguments in the event structure of an utterance.

Structural simplification as a marker of argument structure in signed systems:

In sign languages, just as in spoken languages, there are several other devices to help clarify the argument structure in semantically more complex cases, where word

[23] Further evidence for the influence of animacy on case assignment: There is also variation in how indirect objects are encoded. For example, Finnish verbs assign animate goals to allative case whereas they assign inanimate ones with to illative (Kittilä, 2005). Similarly, Yidiny (an Australian aboriginal language) differentiates between the assignment of the locative case for animate and inanimate noun indicating the location of the subject: animate nouns are assigned with the dative and the inanimate ones are assigned the locative (Dixon, 1977). Other languages reserve a special form of the possessive for nominals with a higher position in the animacy hierarchy. For instance, Russian reserves a special form of the possessive marker –*in* that attaches to proper nouns and kin terms (e.g., *Mash-in,* Eng.: 'Masha's'; *mam-in,* Eng.: 'mother's'), but it does not attach to inanimate nominal (Malchukov, 2008).

order alone cannot reliably convey the message. Spoken languages typically employ case marking strategies when word order alone cannot disambiguate the semantic roles. However, sign languages use various alternative strategies, specifically in animacy dependent cases.

One of the strategies that sign language users employ is to break a larger unit involving two animate characters into two smaller units and allocate only one animate character per action so that who performs and who undergoes the action can be successfully conveyed without ambiguity. Here is an example from Nicaraguan Sign Languages (NSL: Senghas et al., 1997, p.554).

(4) MAN PUSH, WOMAN FALL
Intended meaning: "Man pushes woman"

Instead of producing an utterance involving two arguments of the verb "push", signers prefer to decompose the given proposition into two separate sub-events involving one action and only one character per action, in order to clarify who does the pushing and who becomes affected by the action pushing. In other words, signers simplify the given proposition by breaking a two-argument structure into two successive one-argument structures. As an outcome of this, they introduce what might be called SV/SV word order as an alternative to a combination of S, V and O.

This strategy is used not only in NSL but also in many other sign languages such as ABSL (C. Padden, Meir, Sandler, & Aronoff, 2010), KQSL (Kastner et al., 2014), ISL (Meir, 2010), etc. For instance, in 3-argument structures involving a transfer relation (i.e., throw), ABSL and ISL signers have a tendency to produce responses involving 2- and/or 1-argument successive clauses as in "MAN BALL THROW, GIRL (BALL) CATCH" (I. Meir, 2010), by allocating only one animate character per action.

Association of a character with an actual person as a marker of argument structure in signed systems:

Another strategy that helps sign language users enable ambiguity resolution is "association with a character". Take, for example, the following sentence:

(5) The woman looks at the man.

Signers typically employ a disambiguation strategy to express such reversible cases by identifying themselves, or someone else in the immediate physical environment, with one of the animate characters.

Here are two examples from Israeli Sign Language (ISL: I. Meir, 2010):

(6) WOMAN SIT, MAN SIT; I WOMAN, I LOOK.
= There is a woman and a man. They sit. I am the woman, I look.
Intended meaning: "Woman looks at the man"

(7) YOU MOTHER YOU, FEMALE I CHILD, FEMALE-FEED-OTHER
= You are the mother. I am the child. I feed you.
Intended meaning: "Girl feeds woman"

Signers basically introduce the animate characters by forming associations between themselves (or someone else who is present in the immediate physical environment) and the identity of the characters in a given proposition. They may identify the subject argument with themselves and they may further associate the object argument with the addressee as in (6). By doing so, they assign themselves the agent role and the addressee the patient role.

It is important to acknowledge that assigning oneself and the interlocutor a role are two different strategies. The former enables the signer to utilize his/her own body as a subject whereas the latter enables him/her to utilize someone else's body as a syntactic

argument. Within the scope of this chapter, both strategies will be considered under the same category as both of them involve a constructed event structure by using the iconicity of body as an argument.

Notice that when the subject is associated with the signer, the action is signed with respect to the signer's body. In both (5) and (6), the direction of the action comes out of the signer's body and moves towards the addressee. In other words, the one's own body is used as an iconic[24] referent in space. The same strategy is used in many other sign languages (ASL: Padden, 1986; Kata Kolok: de Vos, 2012; ABSL: Meir, 2010; etc.).

Verb agreement as a marker of argument structure in sign languages:

Another frequent device used by sign languages is verb agreement. Just as verbs agree with their subjects in spoken languages, sign languages also have a verb agreement system in which the syntactic and semantic roles are systematically encoded. However, verb agreement in sign languages substantially differs from that in spoken languages, in that sign languages use space referentially. Signers assign pronouns for animate characters to abstract locations in the signing space, and then they express who is doing what to whom in that abstract setting.

Verb agreement in sign languages is frequently used for verbs denoting a transfer relation (e.g., GIVE, SEND) and it is realized in the following form: In a three-argument construction, like "Man gives a box to woman", the source (i.e., syntactic subject), the theme (i.e., syntactic direct object) and the goal (i.e., syntactic indirect object) are expressed by introducing the arguments first. The nominal for MAN is signed, and then an

[24] One of the main characteristics of spoken languages is "arbitrariness" in that there is not a transparent correspondence between the form of a spoken signal and its meaning. However, signed systems lend themselves to far greater iconicity, that is, the meaning of the signs can be predicted from their forms.

abstract location in the signing space is pointed to. Then the nominal for WOMAN is signed and then another abstract location on the same horizontal plane is pointed to. In other words, these characters are associated with specific points in space, which are called Referential-loci (C. Padden, 1988). Then these referential points are used anaphorically for the nominals associated with them and the transfer relation is signed by moving the object from the referential-locus of the source to the referential-locus of the goal.

In short, this mechanism involves two steps: 1) establishing referential associations between characters and the specific locations in space and 2) referring back to those previously established Referential-loci to express the relation between the characters of the same semantic category (usually human characters).

Literature on the argument structure of sign languages shows that many sign languages use this verb agreement system: e.g., ISL (I. Meir, 2002), ASL (R. P. Meier, 1982; I. Meir, 2002; C. Padden, 1986, 1988), ABSL (Meir, 2010), etc. Use of spatially based grammatical devices is very common in established sign languages; however, there is so far no evidence for such devices in village sign languages (e.g., Mark Aronoff, Meir, Padden, & Sandler, 2008; Marsaja, 2008).

To sum up, previous studies on argument structure of young sign languages suggest that they do not make use of overt syntactic marking like case assignment in spoken languages and verb agreement in established sign languages. However, in those situations two animate characters, they employ various other alternative strategies to communicate the intended message.

3.2.3 The Picture So Far

All in all, the capacity of a language to express the argument structure unambiguously is one of the fundamentals of human communication systems. Some of the spoken languages primarily rely on a rigid word order as a syntactic rule, whereas others make use of case assignment, especially (but not exclusively) in animacy-dependent scenarios where word order alone cannot reliably convey the message. Rigid word order and case assignment (and differences in case assignment for animate vs. inanimate objects/goals etc.), in a sense, are the solutions that spoken languages developed so as to clarify the semantic roles in semantically complex event structures. Typological studies on the order of the arguments in sign languages also present similar findings to spoken languages (i.e., SOV and SVO are the most frequent orders). In addition to this, just as spoken languages make use of case assignment, signed languages also use further strategies to disambiguate the thematic roles in reversible scenarios.

Taking the previous studies into consideration, my predictions for the argument structure in CTSL are as follows:

- If SOV is the basic word order for sequencing information as suggested by typological studies on word order, then I should observe the same pattern in CTSL –as it is a very young language at its initial stages of development– and also in the productions of family signers and silent gesturers.
- If S>O is a hard-wired innate tendency, then I should observe the same pattern in CTSL, silent gesture and family sign, too. Or, if Meir et al. (2014) is right about the "human first" hypothesis, irrespective of its thematic role, a human character should be occupying the initial position in the elicited responses.

- If languages necessarily produce a solution for semantically reversible scenarios, CTSL should not be an exception. I would expect to observe SOV as the predominant word order in irreversible scenarios but maybe (?) SVO in semantically reversible contexts –as suggested by Gibson et al. (2013).
- If word order alone cannot always reliably convey the message, CTSL should also have developed a solution to encoding argument structure other than word order, or as a supplementary device to word order. Even if it has not developed a systematic mechanism for such contexts, it should be on its way to do so. Thus, I should be observing the traces of further disambiguation strategies other than word order.
- Based on previous findings, word order preferences in Turkish should not influence the word order preferences in CTSL, family sign and silent gesture.

3.3. Study 1

3.3.1 Materials:

Participants watched 30 short clips originally compiled from Sandler et al. (2005). The same stimulus set was used to elicit data in ISL and ABSL (e.g., Meir, 2010) and in KQSL (Kastner et al., 2014). The clips involved 13 intransitive (1-argument), 12 transitive (2-argument) and 6 ditransitive (3-argument) actions (See appendix B). 7 of the 1-argument clips involved an animate agent and 5 of them involved an inanimate agent (e.g., Bottle falls). In the 2-argument clips, a human agent acted upon inanimate patients in 6 of the clips (e.g., Man taps a watermelon) and upon animate patients in the remaining 6 clips (Man taps girl's shoulder). All of the 3-argument clips involved a transfer relation

between an animate agent and animate goal, with an inanimate theme changing location between these two animate characters (e.g., A man throws a ball to the girl).

3.3.2. Participants

Group 1: 14 deaf CTSL signers were tested for this study (5 CTSL-1 signers [M_{age} =46.4, Range = 41-53, 2 females, 3 males], 6 CTSL-2 signers [M_{age} =40.2, Range = 34-45, 4 females, 2 males], 3 CTSL-2 signers [M_{age} =19.3, Range = 17-22, two females and one male]). 11 deaf individuals of varying ages are members of the same family in Village 1. However, one of these 11 individuals lives in Village 2 and another one lives in Village 3 as they got married to other deaf individuals from those villages. The other 3 deaf individuals among the 14 deaf individuals tested during this field trip are originally from Village 2 (See appendix C).

The distinction among cohorts was made based on birth order as well as the ages of the signers, rather than simply categorizing them according to the biological generations in the family tree. The older deaf siblings in each family were categorized as Cohort 1 (CTSL-1); the younger deaf siblings as Cohort 2 (CTSL-2). The rationale behind this categorization is that younger siblings were exposed to the signing of the older siblings from birth, rather than creating their own system from scratch. Previous work identified distinct patterns in the signing of two cohorts (see Ergin, 2016). The children of CTSL-2 are categorized as Cohort 3 (CTSL-3).

Group 2: 22 Turkish speakers took part in this study: M_{age} = 39.1, Range = 14-55, 16 females, and 6 males. All of the participants are native speakers of Turkish, and have some degree of proficiency in CTSL.

Group 3: 2 family-signers (M_{age} = 35.5, Range =34-37) from the same region but from different villages and towns that are unrelated to the CTSL community. These signers are brothers. They have been living together and interacting with each other on a daily basis for their entire lives, and had no contact with CTSL or TID signers.

Group 4: 4 hearing adults (M_{age} = 26.25, Range = 21-33) from the village with minimal to no proficiency in CTSL.

We obtained oral consent from Group 1 and Group2 (i.e., the CTSL signers and family-signers) within the presence of a witness. Since these groups do not know how to read and write, we could not have them read the consent form and sign it. Our local research assistant, a hearing CTSL signer, told each participant and their families about the content of our consent forms. A family member of the participants signed the consent form as a witness of the voluntary participation. Group 3 and Group 4 read the consent forms and signed themselves.

3.3.3. Task

The participants were tested in a controlled elicitation task. The reason for testing participants in such a task, rather than collecting data from spontaneous conversations, is that the semantic relationship between the action and the characters can often be inferred from context clues in spontaneous conversations. Consequently, signers have a tendency to omit arguments. In order to eliminate reliance on context and to increase the likelihood for participants to apply word order preferences, or other disambiguation strategies, we used a controlled-elicitation task to study sentences in isolation.

The task was conducted as follows:

- Group 1: deaf CTSL signers were paired up with either a deaf or proficient hearing CTSL signer as the addressee. The signer viewed the short clips and described them in CTSL to the addressee. Data were collected in August 2013.
- Group 2: Two Turkish speakers were paired up with each other. One of them was assigned the speaker role and the other the addressee role. The speaker described the clips to the addressee in Turkish. Data were collected in June 2016.
- Group 3: Family-signers were paired up with a hearing family member. They described the clips to the addressee in their own signed system. Data were collected in June 2016.
- Group 4: Turkish speakers were paired up with a deaf CTSL addressee. They were intentionally paired up with a deaf addressee in order to create pressure to communicate the message in gesture without verbal cues. They performed the task in silent gesture. Data were collected in August 2015.

To check whether the message of the signers/speakers/gesturers were successfully conveyed, the addressees were asked to view an array of three pictures and choose the corresponding picture portraying the scene in the clips as described by the signers/speakers/gesturers (See appendix D).

3.3.4. Coding procedure:

The data were coded according to the criteria below:

A. Another sense of "word order" is not the order of the words in a sentence, but the order of the *functional units*. For example, in (8),

(8) Yesterday, my mother and I moved the table to the garden.

the order of the words based on their syntactic categories are as follows: *adverb*, *possessor*, *noun*, *connector*, *pronoun*, *verb, determiner*, *noun*, *preposition, determiner* and *noun*. However, the order of these words in terms of their syntactic categories is not a parameter defining word order in a sentence. What defines word order is the order of the functional units in a declarative sentence. In (1), they are as follows: *adverbial clause* (i.e., "yesterday"), *subject* (i.e., "my mother and I"), *verb* (i.e., "moved"), *object* (i.e., "the table") and *syntactic adjunct* (i.e., "to the garden"). Due to their mobility, adverbial clauses are not representative for the classification of the world languages in terms of word order typology. In other words, they can appear at the end or the middle of the sentence as well as the beginning of the sentence (i.e., *My mother and I saw Mary yesterday, My mother and I yesterday saw Marry*). A syntactic adjunct does not offer a good criterion for determining the order of the functions in a sentence, either. It is not an integral component of the verb, but rather is a refinement of the meaning of the phrase (Culicover, 2012, p. 69). In other words, when an adjunct is omitted from a sentence (e.g., "to the garden"), the sentence still remains complete and grammatical despite losing specificity in meaning. The object "table" and the subject "my mother and I", on the other hand, are the complements of the verb. When they are omitted from the sentence, the intended message in the sentence becomes incomplete. Therefore, the three central

syntactic functions for the typological classification of word order are subject (S), object (O) and verb (V).

For word order analysis, the utterances elicited with video clips were coded according to the order of the arguments occurring in the signers' descriptions of the videos. The agent performing the action was coded as "subject" (i.e., S), the theme or the patient going through the action was coded as "object" (i.e., O), and the action was coded as "verb" (i.e., V). In those sentences lacking an agent (e.g., Ball rolls), the theme undergoing the action was coded as the syntactic subject.

1-argument responses were coded for the order of S and V; 2-argument responses were coded for the order of S, O and V; and 3-argument responses were coded for an additional core argument, indirect object (i.e., I), as well as the other three main arguments. It is important to note that we do not have clear evidence for the existence of syntactic categories in CTSL, family sign and especially silent gesture. These syntactic terms are used only for convenience.

B. In addition to word order, the CTSL, family sign and gesture data were coded for the other candidate devices as argument structure markers:

a. breaking 2-argument structures into successive 1-argument clauses, or 3-argument structures into successive 1- and/or 2-argument structures.
b. associating oneself (or another person in the immediate physical environment) with one of the characters in the video clips,
c. referential use of space for spatial verb agreement,

C. Success of the utterances was coded in order to check how effectively the message of the signer was conveyed. The success of the utterance was evaluated based on the addressee's selection of the picture that correctly portrayed the action in the clip.

D. In addition to success rate, each attempt produced by each signer in order to convey the message in each clip was coded. The attempt number associated with each utterance was indicated in the analysis and coded for the syntactic arguments.

E. In spoken languages, speakers have to produce one word at a time. However, signed systems can physically afford simultaneous articulation of objects and actions. Objects incorporated into the actions were indicated as "(o)". The ones signed sequentially are indicated as "O". For instance, an utterance like "WOMAN-BOX-LIFT" (i.e., Woman lifts the box) was coded as SOV because all of the core arguments are sequentially signed and the object is not incorporated into the action. The utterances incorporating objects into the action, like "WOMAN-BALL.ROLL" (i.e., Woman rolls the ball), were glossed connected to the verb by a period instead of a hyphen, and coded as SV(o).

F. Prosodic breaks were indicated with a "/", as in "MAN-BALL.THROW / GIRL-BALL.CATCH" (i.e., Man throws the ball to the girl *or* Man throws the ball, girl catches the ball).

G. Some of the elicited sentences involving repeated arguments, such as SOSVOVS, were excluded from the analysis. The rationale behind this decision is that it is not possible to determine the word order pattern.

H. Location of the actions, the instruments used in the actions, the path and the manner of the actions were coded as adjuncts. They can be considered analogous to

syntactic adjuncts in spoken languages. As they are not core arguments in an utterance, they were ignored for word order purposes. For example, the utterances having the following word orders were considered the same:

i. S – Adjunct – O – V → SOV

ii. S – O – Adjunct – V → SOV

iii. Adjunct – S – O – V → SOV

3.3.5. Results for CTSL

While determining the dominant word order in a language, the main criterion is the relative frequency of a certain order in "declarative" sentences. If one of the orders consistently appears more frequently than the other possibilities in large enough samples collected from various different contexts, then that order can be determined to be the dominant word order in that language (Dryer, 2007). The predominant word orders and also further disambiguation strategies clarifying the argument structure in 1-argument, 2-argument and 3-argument CTSL responses (i.e., intransitive, transitive and ditransitive constructions, respectively) are determined by the relative frequency of occurrences of each strategy.

<u>Results for 1-argument Structures</u>:

213 responses were analyzed for the word order in 1-argument structures. The overwhelming majority of CTSL responses exhibit a tendency for SV (e.g., BOTTLE-FALL). While the preference for SV is only 53% in CTSL-1, it increases to 80% in CTSL-2 and 94% in CTSL-3 (Figure 2). The second most frequent word order is SVV (e.g.,

MAN-SIT-STAND.UP) with 3% in CTSL-1, 13% in CTSL-2 and 7% in CTSL-3. Participants are inclined to express the initial state of the agent (i.e., SIT) in order to clarify the end state (i.e., STAND.UP). This order can be considered analogous to SV. Only a small proportion of the responses, 9% in CTSL-1 and 1% in CTSL-2, display a preference for VS. Finally, CTSL-1 signers omit the subject argument in 29% of their responses.

All in all, the increasing tendency for SV across cohorts suggests that CTSL signers have converged on SV as the predominant word order in 1-argument structures over time (Figure 2).

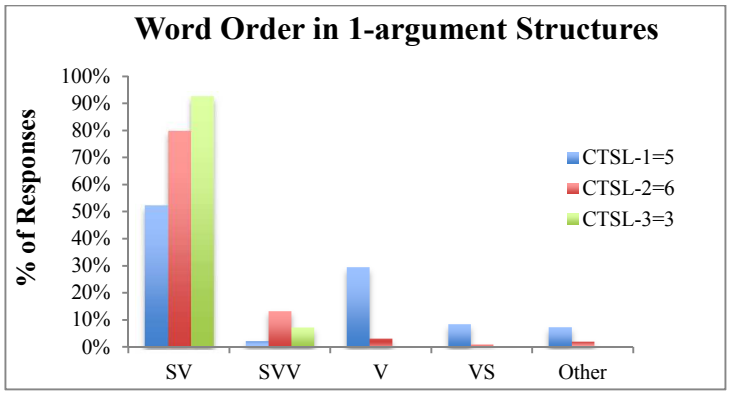


Figure 2: Word order preferences across cohorts in 1-argument structures (n=213). The Y axis indicates the proportional frequency of the responses involving word orders on the X axis.

78%, 94% and 95% of the first attempt responses of CTSL-1, CTSL-2 and CTSL-3 signers, respectively, convey the message with success (Figure 3). CTSL-3 signers reach 100% accuracy only in two attempts; whereas CTSL-2 signers produce up to three attempts and CTSL-1 signers produce up to 4 attempts to reach 100% success in the task.

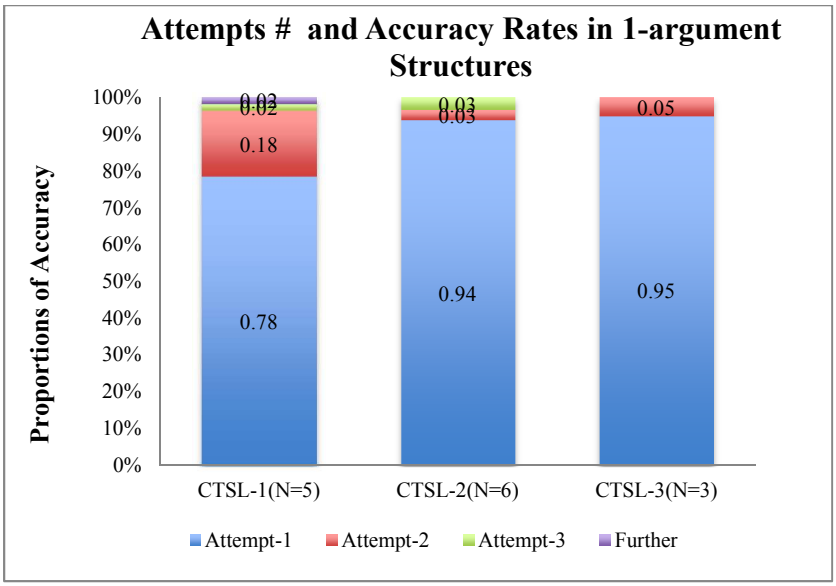


Figure 3: Attempt numbers and accuracy rates in 1-argument structures (n=213). The Y axis indicates the proportional frequency of successful responses in each attempt.

What causes failure in the first attempts is the omission of the subject argument (Figure 4). 18% of the responses of CTSL-1 signers do not involve any information regarding the doer of the action, which inevitably results in communication breakdown.

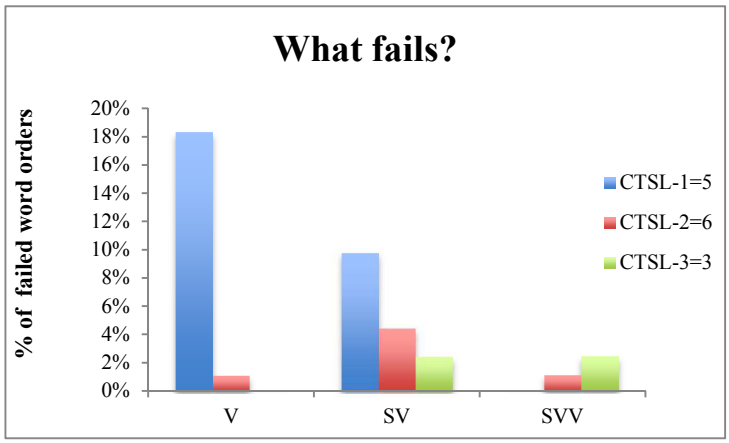


Figure 4: Failure rates and the word orders corresponding to failure are (n=213). The Y axis indicates the proportional frequency of the responses involving word orders that did not convey the message.

As illustrated in Figure 4, despite being the predominant word orders, SV and SVV order may not succeed in conveying the intended message, either. The main reason for such failure is lexical variation. Although the order of the arguments is compatible

with the general tendency, the signer and the addressee may not always have the shared knowledge of lexical items denoting the subject information. For instance, the signer may be using the sign for DRINK both to talk about *bottle* and *water* but the addressee might be using the same sign only to refer to *water*. As an outcome of such lexical variation across signers in the community, an SV string like DRINK-FALL, as a response to the clip illustrating a bottle falling, may still fail to communicate the intended message.

Results for 2-argument Structures:

247 responses were analyzed to determine the word order in 2-argument structures. As is illustrated in Figure 5 below, CTSL signers' responses in all three cohorts vary. Besides the theoretically possible 6 orders that can be constructed with all possible combinations of the core arguments (i.e., S, V, O), signers of all three cohorts introduce many new alternative orders: e.g., object incorporation as in SV(o), argument omissions as in OV, repeated arguments as in SOSV, etc.

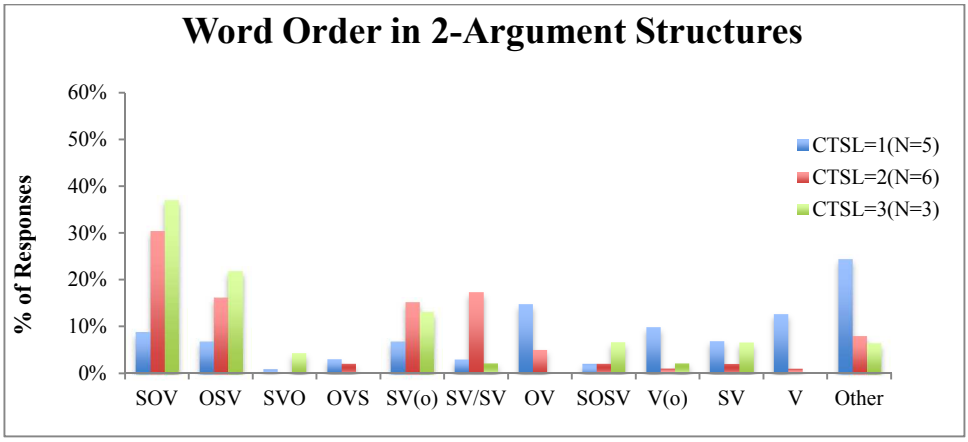


Figure 5: Word order preferences across cohorts in 2-argument structures (n=247). The Y axis indicates the percentage of the responses involving the word orders on the X axis.

Figure 5 shows that there is an increasing tendency for SOV, OSV and SV(o)[25] across cohorts. However, compared to relatively higher proportions of SV preference in 1-argument structures, the proportions for any single tendency in 2-argument structures are drastically lower (Table 1).

Table 1: Proportions for SOV, OSV and SV(o) in Figure 5

	CTSL-1	CTSL-2	CTSL-3
SOV	8%	30%	36%
OSV	7%	16%	22%
SV(o)	7%	15%	13%

In addition to the general tendencies for SOV, OSV and SV(o), there is also a tendency for SV/SV particularly in CTSL-2. In this order, signers allocate one animate character per action. In order to express a 2-argument structure like "Woman looks at the man", signers simplify the 2-argument structure and divide it into two successive 1-argument structures (e.g., MAN-SIT / WOMAN-LOOK). This is a tendency that appears specifically in CTSL-2. The results for this strategy will be elaborated on further in the next section.

Table 2: Proportions for SV/SV in Figure 5

	CTSL-1	CTSL-2	CTSL-3
SV/SV	3%	17%	2%

Besides general word order tendencies, there is an interesting pattern in Figure 4 regarding argument omission. CTSL-1 signers have a strong tendency to omit arguments. More than half of CTSL-1 responses (i.e., a total of 68%) lack one or two of the core

[25] SV(o) encodes the object argument morphologically, not syntactically.

arguments. This proportion decreases to 17% in CTSL-2 and 9% in CTSL-3. The decrease in argument omission implies that CTSL is becoming more conventionalized in terms of the completeness in 2-argument structures across cohorts.

Table 3: Proportions for argument omission in Figure 5[26]

	CTSL-1	CTSL-2	CTSL-3
OV	14%	5%	N/A
V	12%	1%	N/A
V(o)	10%	1%	2%
SV	7%	2%	1%
Other	25%	8%	6%
Total	68%	17%	9%

To sum up, as illustrated in Figure 5, there is an increasing tendency for SOV, OSV and SV(o). However, it is hard to make any strong claims regarding the existence of a predominant word order in 2-argument structures. Once the object argument is added to the event structure, mathematically many more possibilities become available to the signers. Therefore, the distribution of the word order preferences becomes flatter, in comparison with the distribution in 1-argument structures. The decrease in the proportions for word order preferences may be interpreted in several different ways:

- word order as a syntactic strategy is not a very reliable system in CTSL to encode the argument structure.
- word order as a syntactic strategy in CTSL is still evolving; therefore, there is not one single word order to encode the argument structure and these word orders are competing with each other. CTSL signers may converge on a

[26] Please note that verb omission is never observed.

certain order in time, or they may invent alternative devices like case marking in spoken languages.

However, such conclusions would be premature without any further investigation of semantic factors.

Animacy Factor I: Animate agent, inanimate patient

Further analysis revealed that semantic factors also play a role in signers' word order preferences in CTSL (Figure 6). In *irreversible* contexts involving an animate agent acting on an inanimate patient (n=133), SOV becomes a general tendency, with higher proportions than the cumulative results in Figure 5, and it becomes more conventionalized across cohorts. This pattern indicates a change towards more uniformity in the language.

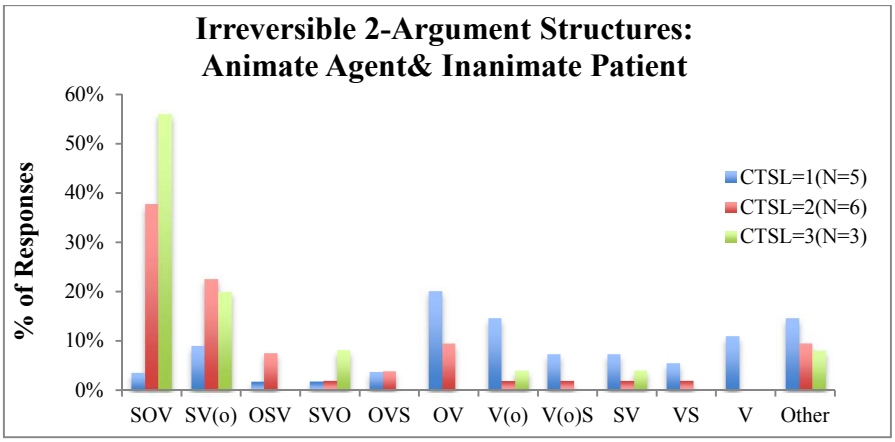


Figure 6: Word order preferences across cohorts in irreversible 2-argument structures (i.e., involving an animate agent and an inanimate patient, n=133). The Y axis indicates the percentage of the responses involving the word orders on the X axis.

When the animate and inanimate patients were collapsed together as in Figure 5, SOV, followed by OSV and SV(o), was the most frequent word order in in the entire task with 8% in CTSL-1, 30% in CTSL-2 and 36% in CTSL-3. When the irreversible contexts

are pulled apart from reversible ones, these proportions change as shown in Figure 6 above and Table 4 below. The preference for SOV proportionately increases as of CTSL-2. The second most frequent word order is SV(o); the tendency for OSV almost disappears. Finally, there is no tendency for SV/SV at all in irreversible cases.

Table 4: Proportions for SOV, SV(o) and OSV in Figure 6

	CTSL-1	CTSL-2	CTSL-3
SOV	7%	38%	56%
SV(o)	9%	23%	20%
OSV	2%	8%	N/A
SV/SV	N/A	N/A	N/A

Table 5 shows that those word orders involving information about all three core arguments (including subject, object and verb) successfully convey the messages whereas those that do not involve all three arguments are not that successful.

Table 5: Success rates for the word orders in Figure 6

SOV: 92% (n=36)	OVS: 75% (n=4)	SV: 100%[27] (n=6)
SV(o): 100% (n=22)	OV: 37,5% (n=16)	VS: 25% (n=4)
OSV: 100% (n=5)	V(o): 40% (n=10)	V: 25% (n=6)
SVO: 100% (n=4)	V(o)S: 80% (n=5)	Other: 25% (n=15)

[27] Please note that 100% success rate for SV, despite not carrying any information regarding the object argument, is because signers produce it in order to emphasize the doer of the action. This order appears as of the second attempts of the signers. Signers introduce both arguments in previous attempts. Then, they produce SV to clarify which nominal is assigned the agent role. Therefore, it elicited 100% success rate.

Animacy Factor II: Animate agent, animate patient

In those contexts involving an animate agent acting on animate patient (n=114), there is a tendency for OSV –rather than SOV– with an increasing consistency across cohorts (Figure 7). The animate object precedes the animate subject in those contexts involving two human characters. However, the proportion of the convergence on a certain word order is lower and the success rate for the highest proportion word order also is lower compared to the ones in irreversible contexts.

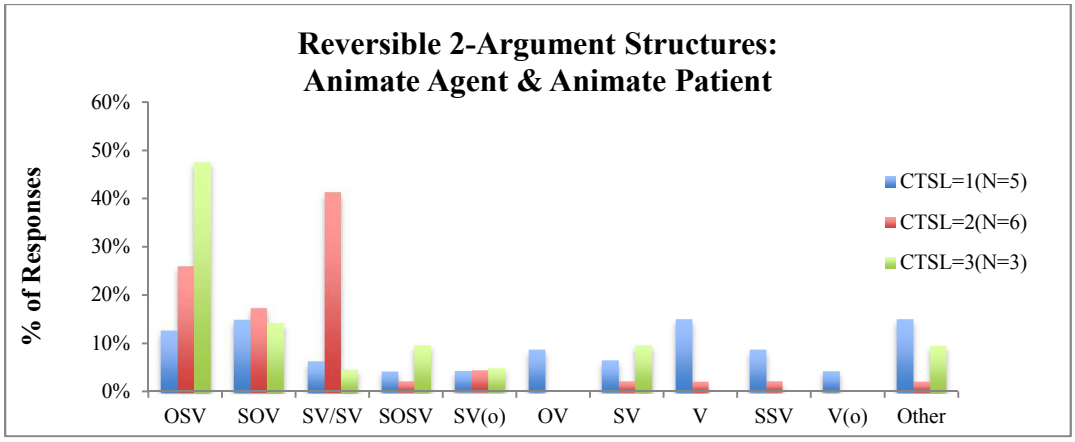


Figure 7: Word order preferences across cohorts in reversible 2-argument structures (i.e., involving an animate agent and an animate patient, n=114). The Y axis indicates the percentage of the responses involving the word orders on the X axis.

A striking difference between Figure 6 and Figure 7 is the appearance of SV/SV order. The use of SV/SV for reversible cases becomes widespread in CTSL-2. OSV and SV/SV are almost exclusively reserved for 2-argument structures involving two animate characters. Thus, there is a systematic contrast between the use of SOV in irreversible cases and OSV together with SV/SV in reversible cases.

The S>O pattern appears in sentences involving an inanimate object, which is in accord with the previous findings in that animate subject occupies the initial position in the responses. However, when both the object and the subject are animate characters, then there is a tendency for O>S.

Table 6 illustrates the success rates of the word orders in Figure 7. In comparison with Table 5 in which the success rates for word order in irreversible contexts are listed, the success rates in Table 6 for the word order preferences in reversible contexts are lower. These numbers imply that word order is a less reliable strategy to convey the message in reversible contexts.

Table 6: Success rates for the word orders in Figure 7

OSV: 75% (n=28)	SV(o): 100% (n=5)	SSV: 0% (n=5)
SOV: 61% (n=18)	OV: 0% (n=4)	V(o): 0% (n=2)
SV/SV: 88% (n=23)	SV: 67% (n=6)	Other: 0% (n=10)
SOSV: 67% (n=5)	V: 0% (n=4)	

Note that the success rates for OSV and SOV are high because signers use the other disambiguation strategies (i.e., structural simplification, association with a character, verb agreement) along with word order as a candidate linguistic device. In other words, it is not only the word order that conveys the message but the messages are supplemented by further devices to resolve ambiguity.

Results for 3-argument Structures:

150 responses were analyzed for word order preferences. As the number of the arguments increased, the word order combinations showed huge variation (Figure 8). What we have here is basically a huge flat distribution with no clear convergence on a certain word order.

Moreover, signers from all three cohorts produced up to 4 attempts in order to get the message across. Yet, most of the utterances still failed to communicate the intended message correctly. The success rate in the entire task was 42%.

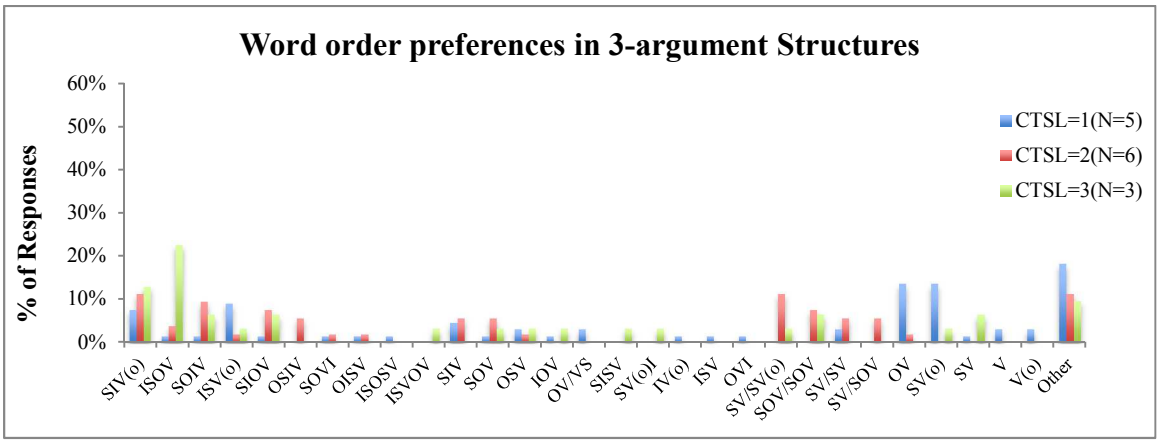


Figure 8: Word order preferences across cohorts in 3-argument structures (n=150). The Y axis indicates the percentage of the responses involving the word orders on the X axis.

The variation in reversible scenarios both for 2- and 3-argument structures indicate that word order is not a reliable linguistic device in CTSL when it comes to complex argument structures. Therefore, signers make use of alternative and/or supplementary devices to clarify thematic roles in reversible cases.

Other disambiguation strategies:

264 responses from *reversible* contexts involving 2- and 3-arguments were analyzed in order to investigate the alternative disambiguation strategies that were introduced in section 1. The results are as follows:

Structural simplification: The proportions for successive simpler clauses to convey the messages in 2-argument structures[28] are 6% in CTSL-1, 48% in CTSL-2 and

[28] e.g., *CTSL*: WOMAN PUSH, GIRL GO AWAY, *Eng*. "Woman pushes girl"

10% in CTSL-3. The proportions in 3-argument structures[29] are 5% in CTSL-1, 40% in CTSL-2 and 23% in CTSL-3. These numbers reveal that this strategy is specifically used by CTSL-2 signers (Figure 9).

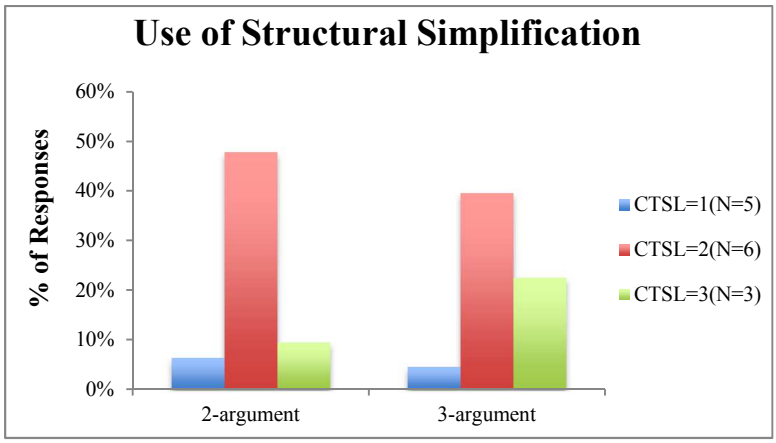


Figure 9: Use of structural simplification in reversible contexts (n=264). The Y axis indicates the percentage of the responses involving successive simpler clauses as a disambiguation strategy.

Table 7: Success rates for Figure 9

	CTSL-1	CTSL -2	CTSL -3
2-argument	100% (n=3)	77% (n=21)	100% (n=7)
3-argument	33% (n=3)	76% (n=22)	57% (n=2)

Table 7 shows the success rates of structural simplification for each cohort for 2- and 3-argument structures. Because of the random fluctuation of these success rates across cohorts, it is hard to draw any conclusions. Please note that these rates depend on shared knowledge between the signer and the addressee. Even if the signer is very clear and systematic with his/her own utterance, s/he may still fail to communicate the message if the addressee does not share the same system. Yet, it is still possible to mention a plausible amount of consistency in the success rates of CTSL-2, which shows significantly higher tendency to use this

[29] e.g., *CTSL*: MAN BALL THROW, GIRL CATCH, *Eng*. " Man throws the ball to the girl".

specific disambiguation strategy than the other cohorts.

Association with a character: The proportions for association with a character to convey the message in 2-argument structures are 0% in CTSL-1, 35% in CTSL-2 and 48% in CTSL-3. The proportions in 3-argument structures are 3% in CTSL-1, 25% in CTSL-2 and 35% in CTSL-3. The results indicate that CTSL-1 signers almost never use this device as a strategy. Starting as of CTSL-2, there is an increasing tendency for this strategy across cohorts (Figure 10).

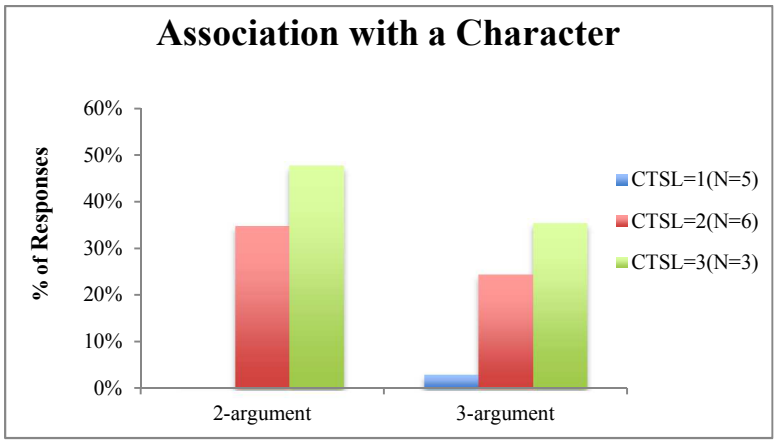


Figure 10: Use of identifying oneself with a character in reversible contexts (n=264). The Y axis indicates the percentage of the responses involving "association with a character" as a disambiguation strategy.

Table 8: Success rates for utterances in which signer identifies self with a character

	CTSL-1	CTSL-2	CTSL-3
2-argument	0% (N/A)	75% (n=16)	80% (n=10)
3-argument	0% (n=2)	62% (n=13)	78% (n=11)

Table 8 shows the success rates of association with a character for each cohort for 2- and 3-argument structures. From CTSL-2 to CTSL-3, there is an increasing trend in the success rates, which might be suggestive of increasing

conventionalization over time.

Referential use of space: The proportions for referential use of space to convey the message in 2-argument structures are 9% in CTSL-1, 9% in CTSL-2 and 29% in CTSL-3. The proportions in 3-argument structures are 2% in CTSL-1, 11% in CTSL-2 and 38% in CTSL-3.

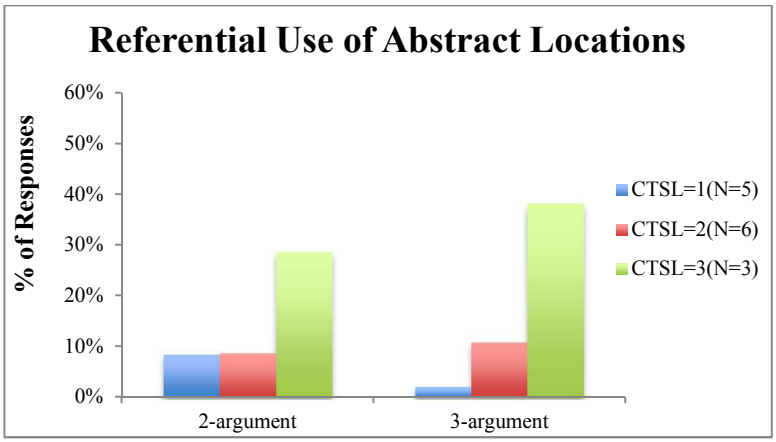


Figure 11: Referential use of space in reversible in 2- and 3- argument contexts (n=264). The Y axis indicates the percentage of the responses involving referential use of abstract location in 2- and 3- argument structures as a disambiguation strategy.

As is illustrated in Figure 11, CTSL-3 signers are making a shift to using the space referentially. Previous cohorts do not make use of this device so much as CTSL-3 signers do.

Table 9: Success rates for referential use of space in Figure 11

	CTSL-1	CTSL-2	CTSL-3
2-argument	0% (n=4)	80% (n=8)	50% (n=6)
3-argument	75% (n=4)	100% (n=5)	100% (n=8)

Table 9 shows the success rates for referential use of space in each cohort for 2- and 3-argument structures. 50% success rate of CTSL-3 in 2-argument structures may be surprising as there is a general increasing tendency in the success

rates across cohorts. Please remember that there is a lot of structural variation in such a young language; therefore, these rates depend on shared knowledge between the signer and the addressee.

Interim summary:

There is a clear tendency for SV in 1-argument structures. When it comes to 2-argument structures, word order preferences show more variation. Yet, CTSL becomes more homogenous in terms of word order preferences over time as CTSL-2 and CTSL-3 signers converge on fewer word orders. There is an increasing tendency for SOV, OSV and SV(o) for 2-argument structures in the entire task. However, SOV and SV(o) are more frequently preferred in irreversible scenarios, while there is a tendency for OSV and SV/SV in reversible ones. When it comes to 3-argument structures, word order preferences vary to a great extent. Signers try all sorts of combinations without a clear convergence on a certain order.

Turning to other factors: argument omission is common in CTSL-1 but this tendency decreases in CTSL-2 and CTSL-3. The decrease in argument omission indicates that CTSL is becoming more conventionalized over time in terms of completeness in its argument structure.

In reversible scenarios, word order is not a reliable mechanism to communicate the messages. Therefore, CTSL-2 and CTSL-3 signers make use of alternative strategies. CTSL-2 signers avoid structural marking of the semantic roles and prefer decomposing a semantically complex situation into sub-events, whereas CTSL-3 signers start using, first,

their own body, and then, the space for verb agreement. CTSL-1 signers seem not to have developed a coping mechanism for the semantic complexity in reversible scenarios.

The statistically prevalent SVO tendency in spoken languages, as claimed by Gibson et al. (2013), to mitigate the possible confusion in reversible contexts is not a preferred word order by CTSL signers.

Discussion:

For word order to operate as an overt linguistic device to encode the argument structure in a language reliably, it has to be a standardized mechanism across the users of that language. Our results for the word order preferences in CTSL show that word order does not appear to be a consistent syntactic device right away, but rather it takes at least a few generations to converge on certain orders in certain contexts.

The distribution of the disambiguation strategies in Figures 9, 10 and 11 indicate that CTSL-1 signers do not have a solution for reversible cases, as they do not have any clear tendencies for any of the disambiguation strategies. CTSL-2 signers, on the other hand, start to use structural simplification to resolve ambiguity in reversible scenarios (Figure 9). As suggested by Meir (2010), by allocating only one animate character per action; therefore, by producing successive simpler clauses to express the semantic content of 2- and/or 3-argument structures, CTSL-2 signers actually avoid marking the semantic roles on the surface structure. In other words, when signers break a complex transitive or a ditransitive event into successive (frequently) intransitive events, they eliminate the need to morphologically mark the semantic relation between the two animate characters.

Instead, they push this information into context and semantics, which puts the burden on the addressee's shoulders to make the correct inferences.

Other than SV/SV, Figure 10 shows that CTSL-2 signers also have a tendency to rely on association with a character as a strategy and, by doing so, they probably provide a model to CTSL-3 signers for this specific device to encode argument structure. By associating themselves and/or someone else in the immediate physical environment with a character in the target message to be conveyed, CTSL-2 and CTSL-3 signers use their own bodies, or the body of whoever is present in the immediate physical environment as iconic reference points for verb agreement. Then, CTSL-3 signers possibly make use of this strategy as a springboard for (more abstract) spatial verb agreement (i.e., referential use of space by assigning characters with abstract locations) –which is absent in CTSL-2. As illustrated in Figures 10 and 11, CTSL-2 signers show some tendency to use association with a character; therefore, to demonstrate the iconic origins of verb agreement, but they have not yet developed a clear tendency to use the space referentially on an abstract basis.

The developmental path that CTSL takes can be summarized as follows: CTSL-1 signers do not demonstrate any clear convergence on a certain order (with all of the arguments explicitly expressed) neither in reversible nor in irreversible scenarios. Word order for CTSL-1 signers may be simply a linear ordering of information with some tendency for little systematicity. Most of the information in the argument structure is frequently pushed into context, semantics and pragmatics.

CTSL-2 signers frequently avoid marking the utterances for verb agreement. Instead, they decompose the entire event into subevents to express the role of each

participant. But they also start making use of body as a subject for verb agreement, which is then transferred into a more advanced abstract setting by CTSL-3 signers.

Table 10: The developmental path that CTSL takes in its argument structure

Word Order	→	SV/SV	→	Assoc. with a character	→	Referential Use of Space
CTSL-1		CTSL-2		CTSL-2/CTSL-3		CTSL-3

The question here is while structural simplification and association with a character do the job just right and convey the message in CTSL-2, then why do CTSL-3 signers make a shift to using spatial verb agreement? Instead of taking structural simplification as a model, why do CTSL-3 signers prefer to take "association with a character" and then develop it into a more abstract system? Briefly, why does CTSL follow this specific developmental pattern? What forces CTSL-3 signers to develop a spatial verb agreement system?

CTSL-3 may be shifting away from SV/SV because structural simplification is a strategy that primarily relies on the semantics of the action produced in each clause. For instance, the path information is not explicitly expressed in an utterance like "MAN BALL THROW, GIRL CATCH", and it can only be guessed from the context or the lexical semantics of the action. The only cue that helps us understand that there is certain object (i.e., ball) and this object changes its location from a source (i.e., man) to a goal (i.e., girl) through some action imposing an external force on the object to be transferred between the source and the goal is the semantic package that "THROW" and "CATCH" entail. However, this may end in communication breakdown because we are basically relying on the best guess we can make based on what comes with the CTSL signs. Without the path

information, for instance, nuances like intentionality (i.e., whether the goal was actually targeted by the agent of the action) is lost. Thus, alternative interpretations cannot be completely eliminated (e.g., maybe the man just threw the ball without an expectation to be caught by the girl, but the girl caught it by chance). This might be one of the reasons why CTSL-3 signers prefer not to rely on SV/SV and develop verb agreement.

Another reason might be the impracticality of producing multiple simpler events to express a complex event. Imagine a reciprocal event involving two animate characters acting on each other, as in "Woman and man punched each other". There are four different sub-events: 1.Woman punch, 2.man punch, 3.woman get punched, and 4.man get punched. Trying to express such semantic complexity with successive simpler clauses is, *first*, cumbersome, and, *second,* may not reliably convey the message.

In 2-argument structures like "WOMAN PUSH, GIRL GO AWAY" (*Eng*. Woman pushed the girl), SV/SV construction may effectively block the alternative interpretations not to interfere with the intended message, and without being impractical, mainly because it is semantically a less complex event. Yet, CTSL-3 signers still prefer to use other devices (i.e., verb agreement) for reversible 2-argument structures rather than merely relying on structural simplification.

In 3-argument transfer relations, the intended message may be more vulnerable to alternative interpretations in an SV/SV construction. It is probably because of this, the proportion for referential use of space is higher for 3-argument both in CTSL-2 and CTSL-3 than it is for 2-argument reversible structures (Figure 11), whereas the proportions for association with a character is higher in 2-argument structures than it is for 3-argument structures (Figure 10). In other words, 3-argument structures should be

transferred to an abstract setting in the signing space to precisely express the role of each character and the path information. 2-argument reversible structures, on the other hand, can still be precisely expressed without an abstract setting as long as one of the characters is associated with the signer or someone else in the immediate physical environment. Therefore, referential use of space might have advantages over association with a character specifically in 3-argument structures.

Another reason for the preference of referential use of space over association with a character is that the latter is more iconic and it may not always be readily available. For instance, there may not be people in the immediate physical environment to associate the characters with. By making a shift to using the space as an abstract setting, CTSL-3 signers are reducing the reliance on minimal tools like semantics, context and pragmatics. Rather, they are developing a more independent verb agreement system that can increase the expressive power of the language, for instance, in hypothetical situations, or in situations involving more than two characters of the same semantic category.

3.3.6. Results for Turkish

Results for 1-argument Structures:

297 Turkish sentences elicited in the same task were analyzed to determine word order in 1-argument structures. There is a clear tendency for SV (87% together with SVV[30] in total) in 1-argument sentences in Turkish (Figure 12).

[30] e.g., Kız duruyordu, düştü (*Eng*. Girl was standing, fell).

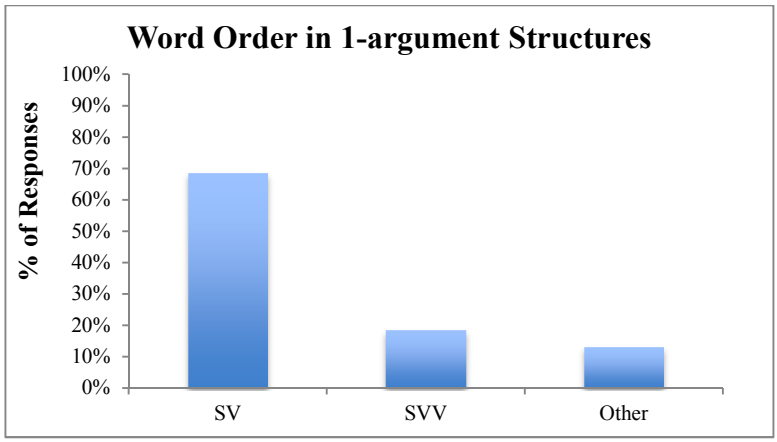


Figure 12: Word order preferences in Turkish 1-argument structures are illustrated (n=297). The Y axis indicates the percentage of the sentences involving the word orders on the X axis.

Results for 2-argument Structures:

273 Turkish sentences elicited in the same task were analyzed to determine word order in 2-argument structures. Irrespective of the semantic category of the patient, there is a clear tendency for SOV: 81% and 88% in responses involving animate and inanimate object, respectively (Figure 13).

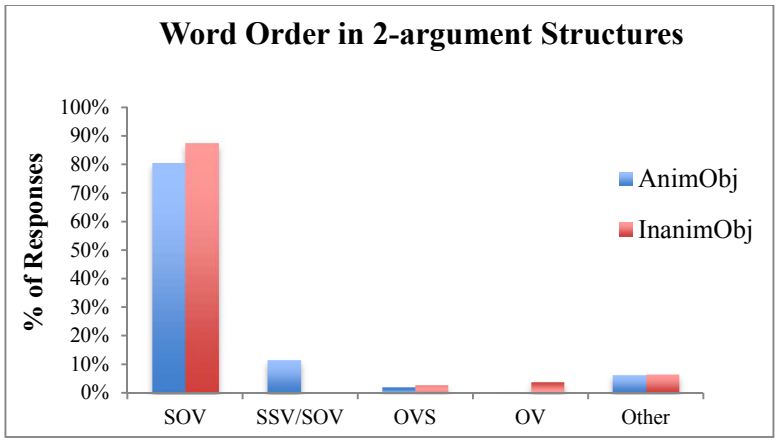


Figure 13: Word order preferences in Turkish 2-argument structures (n=273). The Y axis indicates the percentage of the responses involving the word orders on the X axis. Blue bars stand for the reversible cases (i.e., animate agent acting on animate patient). Red bars stand for irreversible cases (i.e., animate agent acting on inanimate patient).

Turkish 2-argument sentences do not show variation in terms of word order preferences in reversible *vs*. irreversible cases. However, the case assignment reveals

some differences between animate and inanimate objects. As is illustrated in Figure 14, animate objects are never left unmarked. They are either marked with the accusative (52%) or with dative (44%) based on the semantic properties of the verbs. However, 50% of inanimate objects are left unmarked. These findings are in line with results of the previous studies that were introduced in section 1. There is an animacy hierarchy in Turkish as well. Animate objects are case-marked whereas inanimate ones are not.

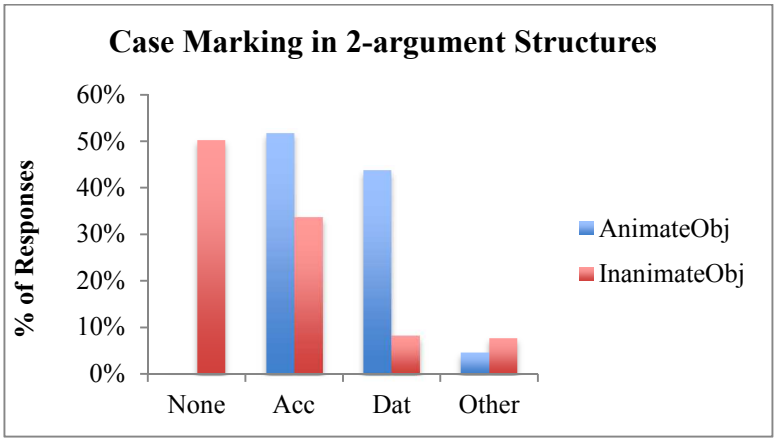


Figure 14: Case assignment in Turkish 2-argument structures (n=273). Blue bars stand for the reversible cases (i.e., animate agent acting on animate patient). Red bars stand for irreversible cases (i.e., animate agent acting on inanimate patient).The Y axis indicates the percentage of the responses involving syntactic objects marked with the cases listed on the X axis.

Results for 3-argument Structures:

115 Turkish sentences elicited in the same task were analyzed to determine word order in 3-argument structures. There is a clear tendency for SIOV (68%) in 3-argument sentences in Turkish (Figure 15).

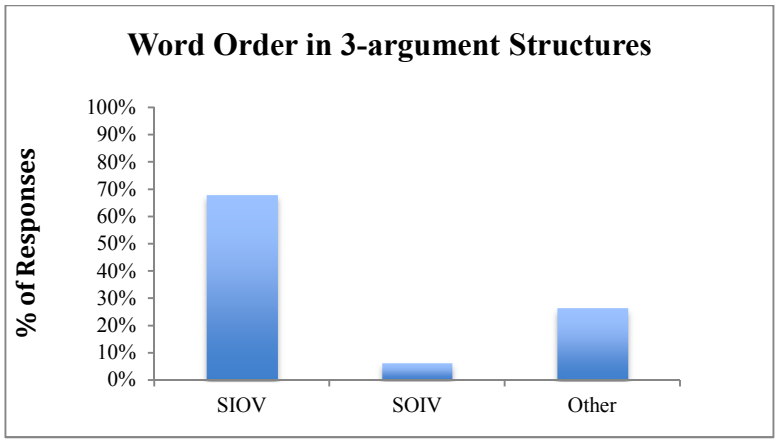


Figure 15: Word order preferences in Turkish 3-argument structures (n=115). The Y axis indicates the percentage of the responses involving the word orders on the X axis.

Turkish subjects are typically marked with the nominative case (Goksel & Kerslake, 2005). As illustrated in Figure 16, subjects are almost always left unmarked (99%). In 3-arguments structures involving an inanimate object being transferred between the animate subject and the animate indirect object, the inanimate object is left unmarked (78%) whereas the animate indirect object is case-marked with the dative (72%). This is again in line with previous findings. The animate character is case marked whereas the inanimate one is not.

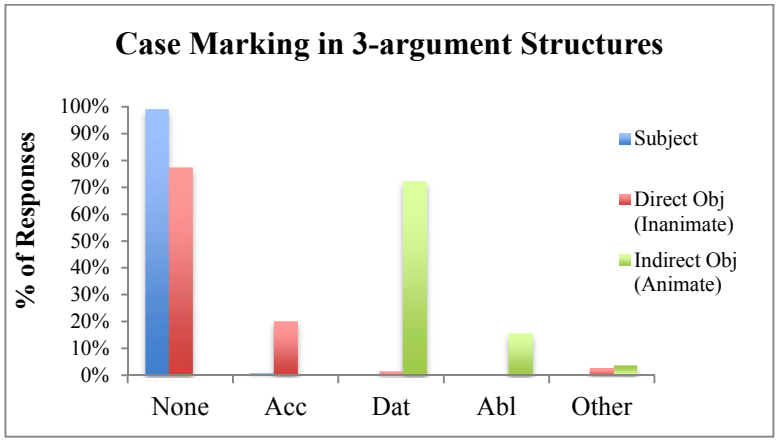


Figure 16: Case assignment in Turkish 3-argument structures (n=115). The Y axis indicates the percentage of the responses involving syntactic arguments marked with the cases listed on the X axis.

Findings from Turkish reveal how a fully developed language behaves: There are systematic word order and case assignment preferences that are consistent across participants, and the success rate in the entire task is 100%. It may be thought that it is irrelevant to look at a spoken language to understand the development of a young signed system. However, it is the same human capacity for language trying to produce solutions to handle the complex semantic event structures and trying to find an efficient way of mapping the same meaning onto a form that takes place in a different modality.

The results for Turkish show that the word order preferences in Turkish, specifically in reversible scenarios, do not have an impact on the word order preferences in CTSL. CTSL has been following its own developmental path, which is totally distinct from the surrounding spoken language: CTSL word order preferences demonstrate a systematic variation between SOV (in irreversible contexts), and OSV and SV/SV (in reversible contexts) in 2-argument structures, whereas Turkish uses SOV irrespective of the context. There is no evidence suggesting that SV in 1-arguments both in Turkish and CTSL is beyond coincidence. In 3-argument structures, CTSL does not have a clear word order tendency while Turkish makes a clear preference for SIOV. Instead, just as the case assignment system that is governed by semantic factors in Turkish, CTSL has a completely different set of strategies to encode the argument structure in reversible cases.

3.3.7. Results for family sign

From the family sign data, 26 responses were analyzed for the word order analysis in 1-argument structures. Both of the family-signers (i.e., two deaf brothers) demonstrated a clear tendency for SV (96%). In 2-argument structures, word order

preferences vary to a great extent across 27 analyzed responses (Figure 17). In reversible contexts, there is an inclination for OSV (36%) and SOV (28%). In irreversible contexts, there is a tendency for SOV (19%) and SV(o) (31%).

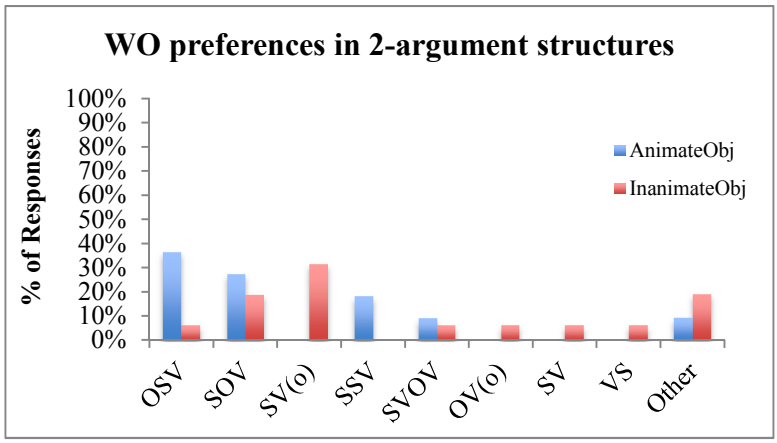


Figure 17: Word order preferences by family-signers in reversible vs. irreversible contexts in 2-argument structures (n=26). Blue bars stand for the reversible cases (i.e., animate agent acting on animate patient). Red bars stand for irreversible cases (i.e., animate agent acting on inanimate patient).The Y axis indicates the percentage of the responses involving the word orders on the X axis.

The distribution for the 2-argument structures involving an inanimate object is more diverse, whereas for the ones involving an animate object, the distribution is more unified. This is not a very surprising finding because no matter in what order the arguments came in irreversible cases, the addressee would still be able to differentiate between the agent and the patient roles. Thus, hypothetically speaking, convergence on a certain way of sequencing information is not because of an acute need to communicate the message in irreversible cases, whereas it is in reversible ones. Yet, the family-signers converge on SV(o) (32%) and SOV (19%) in irreversible, and OSV (36%) and SOV (28%) in reversible scenarios.

In 3-argument structures (Figure 18), the word order preferences show more variation compared to the 2-argument structures. Out of 17 responses, there is some tendency for ISOV (24%) and SIOV (24%).

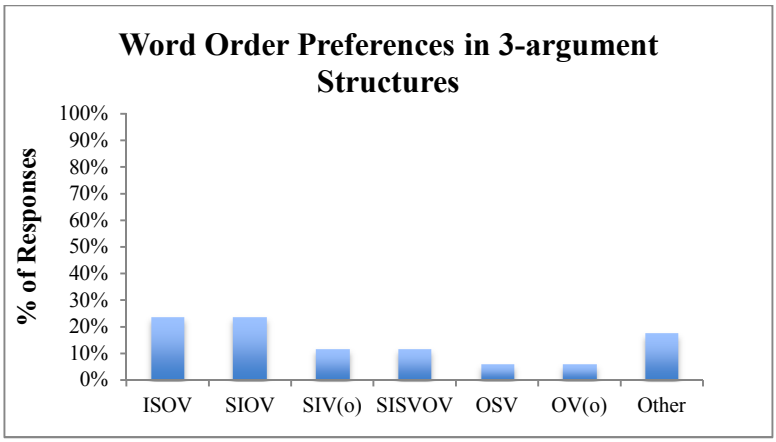


Figure 18: Word order preferences by family signers in 3-argument structures (n=17). The Y axis indicates the percentage of the responses involving the word orders on the X axis.

Other disambiguation strategies: Out of 44 responses (2- and 3-argument), only 1 response involves "association with a character". Other than this, there is not any other data point for disambiguation strategies.

Surprisingly neither SV/SV nor any of the other disambiguation strategies appear in this family sign system at all. An important factor to keep in mind is that these two family signers are brothers. They have been always living together for over 30 years and working in the same place for the last 20 years. They might have actually converged on certain word orders that are mutually comprehensible to both of them, and considering the contribution of shared context to the retrieval of the intended messages, it is probable that they do not need to invent further devices to encode argument structure.

Another possible interpretation of the lack of any other argument structure devices might be a consequence of the size of the community using this system. As the number of the users of a system increases, the amount of variance across users as an outcome of the unique mental systems created by each deaf individual also increases. For instance, in a community involving 10 deaf individuals, and based on an assumption that each individual invents 10 new things per year, over the course of its development, the

system will be exposed to much more lexical and structural variation than a family sign system invented inside a household mainly by two deaf individuals. It is important to remember that higher consistency in sequencing information does not necessarily mean that these two brothers have actually created a word order as a linguistic device. They do not show any traces of verb agreement in their utterances yet. Outside their household, the system may fail to communicate the intended messages with other deaf individuals.

There is no suggestive evidence for the influence of Turkish on the word order preferences of this family sign system, but we cannot completely rule out this possibility because these two brothers are the only deaf individuals in the entire town, and they are completely surrounded by a Turkish-speaking community.

CTSL data, on the other hand, prove that the seeds of verb agreement as a supplementary tool to word order (or along with word order) will necessarily start to emerge at an early stage of language creation when there is a big enough group to invent a shared system and with an acute need to increase the expressive power of the system.

3.3.8. Results for silent gesture

40 responses were analyzed for 1-argument structures in silent gesture. Just like the other systems, Turkish speakers performing the task in silent gesture also demonstrated a strong tendency for SV (95%).

Among the 39 responses elicited for 2-argument structures (18 of them in reversible and 21 of them in irreversible scenarios), there is a strong tendency for SOV (83%) in reversible cases and for SOV (43%) and SV(o) (38%) in irreversible cases (Figure 19).

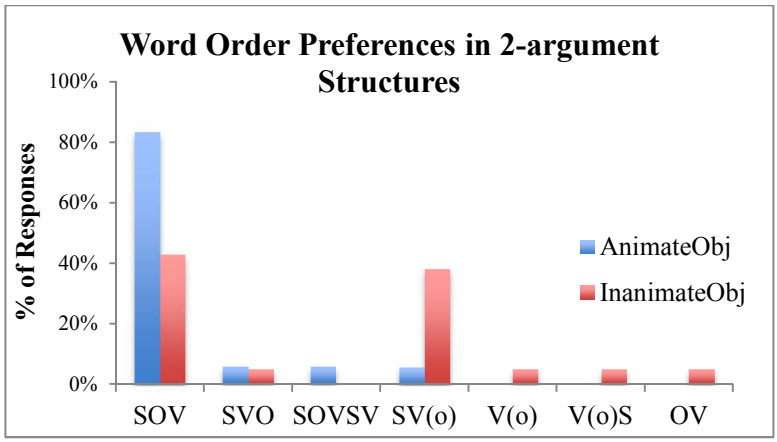


Figure 19: Word order preferences by silent gesturers in 2-argument structures (n=40). Blue bars stand for the reversible cases (i.e., animate agent acting on animate patient). Red bars stand for irreversible cases (i.e., animate agent acting on inanimate patient). The Y axis indicates the percentage of the responses involving the word orders on the X axis.

Participants showed a strong tendency for SOV (83%) in reversible scenarios; and almost equally distributed tendency for SOV (43%) and SV(o) (38%) in irreversible scenarios –the object argument is syntactically expressed in SOV and morphologically expressed in SV(o). The strong tendency for SOV, specifically in reversible cases, implies that word order preferences in silent gesture might be affected by Turkish. Goldin-Meadow et al. (2008) argues against the effect of the native language on people's preferences for word order in silent gesture, and claims that SOV is the general cognitive tendency of the human brain to sequence information in the most natural way. However, such a high convergence on SOV (83%) in our data set, especially in reversible cases, suggest that we cannot completely rule out the possible influence of Turkish in the participants' responses.

Among 39 elicited responses, only two responses (one involving an animate object, and one with inanimate object) involve association with a character. There is no other response involving any other disambiguation strategies.

In 3-argument structures (n=21), the distribution becomes flatter (Figure 20). However, there is a tendency for SIOV (26%), which again might be influenced by Turkish.

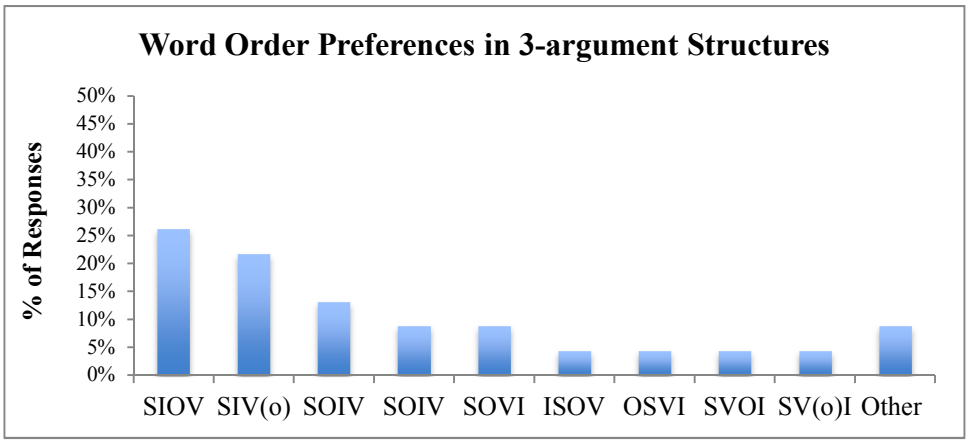


Figure 20: Word order preferences by silent gesturers in 3-argument structures (n=21). The Y axis indicates the percentage of the responses involving the word orders on the X axis.

Consistent word order patterns and lack of argument markers in silent gesture indicate that the devices that CTSL signers have been developing to encode argument structure are not a random compilation of gestures of the hearing people, but they are the tools of a distinct mental system and they are not influenced by the gestures of the hearing people or the spoken language surrounding CTSL. In other words, CTSL structure has been evolving in its own developmental path without being influenced by the word order preferences of a Turkish-speaking brain. Instead, CTSL signers have been introducing various different word orders and creating other devices which are absent in silent gesture, to encode argument structure.

Interim Summary:

In terms of word order preferences, SV in 1-argument structures and SOV in *irreversible* 2-argument structures are the predominant word order in all of the systems

discussed in this chapter. There is also a general subject-first and verb-final pattern in all of the contexts (Table 11) and in all of the systems. These similar patterns across different groups imply that certain cognitive tendencies come along with the language user –language inventor in the case of CTSL, family sign and silent gesture. These biases are not governed by linguistic constraints, but probably shaped by universal cognitive pressures. For example, SV clearly manifests itself as a strong tendency in all of the groups, even in CTSL-1 and family sign, which emerged without a linguistic model.

When it comes to semantically more complex scenarios involving two animate characters, word order preferences vary. In 2-argument reversible contexts, OSV appears to be a general tendency in all three cohorts of CTSL and also in the family sign system. In Turkish and silent gesture, SOV still appears to be a strong tendency.

Table 11: Summary of the top two word order preferences in each set of subjects and tasks

	1-argument	2-argument irreversible	2-argument reversible	3-argument
CTSL-1	SV (52%)	OV (20%) V(o) (15%)	V (15%) OSV (13%)	OV (14%) SV(o) (14%)
CTSL-2	SV (80%)	SOV (38%) SV(o) (23%)	SV/SV (42%) OSV (26%)	SV/SV(o) (12%) SIV(o) (12%)
CTSL-3	SV (93%)	SOV (56%) SV(o) (20%)	OSV (48%)	ISOV (23%) SIV(o) (13%)
Family sign	SV (96%)	SV(o) (32%) SOV (19%)	OSV (37%) SOV (28%)	ISOV (24%) SIOV (24%)
Silent gesture	SV (95%)	SOV (43%) SV(o) (39%)	SOV (84%)	SIOV (26%) SIV(o) (22%)
Turkish	SV (87%)	SOV (88%)	SOV (81%)	SIOV (68%)

Jackendoff (2002) provides an explanation for the overwhelming preference for subject preceding the object pattern (i.e., S>O). Based on the observations from the utterances of late second language learners (Klein & Perdue, 1997), pidgin languages (Givon, 1995) and agrammatic aphasics (Pinango, 1999; 2000), speakers seem to be

inclined to employ an “agent first” rule to disambiguate the semantic roles in utterances involving two characters. According to this principle, an utterance like “hit tree Fred” would mean that it is the tree hitting Fred but not Fred hitting the tree (Jackendoff, 2002, p. 247). These findings imply that there is a natural order in human languages, or a general cognitive tendency for a certain preference, in which the agent (i.e., syntactic subject) precedes the patient or the theme (i.e., syntactic object).

In Turkish and silent gesture, there is an agent-first pattern irrespective of the context. However, “agent first” principle does not explain the predominant OSV pattern in CTSL and in the family sign in reversible scenarios. As an alternative to agent-first principle, Meir (2014) argues that it is the human character that occupies the initial position in young sign languages. Yet, this does not explain why CTSL signers and family-signers systematically produce the human patient prior to the human agent in reversible scenarios, either.

3.4. Study 2

3.4.1. Research questions

Study 2 is a follow-up to Study 1. In Study 1, all of the 2-argument clips involved a human agent acting on either an inanimate or a human patient. In order to truly understand which character comes first and what might be the reasons for this tendency, we tested participants with a stimulus set involving inanimate agents acting on animate and inanimate patients.

3.4.2. Materials and Task

5 video clips in which an inanimate agent acts on either an animate patient or an inanimate patient:

- Water pours on boy (irreversible)
- Ball hits man (irreversible)
- Bottle falls on woman (irreversible)
- Toy car hits the other toy car (reversible)
- Toy car hits the book (reversible)

3.4.3. Participants: The same CTSL signers and Turkish speakers took part in Study 2. We did not have family-sign and silent gesture data for this study. Data were collected in August 2014 and August 2015 from CTSL signers, and in August 2016 from Turkish speakers.

3.4.4. Coding procedure: The same coding procedure was used as in Study 1.

3.3.5. Results for CTSL

63 utterances were analyzed for this task. Please note that OV/SV is not any different than SV/SV. In SV/SV transcription, it is not clear whether it is the patient or the agent that appears in the first clause. As the main question in this study is to understand which character occupies the initial position, the data were coded as OV/SV indicating that it is the patient that appears prior to the agent.

Figure 21 shows that there is a clear tendency for an object first pattern in CTSL in irreversible contexts (i.e., inanimate agent acting on animate patient), and this pattern becomes more consistent across cohorts over time (n = 37).

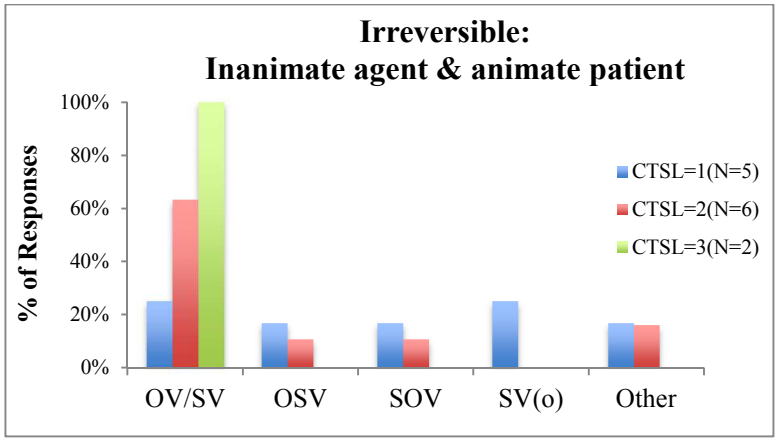


Figure 21: Word order distribution in 2-argument irreversible structures involving and inanimate agent and animate patient (n=37). The Y axis indicates the percentage of the responses involving the word orders on the X axis.

Figure 22 shows that object first pattern is also a general tendency in reversible contexts (i.e., inanimate agent acting on inanimate patient), and this pattern also becomes more consistent across cohorts over time (n = 26).

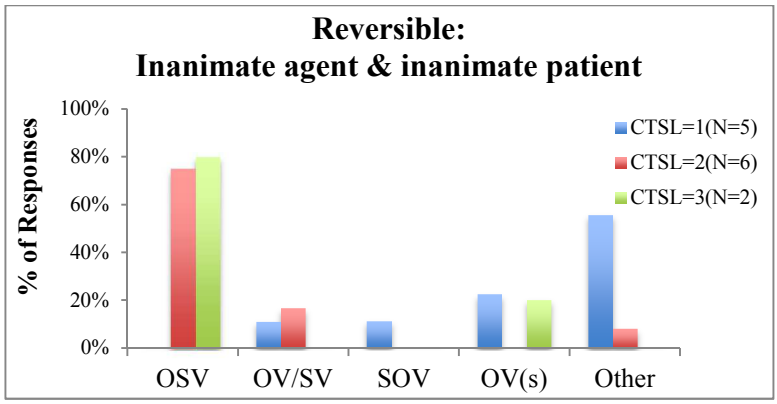


Figure 22: Word order distribution in 2-argument reversible structures involving and inanimate agent and inanimate patient (n=26). The Y axis indicates the percentage of the responses involving the word orders on the X axis.

These results indicate that it is neither the agent nor the human that comes first; it is the "ground" that comes first. This preference becomes more prevalent across cohorts over time in both contexts.

3.3.6. Results for Turkish

103 Turkish responses were analyzed for this study. There is a systematic variation between OSV and SOV in reversible *vs*. irreversible cases (Figure 23). When an inanimate agent acts on animate patient, Turkish speakers consistently prefer OSV. When an inanimate agent acts on an inanimate patient, they go for the canonical SOV order.

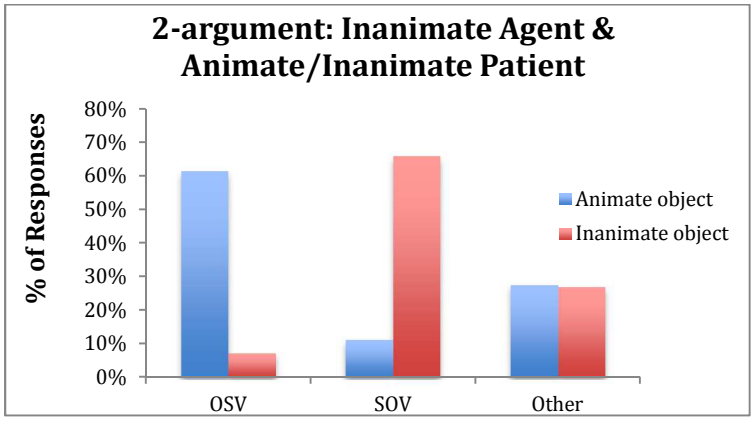


Figure 23: Word order preferences in Turkish 2-argument structures involving an inanimate agent and an in/animate patient (n=103). Blue bars stand for the irreversible cases (i.e., inanimate agent acting on animate patient). Red bars stand for reversible cases (i.e., inanimate agent acting on inanimate patient). The Y axis indicates the percentage of the responses involving the word orders on the X axis.

As suggested by Meir (2014), Turkish shows the human-first pattern when the human character is the patient being acted upon by an inanimate patient. These findings indicate that animacy hierarchy plays a role in word order preferences in Turkish. However, if the agent is inanimate, CTSL operates on a ground-first basis irrespective of the semantic category of the object.

The word order preferences based on the findings of Study 1 and Study 2 can be summarized as follows:

1. Animate agent acting on inanimate patient → "human" wins and the word order preference is SOV in all of the subject groups
2. Animate agent acting on animate patient → no difference in humanness. "ground" and the OSV order win in CTSL and family sign, but "agent" and the SOV order win in silent gesture and Turkish
3. Inanimate agent acting on animate patient → "human" and "ground" both win, word order preference is OSV both in CTSL and Turkish
4. Inanimate agent acting on inanimate patient → no different in humanness. "ground" and the OSV order win in CTSL; but "agent" and the SOV order win in Turkish.

3.5. General Discussion

When people are asked to pantomime information, they sequence it with certain cognitive tendencies for ordering information, which does not necessarily mean that they invent a linguistic convention on the fly. Regularity in the sequential ordering of information has been claimed to be evidence of a syntactic mechanism (e.g., Goldin-Meadow et al., 2008). However, for word order to operate as a linguistic device, a community of language users should converge on a standard order.

A vast majority of well-established spoken and sign languages primarily rely on SOV, followed by SVO, to encode argument structure. For Goldin-Meadow et al. (2008), SOV is the default pattern in nonverbal representation of information. In reversible scenarios, Gibson et al. (2013) presents evidence for a shift from SOV to SVO because of communicative pressures. Partly in line with previous findings, our results confirm that SOV is the default pattern both in verbal and nonverbal communication *only* in irreversible contexts. SVO does not appear to be a prevalent preference either in verbal or nonverbal communication to resolve ambiguity. When it comes to reversible contexts, word order preferences vary to a great extent, specifically in CTSL. Signers show a tendency for certain word orders but it is hard to mention a standardized word order as a marker of argument structure in semantically complex scenarios. Much of the variance possibly spring from the size of the CTSL community; as the language community grows, the function of the languages becomes more complex (Senghas, Kita & Ozyurek, 2004), and as the function of the languages becomes more complex, the pressure to develop variations in form even at the cost of sacrificing the default SOV order and the S>O pattern becomes inevitable.

Our findings indicate that CTSL gradually has been tailoring itself to the linguistic demands of a growing deaf community, and certain inventions reflect the beginning of a linguistic system: Cohort 1 signers heavily rely on word order to express who is doing what to who; however, even today, this is still not a reliable system in CTSL-1. As explained in the introduction, word order is not the only linguistic mechanism to encode argument structure. Spoken languages recruit morphological markers in order to clarify semantic roles, whereas sign languages recruit space for the same purpose.

Signed systems are not completely arbitrary and they can allow grammatical elements (e.g., source and goal) to be represented in an iconic (i.e., transparent) way. As defined by C. Padden, Meir, Aronoff, and Sandler (2010), there are two types of iconicities in spatial verb agreement that are in competition with each other. One of them adopts body as animate subject, and the other one makes use of abstract locations in space. It may be thought that either (or both) of these spatial verb agreement mechanisms should emerge quickly in a young system mainly because of the iconic nature of sign system. It may even be expected to precede convergence on a certain word order. Yet, they do not emerge overnight and they do not follow a quicker course of development than that of a consistent word order.

Neither the use of body as a subject nor the spatial verb agreement is present in CTSL-1, as they are not present in the family sign system and silent gesture, either. We start observing the traces of spatial verb agreement only as of CTSL-2. CTSL-2 signers first go through a stage of structural simplification (i.e., avoiding any marking but relying on SV/SV), but they also start using their own body as subject. In other words, instead of

readily assigning abstract referential loci for characters in space, CTSL-2 signers, *first*, use their own body and that of the addressee (or whoever is available in the immediate signing space) as referential loci for the characters in the target event to be expressed. In other words, using body is the first step for spatial verb agreement. The CTSL utterances below exemplifies the use of body as subject:

(8) [GIRL, POINT(to self)] / [MAN, POINT(to addressee) / [I PULL YOUR.ARM]
= 'there's a girl, that's me– There is a man –that's you' -- I pull your arm.
Intended meaning: "Girl pulls man's arm"

(9) [WOMAN, POINT(to PERSON)] / [GIRL POINT(to self)] / WOMAN-PUSH-ME
= 'there's a woman, that's her. There is a girl, that's me --- She pushes me.
Intended meaning: "Woman pushes girl"

In (8), the signer associates herself with the agent and the addressee with the patient. The direction of "pulling" is from the addressee (i.e., the one who is pulled) to herself (i.e., the one who pulls) to express that it is herself that performs the pulling action. In (9), the signer associates the agent with another person in the immediate physical environment and the patient with herself. The direction of "pushing" is from that person (i.e., the one who pushes) to herself (i.e., the one who is pushed). As is clear from these examples, the verbs are body-anchored. Exploiting the iconicity of one's own body is an essential developmental stage in the initial stages of creating a systematic verb agreement mechanism. As the next step, CTSL-3 signers turn this conventionalized use of body for verb agreement into an abstract verb agreement system. That is to say, body-anchored verb agreement serves as an intermediate step that paves the way to the more abstract referential use of space for verb agreement.

The developmental path that CTSL takes suggests that signers of different cohorts recognize animacy differences, but they encode them in distinct ways –in more advanced ways from CTSL-1 to CTSL-3. While making a transition from iconic use of body as a subject to iconic use of space unfolds gradually. The competition from body, as a grammatical source, is strong at the beginning. Leaving body and adopting a less-context dependent spatial verb agreement takes time. These mechanisms are not present from the very beginning. But once the verbs are dissociated from body, as the frequent use of spatial verb agreement in CTSL-3 suggests, the system finds its way into the system quickly.

Previous studies on the argument structure of emerging sign languages present evidence for similar developmental patterns to those of CTSL. Senghas et al. (1997) reports that the use of successive 1-argument clauses appear in the second generation NSL signers. The same basic strategy is present both in ISL and ABSL. In reversible transitive contexts, ABSL displays a higher tendency (47%) for SV/SV than ISL (33%), which suggests that ABSL, as a village sign language, makes a preference for a simpler strategy than a more conventionalized signed system used in formal education settings (Meir, 2010). This opposition can be considered analogous to the decrease of SV/SV in the transition from CTSL-2 to CTSL-3. A more developed system start to rely on more efficient strategies like spatial verb agreement.

In addition to the similarities in the use and development of SV/SV, emerging sign languages also display similar patterns in the development of spatial verb agreement. Just like older CTSL signers, the older signers of ISL hardly use spatial verb agreement, but it becomes more prevalent in the utterances of the younger signers; and ABSL signers

do not use it, at all (Meir, 2010). This is also true for NSL: Cohorts 1 and 2 differ in their use of space to express argument structure. Similar to the productions of CTSL-1 signers, the first cohort of NSL signers produce a spatially neutral version of argument structure whereas Cohort 2 signers produce spatially marked forms (Senghas & Coppola, 2001).

These cross-linguistic findings suggest that different brains in different parts of the world adopt the same pattern –which family signers and gesturers do not seem to adopt. Yet these young languages do not entirely follow the same developmental paths. For instance, Meir (2010) reports that ABSL signers came to mainly rely on word order to encode argument structure. They developed this mechanism within the span of one generation, whereas ISL signers did not develop a preferred word order until its third generation (Meir, 2010). CTSL signers, on the other hand, do not necessarily rely on word order as a linguistic mechanism except for irreversible cases.

These differences in three young sign languages indicate that there is not a single universal path for the development of argument structure marking. Languages may differ in that respect as of the very early stages of their existence.

CHAPTER 4

EMERGENCE OF DISTINCT VERB CLASSES

4.1 Introduction

In Chapter 3, I focused on how the arguments of intransitive, transitive and ditransitive actions are encoded on the surface structure of spoken and signed systems, with a special emphasis on CTSL to understand where it falls on the spectrum of languages in terms of its structural maturity and complexity. In this chapter, I investigate how the semantic complexity of reciprocal and symmetrical actions is realized on the surface structure of CTSL. The motivation for such investigation is as follows: The event structures in the previous chapter are either *non-directional* in that a theme undergoes an action without external causation (i.e., intransitive events), or *unidirectional* in that an agent acts on a patient (i.e., transitive events) and/or an object is transferred from a source to a goal (i.e., ditransitive events). Reciprocal and symmetrical actions, on the other hand, have semantically much more complex event structures because they involve *bidirectional* relations with the participation of at least two characters. In other words, each character performs an action on the other character and undergoes the same action performed by the other character. This study aims to reveal how far we can push the structural limits of CTSL with such semantic complexity.

4.1.1. Symmetry:

As defined by Dimitriadis (2008), there are two necessary and sufficient conditions for a predicate to be considered symmetrical: a) expressing a simultaneous binary relationship, and b) having two arguments that identically participate in any event described by the predicate (p. 329). For instance, there cannot be an event of Jane shaking hands with Tom without Tom shaking hands with Jane.

Syntactic realization of symmetry in English: The two arguments are interchangeable in the transitive realization of *shaking hands* (Dimitriadis, 2008). In other words, replacing the arguments with each other preserves truth values of the event: X *shake hands with* Y is equal to Y *shake hands with* X, but X *see* Y is not equal to Y *see* X. In the latter, exchanging arguments does also change the meaning of the sentence (e.g. Dowty, 1979; Fillmore, 1972; Gleitman, Gleitman, Miller, & Ostrin, 1996; Langacker, 1987; Polinsky, 1996; Talmy, 2000).

4.1.2. Asymmetry:

There are many other predicates that are clearly asymmetric. For instance, *follow* and *precede* are two of them. If *A follows B* is true, *B follows A* cannot take place at the same time. These two relations are mutually exclusive (Dimitriadis, 2008).

4.1.3. Reciprocity:

As defined by Kemmer (1997), in a typical reciprocal situation, such as *punch each other* or *kiss each other*, the focus of the event is not on how a character affects the other, but on the mutual interaction of the two characters. For instance,

(1) a. The truck and the car collided

b. *The truck and the lamppost collided. [31]

c. The truck collided with the lamppost.

d. *The lamppost collided with the truck.

In (1a), *collide* is a reciprocal event because it involves a joint action of the two characters of the same semantic category. In other words, it is a simultaneous and coordinated individual actions of the same type performed on one another by two motor vehicles. *Collide* in (1b) is not reciprocal because the two characters are not from the same semantic category, which naturally creates an asymmetry between the two parties. (1b) is semantically implausible –unless it is a mobile lamppost. (1c) is grammatical, and semantically plausible but it is not reciprocal, either. Rather, it is a unidirectional relation in which one party acts on the other. (1d) is not grammatical because the lamppost is a motionless object that does not have the capability of creating the physical force that is necessary to initiate the action "collide into a truck".

Since *collide* expresses reciprocity inherently when involved with two moving objects, it does not require a further lexical item like *each other* to denote reciprocal meaning in (1a). However, *punch* and *kiss*, do not involve reciprocity inherently. Therefore, to express a reciprocal relation with these verbs in English, the use of an additional reciprocity marker becomes a necessity.

(2) a. Jane and Tom punched each other. (=Tom and Jane punched each other)

b. Tom and Jane kissed each other. (=Jane and Tom kissed each other)

c. Tom punched Jane. (≠Jane punched Tom)

d. Jane kissed Tom. (≠Tom kissed Jane)

[31] (1b-d) are taken from Dong (1970).

(2a) and (2b) are reciprocal as both parties act on each other. Jane is the agent of kissing/punching John, John is the patient of being kissed/punched by Jane, and also Tom is the agent of kissing/punching Jane and Jane is the patient of being kissed/punched by Tom. In brief, a reciprocal kisser/puncher is both the agent and the patient of some kissing/punching events (Rubinstein, 2007). (2c) and (2d), on the other hand, do not involve symmetrical relations.

A reciprocal action may take place between two participants, but it is not limited to two, as in (3) and (4) (Dalrymple, Kanazawa, Kim, Mchombo, & Peters, 1998).

(3) The people in the room looked at each other.

(4) Students helped each other.

In addition, a reciprocal action may take place simultaneously or sequentially. For instance, in (2a), the reciprocal punching might have initiated by Jane and Tom simultaneously, or one of them might have punched first and the other later (Dalrymple et al., 1998).

In brief, the essential semantic properties of reciprocity can be summarized as follows: a) there have to be at least two arguments/participants; b) participants have dual thematic roles; and c) it is a symmetrical relation that involves a sequential or simultaneous joint action of the arguments/participants.

Strategies for encoding reciprocity in spoken languages:

Languages employ various strategies to express reciprocal relations. For instance, some languages syntactically encode reciprocity using mono-clausal and/or multi-clausal strategies while others use morphological strategies (see Evans, 2008; König & Kokutani, 2006; Nedjalkov, Geniusiene, & Guentchéva, 2007). Some of the strategies that spoken

languages use are as follows:

a. Mono-clausal strategies:

Use of a conjunction: English uses a conjunction as in (1a) and (2a,b) to indicate that it is a joint action and performed by two arguments.

Use of a nominal/adverbial: The lexical semantics of some verbs reliably convey the binary relation as they inherently express reciprocity (e.g., "collide"). Many others need to be supplemented with a nominal (e.g., "each other" in English) or an adverbial as in (5).

(5) MANDARIN: Tāmen hù-xīang daò-qian-le.
They mutually apologize-PERF
'They apologized to each other.' (König, 2007).

b. Multi-clausal strategies:

Bi-clausal constructions: Some languages express reciprocity in two clauses as in the Cantonese example below.

(6) CANTONESE: Léih mohng ngóh, ngóh mohng léih.
I stare at you, you stare at me
'We stare at each other' (König, 2007).

In some cases, English also express reciprocity in multiple clauses:

(7) a. Jane hates Tom and he hates her, too.

b. Tom doesn't like Jane, and vice versa.

c. Tom loves Jane and she loves him back.

Other multi-clausal strategies include, for example, verb compounding.

Verb compounding with symmetrical predicates:

(8) MANDARIN: Tāmen dă-lái-dă-qù.
3PL beat-come-beat-go
'They beat each other'

Verb compounding with repeated predicates:

(9) Godié[32]: Wa wà-wà
They love-love
'They love each other.' (Maslova & Nedjalkov, 2005).

c. Morphological Strategies:

In many languages such as Hebrew, Russian, Swedish, Finnish, Turkish, Hungarian and Somali, reciprocal relations are marked morphologically as a result of derivational processes (König, 2007).

(10) TURKISH: Adamla kadın öp-üş-tü-ler.
Man-WITH woman kiss-RECIP-PAST-PLU
'Man and woman kissed each other.'

4.1.4. Non-symmetry:

Unlike *shake hands*, *kiss* and *punch* are *non-symmetrical* actions but they are not incompatible with symmetry. When these actions are used in a situation like (2a) and (2b), they express a reciprocal relationship involving symmetry. *Kiss* and *punch* are reciprocal on this specific set of characters in (2a-b), but in other situations, they are not necessarily symmetrical predicates (Dimitriadis, 2008).

While the concepts of reciprocity and symmetry are frequently used interchangeably, within the scope of this chapter, they will refer to different concepts. Symmetrical actions differ from reciprocal actions in that, for example, for *shake hands* to be *shake hands*, it has to be a joint action of two characters, but for *kiss* to be kiss this is not a necessity. Kissing can also be unidirectional; therefore, it is non-symmetrical.

[32] The Godié language fis rom the Niger-Congo language family and it is spoken on the Ivory Coast.

4.2. The focus of the current study

All in all, there are three types of relations: *symmetric*, *asymmetric* and *non-symmetric*. A predicate is either necessarily symmetric, or depending on the context it appears, it might be symmetric, asymmetric or non-symmetric. Following König and Kokutani (2006), Evans (2010) and Dimitriadis (2008), I will use the term "symmetrical actions" only for the events that are necessarily symmetric, "reciprocal actions" for the events that are symmetric but can also appear in asymmetric/non-symmetric contexts, "transitive actions" for non-symmetric two- or three-argument events, and "intransitive actions" for non-symmetric one-argument events.

The challenge in Chapter 3 was the potential communication breakdown because of potential ambiguity in reversible in two- and/or three-argument events. As explained in the previous chapter, in an utterance like WOMAN + MAN + PUNCH, it is not clear whether it is the woman punching the man or vice versa. Both of the characters are equal to each other in terms of their semantic categories, but not in their thematic roles in this event. One of them gets the high position in the animacy hierarchy as the agent, and the other one gets the low position as the patient. The challenge in the previous study was to unambiguously convey the role of each human character in reversible contexts.

In this chapter, the semantic challenge posed on the grammar is a greater one because a reciprocal event contains two separate transitive sub-events (i.e., *Woman punches man*, and *man punches woman*), and these two sub-events are actually the reverse version of each other. In other words, both possible reverse scenarios are inside the same event and each animate character gets to be in both high and low positions in

the animacy hierarcy (i.e., agent & patient). Thus, they are equal in their thematic roles both as an agent and as a patient. This is what amplifies the semantic complexity of the event and poses a greater challenge for the surface structure of a very young language.

Note that symmetrical contexts (i.e., *shake hands*) do not involve the reversibility problem because the role each character plays is necessarily symmetrical and they are the same. One of the characters plays one half of the action, and the other character plays the other half. All in all, a symmetrical action is an intransitive event involving plural subjects acting on each other.

Reciprocal actions, on the other hand, are semantically much more complicated as opposed to symmetrical events. They involve two transitive sub-events, and each of these sub-events also has their own sub-events: 1. *Woman punches man* (EVENT-1: woman → agent), 2. *Man gets punched* (EVENT-2: man → patient), 3. *Man punches woman* (EVENT-3: man → agent) and 4. *Woman gets punched* (EVENT-4: woman → patient).

As reviewed in this section, there are many studies that investigated spoken languages for their syntactic and morphosyntactic structures expressing the meaning in reciprocal and symmetrical actions. To the best of my knowledge, except for the study conducted on NSL and Nicaraguan homesigners by Flaherty, Goldin-Meadow, Senghas, Coppola, and Gleitman (2014), no other study addressed the behavior of reciprocal and symmetrical actions in signed systems.

The main research questions I will be addressing in this study are as follows:

- As explained in this section, there are conceptual differences in *symmetric*, *asymmetric* and *non-symmetric* events. Do CTSL signers have distinctive and conventionalized structural strategies to express these concepts?

- Are there distinctive structural strategies that CTSL signers use in order to unambiguously communicate the right semantic roles in a reciprocal event?
- If yes, how is this expressed in CTSL? Chapter 3 showed that CTSL signers have a tendency to break an event involving two animate characters into two sun-events by allocating only one animate character per action (i.e., SV/SV constructions). In reciprocal events, do they also resort to similar serial verb constructions? If this is the case, do they decompose all of the four sub-events and produce successive intransitive constructions –which would be something like SV/SV/SV/SV? Or do they have less cumbersome markers to express all of these sub-events in a more holistic way?
- Do all of the cohorts express reciprocal and symmetrical events in the same way, or do they display differences? If there are differences, what sort of developmental processes do these markers follow across cohorts of CTSL signers?

4.3. Methods:

4.2.1. Materials and Task

We devised a controlled elicitation task in which deaf signers viewed 62 short clips which involved *two* characters of the same semantic category performing actions that were intransitive (e.g., both characters waving hands), transitive (e.g., one pushing the other), reciprocal (e.g., pushing each other), and symmetrical (e.g., shaking hands). All of the participants viewed the actions in the same randomized order (See Appendix E).

In the stimulus set, by reciprocal actions, we mean two animate characters acting on each other by performing the same action on each other. For example, “punch” can be performed reciprocally in which both parties punch each other. However, it can also be performed unidirectionally by only one of the characters punching the other (Figure 24). Symmetrical actions, on the other hand, are inherently bidirectional and necessarily require two parties to be involved in the action so as to perform a symmetrical action together (e.g., Figure 25: shaking hands, arm-wrestling, etc).

There were 22 different actions in the stimulus set. 10 of these actions were displayed in the following *four* versions (=40 short clips in total): transitive action with an animate object (e.g., A man punches another man), transitive action with an inanimate object (e.g., Man punches wall), reciprocal version of the action (e.g., Two men punch each other.) and intransitive action with two subjects (e.g., Two men punch towards camera).

The rationale behind this design was to investigate the realization of the reciprocal actions on the surface structure of CTSL by pulling them apart from the realization of the same actions in other event structures. In other words, the transitive version involving two animate characters (or animate-inanimate) and the intransitive versions of the same action involving two animate subjects were used as controls.

a. Transitive “punch” with inanimate patient

b. Transitive “punch” with animate patient

c. Reciprocal “punch”

d. Intransitive “punch” with plural subjects

Figure 24: The different versions of “punch” that were used in the stimulus set. Picture “a” illustrates an animate agent punching an inanimate patient, Picture “b” illustrates an animate agent punching an animate patient, Picture “c” illustrates the reciprocal version of punch, and Picture “d” illustrates the intransitive version of punch performed by two animate characters side by side.

Besides these, there were 10 different short clips involving symmetrical actions (e.g., hand-shaking, slow dance, arm-wrestling, high-five etc.). The remaining 12 video clips were used as fillers involving solo performers performing one of these actions in an intransitive construction.

a. Symmetrical arm-wrestling

b. Symmetrical handshaking

Figure 25: Examples for the symmetrical events from the stimulus set.

4.2.2. Participants:

Group 1: 12 deaf CTSL signers, grouped into three successive cohorts, participated (M_{age}=42.2, age range: 17-55; 8 Females, 4 males; 4 CTSL-1 signers, 6 CTSL-2 signers, 2 CTSL-3 signers). Except for two of the CTSL-2 participants living in Village 2, all of the other participants are from Village 1.

Group 2: 18 Turkish speakers from Village 1 took part in this study: M_{age} = 39.1, Range = 14-55, 12 females, and 6 males. All of the participants are native speakers of Turkish also with varying degrees of proficiency in CTSL. None of them received education beyond mandatory primary school education.

Group 3: One family-signer (*age* = 55) from the same region but from a different village that is not in contact with the CTSL community. He never attended school for the deaf.

4.2.3. Task:

The participants were tested in a controlled elicitation task, which was conducted as follows:

Group 1: deaf CTSL signers were paired up with either a deaf or proficient hearing CTSL signer as the addressee. The signer viewed the short clips and described them in CTSL to the addressee. Data were collected in August 2015.

Group 2: Two Turkish speakers were paired up with each other. One of them was assigned the speaker role and the other the addressee role. The speaker described the clips to the addressee in Turkish. Data were collected in June 2016.

Group 3: The family-signer was paired up with his deaf sister (*age* = 52). These two siblings live in the same neighborhood and interact with each other on a daily basis. The participant described the clips to the addressee in their own family sign system. Data were collected in June 2016.

To check the success of the target message described by the signers/speakers, the addressees were asked to view an array of three pictures and pick the corresponding picture portraying the scene in the clips as described by the signers/speakers (See appendix F).

4.2.4. Coding Procedure:

We examined the use of several different devices that were candidate structural cues and compared them across the cohorts in order to have a measure of how CTSL expresses reciprocity and symmetry, and how it has changed over the 50-year period that it has been developing. As explained in the introduction, spoken languages make use of syntactic and morphological strategies to encode reciprocity and symmetry in the argument structure. We coded the data for candidate morphological and syntactic devices in CTSL, which are as follows:

Temporal sequencing: Distributing information temporally across an utterance by sequentially signing each action performed/experienced by each character. For instance, in an utterance like "MAN-PUNCH / MAN-OTHER-GET.PUNCHED" (*Eng*., one man punches the other), the action "punch" that the agent performs (i.e., EVENT-1) and the outcome "get.punched" that the patient undergoes (i.e., EVENT-2) take place simultaneously in the stimulus item. However, it is a common tendency for signers to break such transitive

events into sub-events and sequentially sign them[33]. In other words, they distribute the temporal information across the entire utterance. We coded such utterances as temporally sequenced and distributed across the entire utterance.

Body segmentation: Allocating one side of the body for one of the characters and allocating the other side for the other character. The utterance of a CTSL signer for reciprocal "punch" is illustrated in Figure 26[34]. As is seen in the figure, right and left hands represent different animate characters; PERSON-1 and PERSON-2, respectively. The right side of the body and the right side of the signing space belong to PERSON-1, and the left side of the body and the left side of the signing space belong to PERSON-2. PERSON-1 punches towards left, indicating that s/he is punching PERSON-2; and PERSON-2 punches towards right, indicating that s/he is punching PERSON-1.

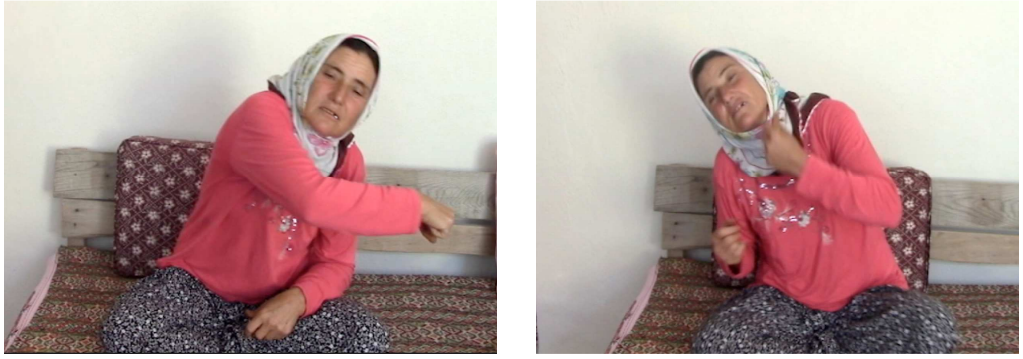


Figure 26: illustrates body segmentation for the reciprocal version of 'punch".

Referential use of space: Assigning abstract locations for characters as pronouns and referring back to those locations to clarify semantic roles. For instance, signers point to a location in the signing space for one of the characters, then point to another location in the signing space for the other character and they refer back to those locations to

[33] This tendency was referred to as SV/SV in Chapter 3.
[34] Please note that Figure 26 also exemplifies temporal sequencing.

express the relation between the two characters in the clips. Figure 27 illustrates the referential use of space.

a. WOMAN-1 b. Locus of WOMAN -1

c. WOMAN-2 d. Action by WOMAN-2

Figure 27: In Picture "a", the signer signs the word for "woman" with her left hand (i.e, PERSON-1). Then in Picture "b", she sets an abstract location for this character with the same hand. The open and flat hand shape in the vertical plane is a pronoun representing the first character. The signer preserves this hand shape and its location throughout the utterance. In Picture "c", she signs the word "woman" again with her right hand. By doing so, she introduces a new character to the scene (i.e, PERSON-2). Then, in Picture "d", right hand taps the left hand (PERSON-1 taps PERSON-2).

Mirroring: Signing with both hands in a mirror-image configuration in which both hands perform the same action on each other. For instance, while signing the symmetrical action "toasting", the CTSL signer in Figure 28 uses both hands in a mirror-image configuration. Flaherty et al. (2014) investigated this device in NSL and Nicaraguan homesign systems for reciprocal and symmetrical actions. Their results showed that all of

the NSL cohorts and homesigners used mirrored articulators exclusively for events involving a bidirectional action. In other words, they used this device only for reciprocal and symmetrical actions but not for transitive and intransitive actions.

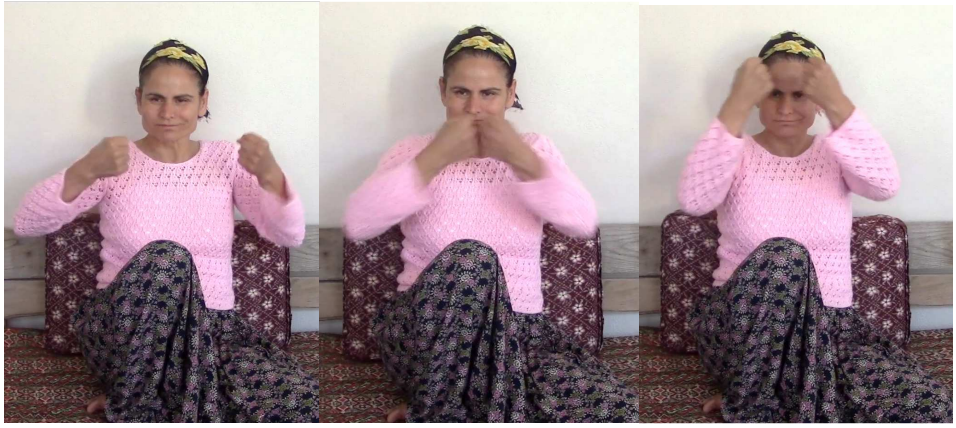


Figure 28 illustrates the mirror-image configuration in "toasting". Signer's fists represent the cups the characters in the video clips hold and toast.

Perspective: From whose perspective the action is signed (i.e., from agent's, from patient's or from both perspectives). Flaherty, Goldin-Meadow, Senghas, Coppola, and Gleitman (2013) investigated this device in NSL. For instance, to describe an event in which a man tickles a woman, NSL signers have a tendency to produce "MAN TICKLE, WOMAN GET-TICKLED"; therefore, they describe the reversible transitive events both from the agent's and the patient's perspective. NSL is not alone in expressing both perspectives. For example, English also has surface devices expressing the action performed by the agent and the effect of this action on the patient: e.g., in "John knocked Tom dead", John knocks Tom, and Tom becomes dead as a consequence. Following Flaherty et al. (2013), I coded the data for single and double perspective in order to have comparable data with NSL.

Use of a lexical marker: Using a specific lexical item to clarify the reciprocal and symmetrical relations between the characters (i.e., similar to the function of "each other" in English).

4.4. Results for CTSL:

946 responses ($n_{\_intransitive}$ = 255, $n_{\_reciprocal}$ = 190, $n_{\_symmetrical}$ = 137, $n_{\_transitive}$ = 364) were analyzed for candidate structural devices. The findings are as follows:

Temporal sequencing: CTSL signers distribute information temporally across their utterances by sequentially signing each action performed by each character in the contexts involving two characters performing intransitive (CTSL-1: 3%, CTSL-2: 21%, CTSL-3: 37%), transitive (CTSL-1: 13%, CTSL-2: 36%, CTSL-3: 39%) and reciprocal actions (CTSL-1: 13%, CTSL-2: 25%, CTSL-3: 33%), but not symmetrical actions (CTSL-1: 0%, CTSL-2: 0%, CTSL-3: 7%) (Figure 29).

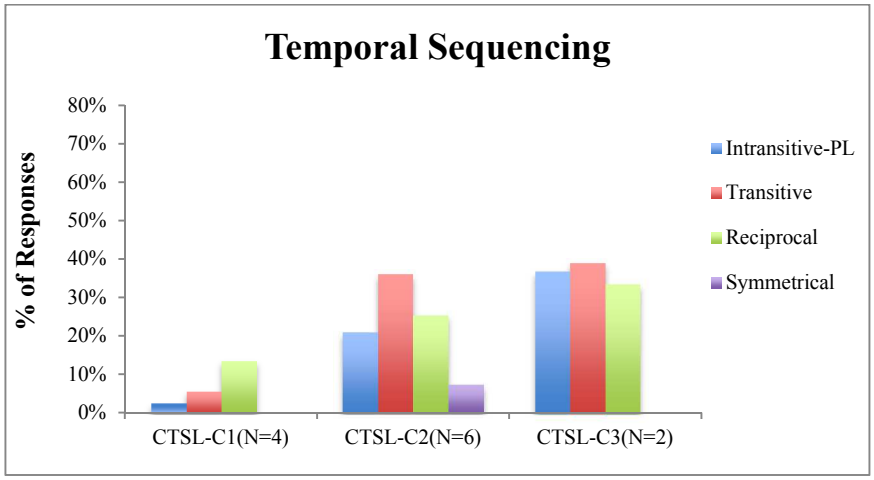
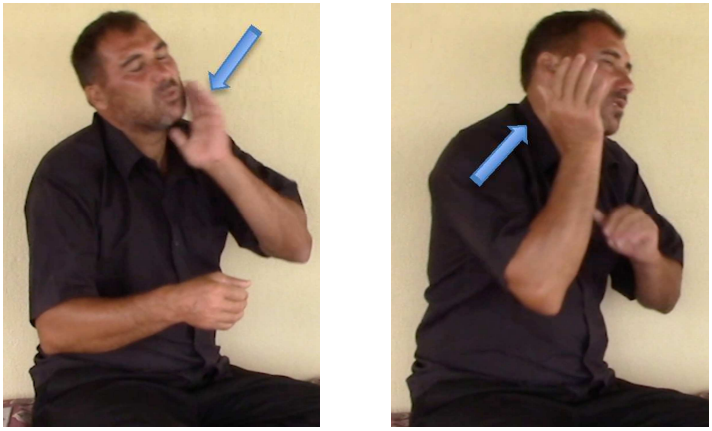


Figure 29 Overall proportion of temporal sequencing of actions across cohorts ($n_{\_total}$ =946, $n_{\_intransitive}$ = 255, $n_{\_transitive}$ = 364, $n_{\_reciprocal}$ = 190, $n_{\_symmetrical}$ = 137).

For example, a reciprocal *punch* subcategorizes the following sub-events: EVENT-1: There is an agent called MAN-1 who performs PUNCH-1 on MAN-2; and EVENT-2: There is an agent called MAN-2 who performs PUNCH-2 on MAN-1. In order to reliably convey this bidirectional relation, signers decompose the larger predicate (i.e., reciprocal punch) into its sub-events and express each action (i.e., PUNCH-1, PUNCH-2) performed *by* and *on* each character (i.e., MAN-1, MAN-2) in a serial order using multiple clauses (Figure 30). This is basically the same way of encoding reciprocity as in (6), the bi-clausal Cantonese example[35].



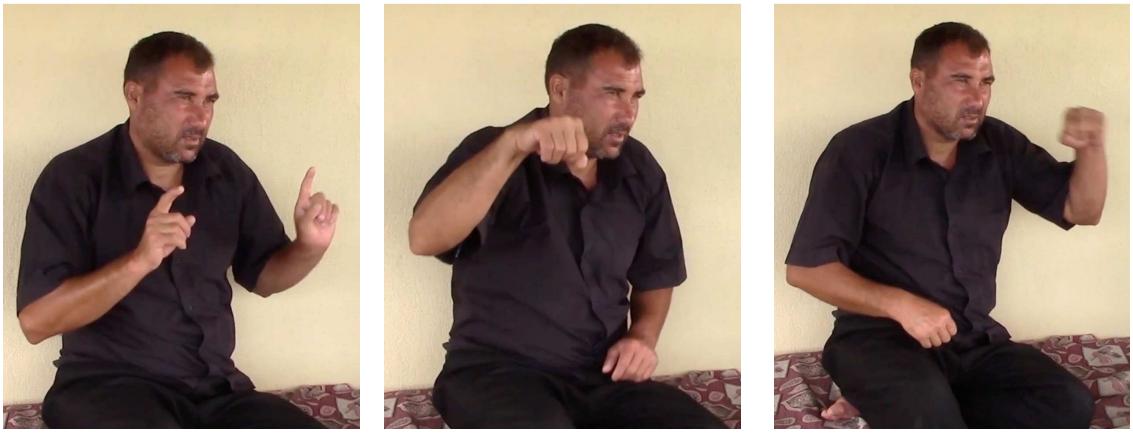
a. (MAN-1) PUNCH-1 b. (MAN-2) PUNCH-2

Figure 30: Reciprocal punch is illustrated. A CTSL-2 signer sequentially signs PUNCH-1 and PUNCH-2. Right hand represents MAN-1 and the left hand represents MAN-2.

CTSL signers temporally sequence PUNCH-1 and PUNCH-2 in plural intransitive constructions, too. However, rather than performing these actions on their own body, they punch towards camera in order to indicate that these actions do not have a recipient. As it is illustrated in Figure 31, PUNCH-1 and PUNCH-2 are sequentially signed and they are

[35] In reciprocal contexts and plural intransitive contexts, CSTL signers alternate between MAN-1 + PUNCH-1 / MAN-2 + PUNCH-2 (i.e., SV/SV order) and MAN-1 + MAN-2 + PUNCH-1 + PUNCH-2 (i.e., SSVV). With respect to verb compounding with repeated predicates, CTSL responses might be considered analogous to Mandarin example in (8) and Godie example in (9).

away from the body of the signer. In picture “a”, index fingers represent the plural subjects that perform the action side by side.



a. side by side b. (MAN-1) PUNCH-1 c. (MAN-2) PUNCH-2

Figure 31: Plural intransitive punch is illustrated. The same CTSL-2 signer sequentially signs PUNCH-1 and PUNCH-2. Right hand represents MAN-1 and the left hand represents MAN-2. Picture “a” describes the placement of these characters in the scene.

Temporal sequencing is also used for reversible transitive events because they also have decomposable sub-events (i.e., MAN-1 + PUNCH / MAN-2 + GET PUNCHED). As discussed in Chapter 3, CSTL signers display a tendency to sequence the agent and the patient in an SV/SV construction so as to mitigate possible confusion about the semantic roles of two animate characters.

Temporal sequencing is almost absent in CTSL-1 (Figure 29). This finding is as expected because the results in the previous chapter showed that serial verb constructions (i.e., SV/SV utterances) for transitive events start to emerge as of CTSL-2. Figure 29 displays a similar pattern to the findings in Chapter 3 in that temporal sequencing for reciprocal events mainly starts as of CTSL-2 and becomes slightly more systematic in in CTSL-3 for all action types.

For a symmetrical action like *shaking hands*, temporal sequencing is not a tendency because symmetrical actions require "necessarily" simultaneous participation of the arguments in the event. In other words, a sequential *shaking hands* is not a logical possibility as this event cannot be temporally decomposed. Therefore, it is not realized sequentially on the surface structure of CTSL (Figure 29). A reciprocal action, on the other hand, can be temporally decomposed irrespective of taking place simultaneously or sequentially in the real world. Thus, CTSL responses for reciprocal events are more frequently marked with temporal sequencing whereas symmetrical actions are almost never marked with this device.

Referential Use of Space: Irrespective of the action type, when two characters of the same semantic category are involved in the event structure, the use of space to disambiguate the semantic roles of the characters turns into a systematic strategy across cohorts over time (Figure 32).

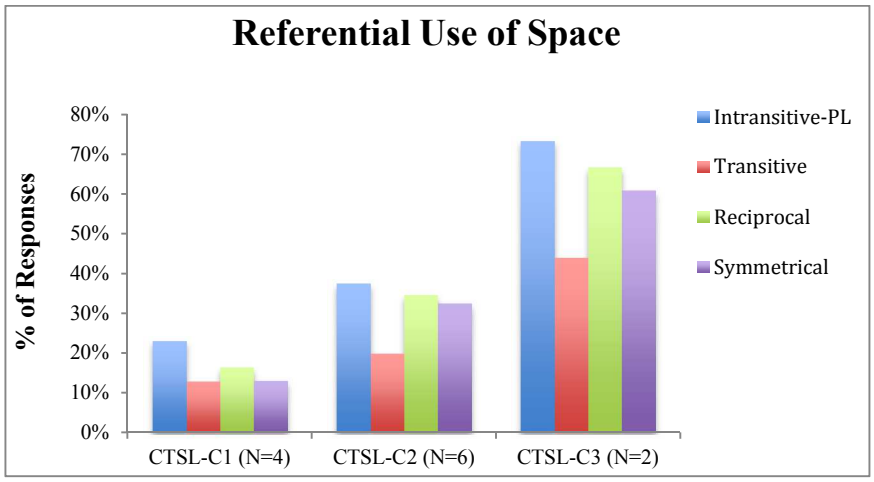


Figure 32 Overall proportion of use of space across cohorts (n_{total} =946, $n_{intransitive}$ = 255, $n_{transitive}$ = 364, $n_{reciprocal}$ = 190, $n_{symmetrical}$ = 137).

In line with the findings in Chapter 3, referential use of space develops gradually. It is not a general tendency in CTSL-1. It becomes moderately systematic in CTSL-2; then it becomes fairly systematic in CTSL-3. As discussed in the previous chapter, it takes time to abandon relying on the iconicity of the body as a subject and to transfer the argument structure of an event on an abstract setting in the signing space. Thus, the results for referential use of space in this study successfully replicate the results in Chapter 3.

Note that the high variability in CTSL-3 is because of the number of participants, which is only 2, and one of them is a more fluent TID signer. Thus, she has a tendency to use space more effectively.

Figure 32 shows that space is used referentially in all action types that basically involve multiple characters from the same semantic category. Therefore, there is no suggestive evidence regarding the status of this device as a marker of reciprocity or symmetry.

Body segmentation: Reciprocal (CTSL-1: 49%, CTSL-2: 64%, CTSL-3: 64%) and symmetrical (CTSL-1: 57%, CTSL-2: 57%, CTSL-3: 52%) actions come to be frequently marked by body segmentation. In other words, one side of the body is allocated for one of the characters and the other side is allocated for the other character (illustrated in Figures 30 and 31) in order to express the binary relation in these event types. The use of this device becomes slightly more conventionalized over cohorts especially for reciprocal actions (Figure 33).

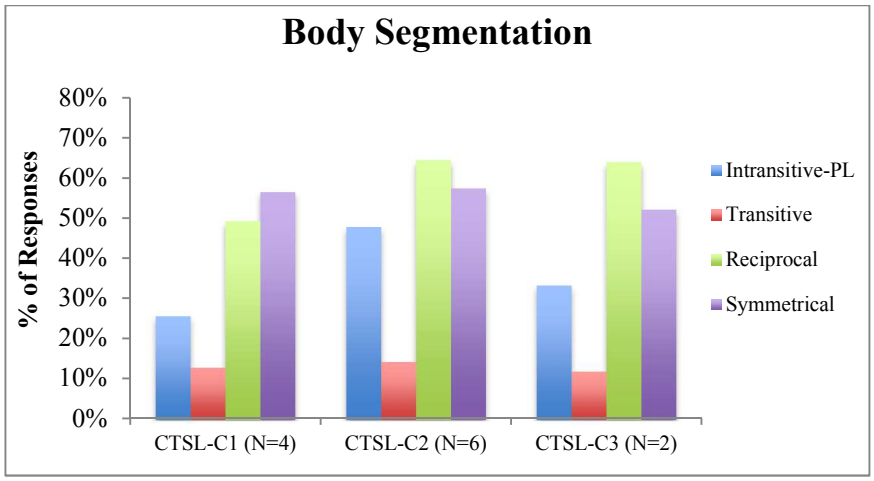


Figure 33 Overall proportion of body segmentation across cohorts ($n_{\_total}$ =946, $n_{\_intransitive}$ = 255, $n_{\_transitive}$ = 364, $n_{\_reciprocal}$ = 190, $n_{\_symmetrical}$ = 137).

This device is rarely used for transitive actions (CTSL-1: 13%, CTSL-2: 14%, CTSL-3: 12%). As shown in Figure 29, transitive actions are marked by temporal sequencing rather than body segmentation.

Figure 33 shows that signers make use of body segmentation also for plural intransitives (i.e., two animate characters performing the same action side by side without acting upon each other; CTSL-1: 26%, CTSL-2: 48%, CTSL-3: 33%). These events do not involve symmetry; however, they involve coordinated individual actions performed by two animate characters performing in a parallel configuration (e.g., two men, standing side by side, punch towards camera). Thus, it is not surprising to see that signers use right and left hands to represent different characters (see Figure 31). Note that signers differentiate between the plural intransitive actions and reciprocal/symmetrical actions by mirrored articulators, which will be discussed along with Figure 34.

A surprising finding in Figure 33 is that body segmentation[36] is strong both for reciprocal and symmetrical actions from the very beginning (i.e., as of CSTL-1). So far we have observed incremental development of regularities in CSTL structure and interpreted these findings as the gradual emergence of linguistic structure over time. The fact that body segmentation is strong from the very beginning implies that this is a device might be produced on the fly with no requirement of a developmental inftrastructure. The iconic nature of (especially young) signed systems may have a role in this strong tendency as of CTSL-1.

Mirroring: Signing the events sequentially or simultaneously with both hands in a mirror-image configuration is often used for reciprocal (CTSL-1: 39%, CTSL-2: 61%, CTSL-3: 64%) and symmetrical (CTSL-1: 59%, CTSL-2: 52%, CTSL-3: 52%) actions, but not for intransitive and transitive actions (Figure 34). These findings are in line with NSL results (cf. Flaherty et al., 2014).

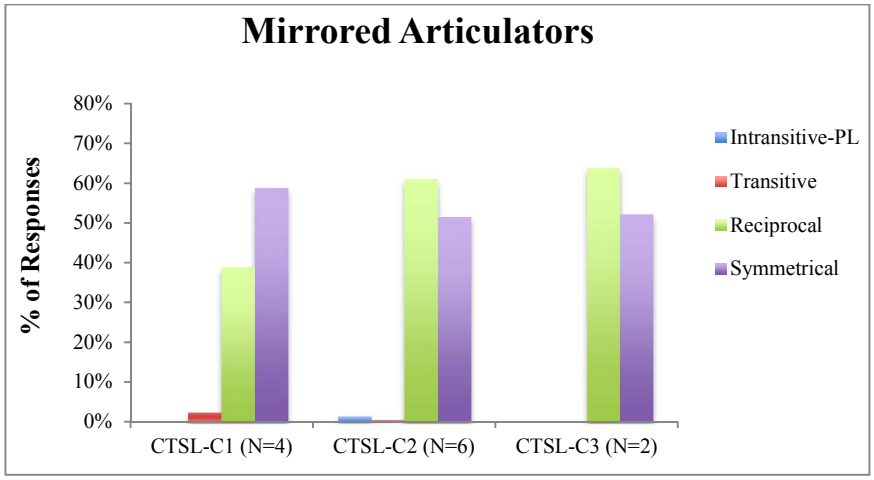


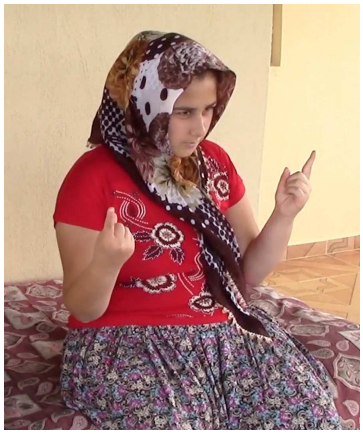
Figure 34 Overall proportion of mirrored articulators across cohorts (n_{total} =946, $n_{intransitive}$ = 255, $n_{transitive}$ = 364, $n_{reciprocal}$ = 190, $n_{symmetrical}$ = 137).

[36] Two of the actions in our stimulus set (i.e., *folk dance* and *hug*) are actions that involve both sides of a single body (e.g., two-hands). Therefore, it is not possible to segment the body for these actions due to physical affordances of a signed system.

The reason for the use of mirrored articulators only in reciprocal and symmetrical actions is because these events involve symmetry, but intransitive and transitive actions do not. It is the mirror-image configuration that marks the identical participation of the characters in reciprocal and symmetrical events.

Similar to the pattern in the use of body segmentation, this device is also strong from the very beginning, as of CTSL-1, especially for symmetrical actions. Reciprocal actions seem to become slightly more conventionalized over time in terms of mirrored articulators, but the strong tendency in symmetrical actions remains pretty much the same across cohorts. This might be, again, an outcome of the iconic nature of the signed systems that allows the mimetic descriptions of the perceived events.

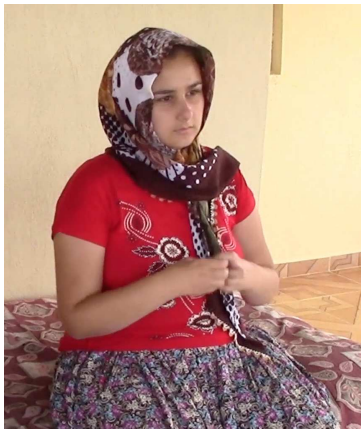
All in all, mirror-image configuration is a distinctive function that separates the reciprocal and symmetrical action from plural intransitives. Remember that body segmentation is used for all three of these groups (Figure 33). It reliably conveys the message in plural intransitives. For reciprocal and symmetrical actions, on the other hand, body segmentation alone cannot reliably convey the bidirectional nature of these events. It has to co-occur with (simultaneous or sequential) mirrored articulators so that the addressee can comprehend that it is a joint action of two characters who act on each other and switch between the agent-patient roles.



a. Setting the subjects (side by side)

b. Both subjects raise their cups

c. Setting the subjects (side by side)



d. Subjects toast their cups

Figure 35 illustrates the contrast between the plural intransitive and symmetrical versions of *toasting*. In picture "b", right and left hand of the signer represent different characters. They both independently raise cups in a parallel configuration without acting on each other. In picture "d", right and left hands, again represent different characters and they act on each other in a mirror-image configuration to express the symmetry involved in the event.

<u>*Perspective*</u>: CTSL signers sign an event from the perspective of both characters (Figure 36) in the contexts involving two human characters performing intransitive (CTSL-1: 33%, CTSL-2: 72%, CTSL-3: 73%), reciprocal (CTSL-1: 42%, CTSL-2: 78%, CTSL-3: 97%) and symmetrical actions (CTSL-1: 57%, CTSL-2: 60%, CTSL-3: 61%), but not in reversible transitive actions (CTSL-1: 22%, CTSL-2: 49%, CTSL-3: 14%). Double perspective follows an increasing developmental path for plural intransitives and reciprocals whereas it remains stable across cohorts for symmetrical actions.

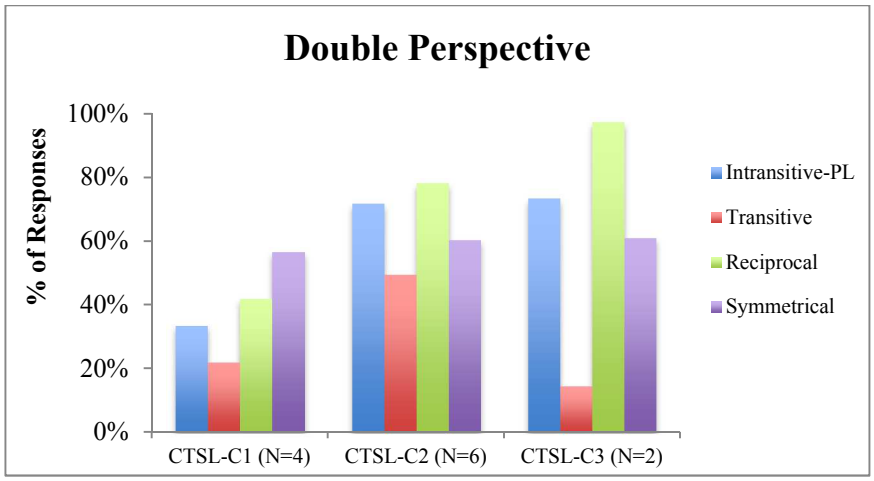


Figure 36 Overall proportion of double perspective in the entire task. All of the events involve two animate characters ($n_{\_total}$ =946, $n_{\_intransitive}$ = 255, , $n_{\_transitive}$ = 140, $n_{\_reciprocal}$ = 190, $n_{\_symmetrical}$ = 137).

Double perspective may be represented simultaneously or sequentially. For instance, in a serial verb construction (i.e., SV/SV), each perspective is expressed sequentially. In a body-segmented utterance, both perspectives may be expressed either sequentially or simultaneously. Figure 30 and 31 illustrate sequential double perspectives in reciprocal and plural intransitive contexts, respectively. Figure 35-b and 35-d illustrate simultaneous double perspective in plural intransitive and symmetrical contexts, respectively.

Figure 36 shows that CTSL signers are fairly systematic in expressing what each character is performing and/or undergoing in plural intransitive, reciprocal and symmetrical contexts. However, this tendency drops in reversible transitive contexts in CTSL-1 and CTSL-3. In line with the findings in Chapter 3, expressing double perspectives in a serial verb construction (i.e., SV/SV) is a general tendency in CTSL-2, but not that common in CTSL-1 and CTSL-3.

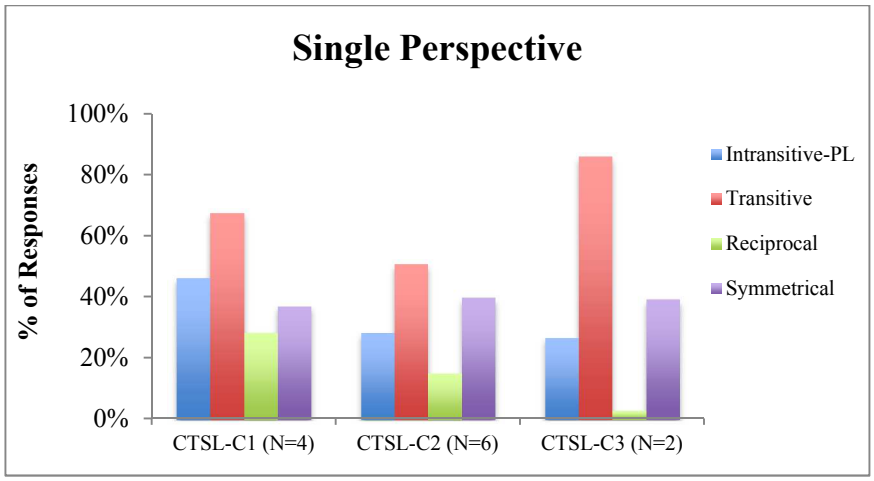
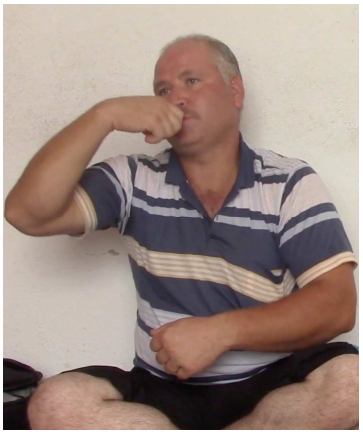


Figure 37 Overall proportion of single perspective in the entire task. All of the events involve two animate characters ($n_{\_total}$ =946, $n_{\_intransitive}$ = 255, $n_{\_transitive}$ = 140, $n_{\_reciprocal}$ = 190, $n_{\_symmetrical}$ = 137).

Flaherty et al. (2013) report that NSL signers make a preference for double perspectives in reversible transitive contexts in an SV/SV or SSVV construction. CTSL signers diverge from NSL signers in that they mainly prefer single perspective in reversible transitive events (Figure 37). Remember from Chapter 3, CTSL-1 signers do not have a consistent strategy to reliably disambiguate argument in reversible transitive contexts. CTSL-2 signers make a preference for serial verb constructions by allocating only one animate character per action; therefore, they have a higher tendency for expressing both perspectives in reversible transitive constructions. CTSL-3 signers either use space referentially or they identify themselves with one of the animate characters rather than expressing both perspectives in a serial verb construction. In brief, CTSL-1 and CTSL-3 signers have a higher single perspective bias and they generally convey the message from the agent's perspective: CTSL-1: 50%, CTSL-2: 33%, CTSL-3: 62%. However, some signers have a tendency for associating themselves with a character that is compatible with their age and gender. In those cases, they also identify themselves with the patient. : CTSL-1: 17%, CTSL-2: 18%, CTSL-3: 24%.

a. Agent's perspective



b. Patient's perspective

Figure 38: A CTSL-2 signer (Picture a) describes "Woman feed man" from the agent's perspective by associating herself with the female character. Another CTSL-2 signer (Picture b) describes the same event from patient's perspective by associating himself with the male character.

A possible explanation for the tendency of the signers to identify themselves with the agent more frequently than the patient may be the practicality of iconic mechanisms that allow signers to use their own body as a subject. The bias for associating oneself with the semantically high-position character drastically drops in reciprocal events, probably because there is not an asymmetry between the animate characters and each character gets to be both in the high and low positions. Instead, CTSL signers express the perspectives of both characters in an event involving a reciprocal action.

Furthermore, in contrast to the increasing pattern for reciprocal actions in Figure 36, there is a decreasing pattern in Figure 37, which presents evidence for the conventionalization of double perspective as a differential marker of the reciprocal actions.

Notice that single perspective for symmetrical actions is not infrequent in Figure 37 (CTSL-1: 37%, CTSL-2: 40%, CTSL-3: 39%). These numbers show that a symmetrical event can alternatively be expressed from a single perspective while a reciprocal event has to be expressed from double perspective. As explained in the

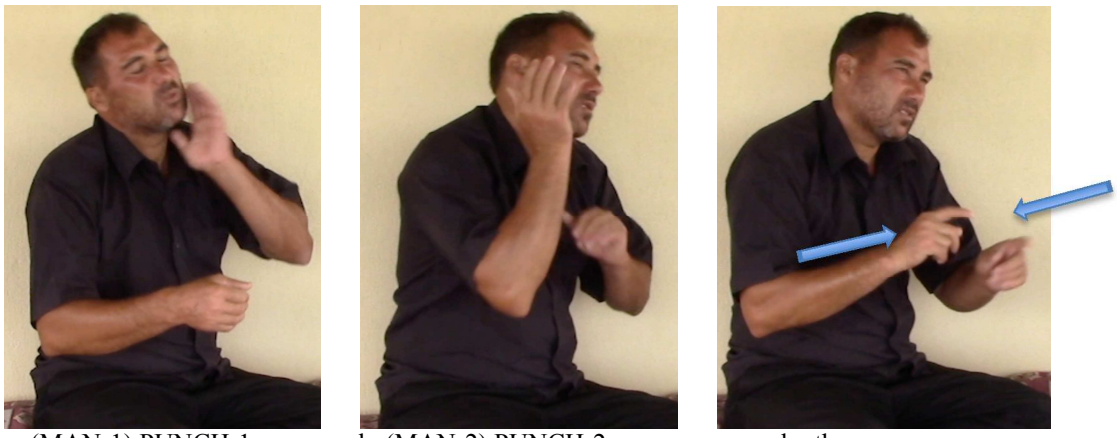
introduction, a symmetrical action like *shaking hands* necessarily requires the identical participation of another party, whereas an action like *punch* may appear in unidirectional contexts as well as bidirectional ones. Unless the semantic role of the second character in a reciprocal punch context is expressed through body segmentation, mirroring and/or temporal sequencing, it is not possible for the addressee to rule out the unidirectional possibility. However, even if a symmetrical action like *shaking hands* is expressed from single perspective without explicit articulation of the second character (Figure 39), the addressee can still make precise predictions about the identical involvement of a second character[37].

a. Double perspective b. Single perspective

Figure 39: A CTSL-2 signer describes "Two men shake hands" from double perspective (Picture a). A CTSL-3 signer describes the same event from a single perspective (Picture b).

<u>*Use of a lexical marker*</u>: Similar to the use of a nominal or an adverbial denoting reciprocity or symmetry in spoken languages (e.g., "each other" in English), some of the CTSL signers use idiosyncratic special signs in order to express the binary relation in reciprocal and symmetrical events. One such sign is "each other" (Figure 40).

[37] Future directions: Symmetrical actions should be tested in contexts involving animate characters from different semantic categories (e.g., a man handshaking with a dog) to see if signers would still rely on single perspective.



a. (MAN-1) PUNCH-1 b. (MAN-2) PUNCH-2 c. each other

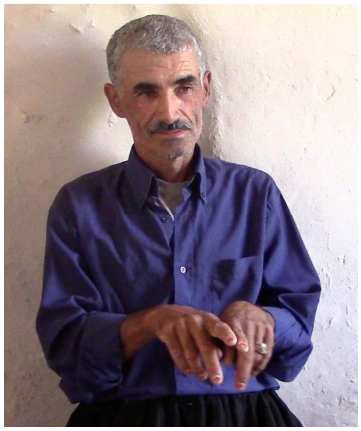
Figure 40 illustrates one of the signs for "each other" in reciprocal events. Arrows in picture "c" indicate that index fingers are moving towards each other.

In Figure 40-a, a CTSL-2 signer is describing MAN-1 performing PUNCH-1 on MAN-2. In 40-b, he is describing MAN-2 performing PUNCH-2 on MAN-1. In 40-c, the signer is producing his own sign for "each other". His index fingers, representing the human characters in the event, move towards each other to clarify bidirectional nature of a reciprocal event. Note that this sign cannot be generalized across other CTSL signers. Each signer has his/her own special signs denoting binary relations in a reciprocal and/or symmetrical event. Deaf members from the same household have a tendency to share similar signs; however, other deaf members of the community may use different signs, or often times they do not use a lexical item at all. Some of the other lexical markers are illustrated below:

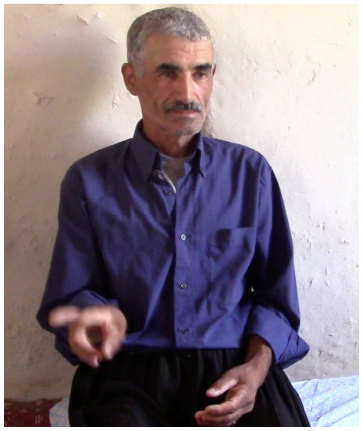
a. each other

b.facing each other

c. facing each other



d. together



e. side by side

f. side by side

Figure 41 illustrates various lexical markers produced by the CTSL signers.

Figure 41-a illustrates a different version of "each other". Right and left hands cross each other as opposed to moving towards each other in Figure 40-c. Figures 41-b and 41-c both illustrate lexical items corresponding to "facing each other". 41-b represents a single perspective whereas 41-c represents double perspectives (each hand stand for one of the characters involved in the event and they face each other). Figure 41-d shows a lexical item denoting that the event involves a joint action. In 41-e, the index and middle fingers are selected to express the number of the characters involved in the event, and this handshape is used in a repetitive movement from right to left to show that

these two characters are located side by side. Despite referring to the same meaning, 41-f, on the other hand, does not involve a repetitive movement. The index fingers represent human characters standing side by side.

Figure 42 shows that the use of a lexical marker is not a common tendency in CTSL community (i.e., 68 out of 255 in plural intransitive, 3 out of 140 in transitive, 42 out of 190 in reciprocal and 17 out of 137 symmetrical contexts). Among limited number of utterances involving a lexical marker, "each other", "facing each other" and "together" are frequently used in reciprocal and symmetrical events. "Together" is rarely used in plural intransitives, too. This is possibly because there are multiple characters performing the same action. Variations of "side by side" are generally used for plural intransitives. Surprisingly signers also use "side by side" in events involving symmetry, but the number of occurrences of this lexical item in reciprocal and symmetrical events is low.

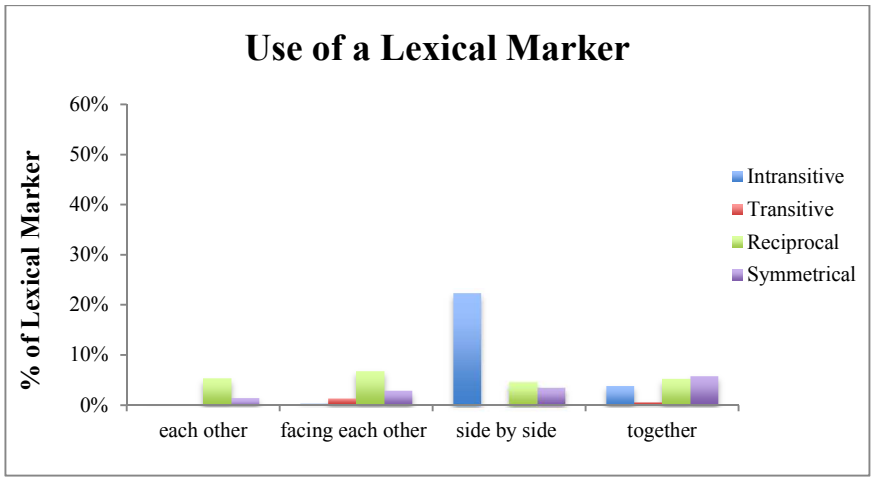


Figure 42 Overall proportion of lexical markers in the entire task. All of the events involve two animate characters ($n_{\_total}$ =722, $n_{\_intransitive}$ = 255, $n_{\_transitive}$ = 140, $n_{\_reciprocal}$ = 190, $n_{\_symmetrical}$ = 137).

Note that a lexical marker alone is not sufficient to get the message across. Signers rarely use these markers alone without using any of the devices investigated in this study. Only 6 out of 190 reciprocal utterances conveyed the message with a lexical

marker (i.e., either “together”, or “facing each other”) alone. 3 out of 137 symmetrical utterances involved none of the other devices except for the lexical marker “together”. 5 out of 255 plural intransitive utterances conveyed the message only with “side by side” or “together”.

Interim summary and discussion:

In this study, the devices that carry the load of marking for different verb classes are as follows: a) Temporal sequencing shows that there are multiple events; b) body segmentation indicates that there are multiple characters; c) referential use of space help the addressee understand how these characters are placed in the scene; d) mirrored articulators tell whether or not these character act on each other/identically participate in the event; e) perspective clarifies who the agent/patient is, and f) a lexical marker consolidates the reciprocity and symmetry.

The results of this study indicate that, *first*, reciprocal and symmetrical actions differ from transitive actions in that the transitive actions do not use body segmentation and mirrored articulators and, they are expressed from a single perspective whereas reciprocal and symmetrical actions are body segmented, mirrored and expressed from double perspectives. *Second*, reciprocal and symmetrical actions differ from plural intransitives by mirror-image configuration. *Third*, a reciprocal action differs from a symmetrical action in that the former is temporally sequenced whereas the latter is not. *Fourth*, space is used in any context involving multiple characters of the same semantic category and it becomes more conventionalized over time. However, it is not a differential marker for reciprocity/symmetry. *Fifth*, a lexical marker is not necessarily the

essential component to encode symmetry but it consolidates the symmetry involved in a reciprocal or symmetrical event. *Finally*, high variability in the use of all of the devices indicated by error bars in the graphs indicates that the structure of CTSL is not yet completely stable across cohorts and within the members of the same cohort.

Table 12: Summary of the Results for CTSL

Device	Intransitive-PL	Transitive	Reciprocal	Symmetrical
Temporal Sequencing	□	□	□	■
Body Segmentation	□	■	□	□
Mirroring	■	■	□	□
Referential Use of Space	□	□ / ■	□	□
Perspective	Double	Single	Double	Double/Single

In addition, tendency for temporal sequencing, referential use of space and expressing from a single/double perspective are not strong from the very beginning but they develop over time. Body segmentation and mirrored articulators, on the other hand, are strong as of CTSL-1. This might be a consequence of the iconicity that signed systems lend themselves to.

Lastly, in a single reciprocal or symmetrical utterance, signers may use only one of these devices, or they may use several of them together (e.g., a mirrored configuration has to entail body segmentation). By doing so, rather than merely compressing arguments into simpler successive clauses and saying what each person is doing, CTSL signers simultaneously express the symmetry and reciprocity. In addition, a lexical marker alone may unambiguously convey the symmetry in some spoken languages (e.g., English).

However, a lexical marker in CTSL alone is not sufficient to get the message across. Signers use other devices along with a lexical marker.

4.5. Results for Turkish:

1093 Turkish responses were analyzed. The results show that Turkish handles the clarification of semantic roles in bidirectional contexts with a nominal/adverbial and/or with a morphological marker (see Table 13).

Table 13: Summary of the Results for the morphological marker in Turkish

Event type	**# of responses**	**Proportion of –(I)ş**	**Use of a lexical marker**
Intransitive-PL	297	0%	61%
Transitive	425	0%	2%
Reciprocal	196	26%	67%
Symmetrical	175	32%	33%

Reciprocal and symmetrical events make use of the bound morpheme –(I)ş[38] to express bidirectionality in Turkish. The use of this marker is not observed in plural intransitive and transitive events. The binary relation in reciprocal and symmetrical contexts can also be expressed syntactically with a lexical marker. 67% of the reciprocal responses involve a lexical marker, but it is only 33% in symmetrical actions (Table 13). Among the lexical markers that Turkish speakers used in the entire task (Figure 43), the case-marked version of "birbiri" (*Eng*. "each other") is specifically reserved for reciprocal events (55%) –the case assignment on this lexical item varies depending on the semantic properties of the verb. This lexical item is less frequently used in symmetrical

[38] The vowel in this morpheme is subject to vowel harmony rules and it has to agree with the preceding vowel, or it may be omitted when attached to a word ending in a vowel.

events (10%). “Karşılıklı” (*Eng*. facing each other) is the second most common lexical marker used in reciprocal events (12%). It is rarely used in symmetrical events (2%).

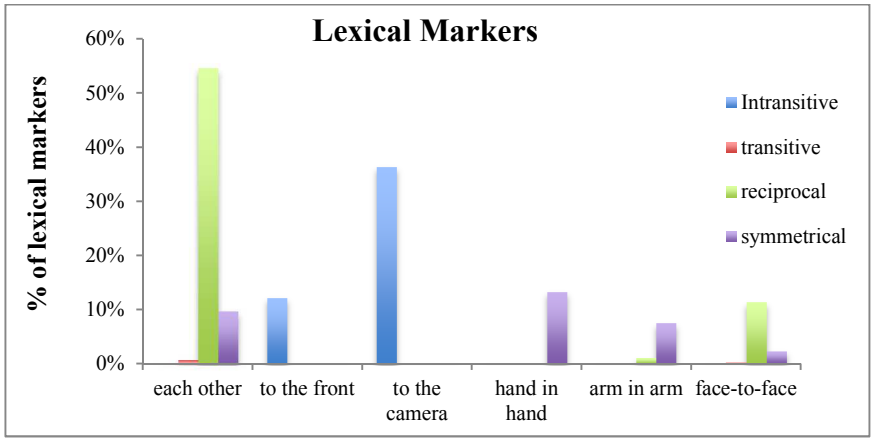


Figure 43 The distribution of a lexical marker in Turkish

In addition to “each other”, symmetrical events elicited “hand in hand” (13%) and “arm in arm” (7%), and plural intransitives elicited “to the camera” (36%) and “to the front” (12%). These lexical items are specific to the stimulus items used in this study. Speakers used them to describe that the action in the stimulus was performed to the camera without a recipient so that the addressee could eliminate the reciprocal and symmetrical alternatives.

CTSL and Turkish display similar tendencies about the use of “each other”. Both of the systems use it more frequently in reciprocal actions, and less frequently in symmetrical actions. This is probably because, *first*, a symmetrical verb inherently expresses the binary relation and does not need to be supplemented with a lexical item; *second*, symmetrical actions do not involve the reversibility problem. Thus, reciprocal events possibly require additional devices to be unambiguously expressed in both systems.

Furthermore, symmetrical actions use the bound morpheme –(I)ş more often than the reciprocal actions do (32% vs. 26%, respectively). Turkish speakers seem to encode bidirectionality in reciprocal events syntactically whereas they express it morphologically, or possibly based on the semantic properties of the verb, in symmetrical events. This is partly true for CTSL, too. For reciprocal actions, CTSL signers use a syntactic strategy (i.e., temporal sequencing) along with morphological strategies (i.e., body segmentation and mirrored articulators). Symmetrical actions, on the other hand, express the binary relation at a morphological level without using serial verb constructions.

4.6. Results for Family Sign:

66 responses were analyzed. The results are as follows:

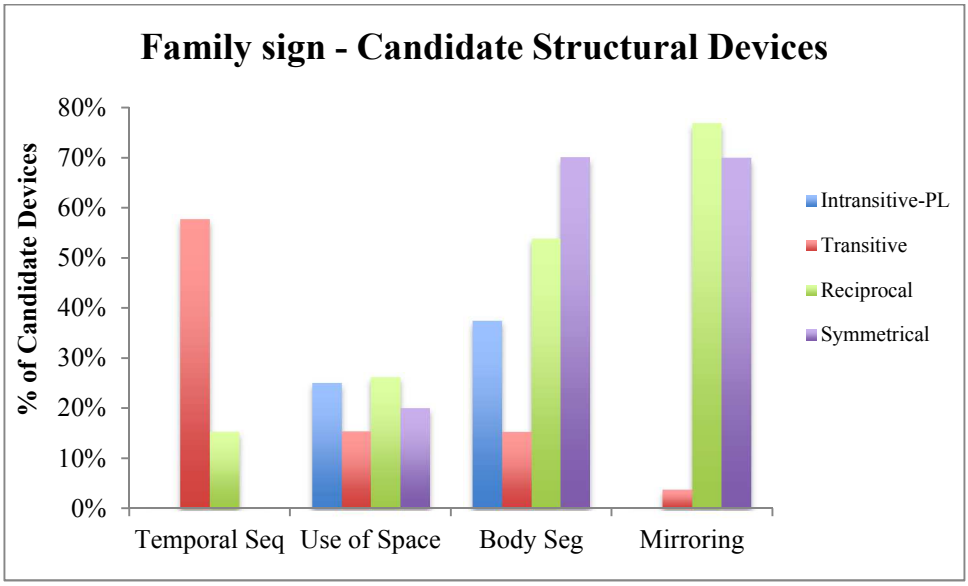


Figure 44 The distribution of candidate devices in family sign system ($n_{\_total}$ =66, $n_{\_intransitive}$ = 31, $n_{\_transitive}$ = 12, $n_{\_reciprocal}$ = 13, $n_{\_symmetrical}$ = 10).

Some of the results for the family sign data display similar patterns to the ones observed in CTSL, and some of them do not. In terms of temporal sequencing in reversible transitive events, CTSL and this particular family sign system behave similarly. However, CTSL makes use of temporal sequencing also in plural intransitive and reciprocal contexts, whereas this family sign system uses it rarely in reciprocals and never in plural intransitive events.

In terms of referential use of space, this family sign system is similar to CTSL-1. The low proportions for the use of this device indicate that using space referentially is not a strongly preferred strategy by this family signer. Previous literature (and CTSL data in chapter 3) on the use of space to encode argument structure has proved that new systems do not readily incorporate space into their grammar (e.g., Padden et al., 2010). This family signer apparently has not developed a spatial verb agreement system yet.

Therefore, space is not a differential marker of symmetry in reciprocal and symmetrical events.

Just as CTSL signers do, the family signer frequently uses body segmentation and mirroring in reciprocal and symmetrical events. He is basically relying on these two devices to separate reciprocal and symmetrical events from transitive and intransitive actions. As is observed in CTSL, the use of these two devices for encoding symmetry is strong from the beginning in the family sign system, too. These consistent findings imply that mirroring and body segmentation emerge easily in young signed systems.

Furthermore, the family signer uses double perspective for all of the actions types (Figure 45). In CTSL, on the other hand, double perspective is reserved for plural intransitive, reciprocal and symmetrical events, but not for reversible transitive events (except in SV/SV constructions).

Thus, despite playing a role in CTSL, there is no suggestive evidence in this family sign system for the use of perspective as a differential marker of a specific verb class.

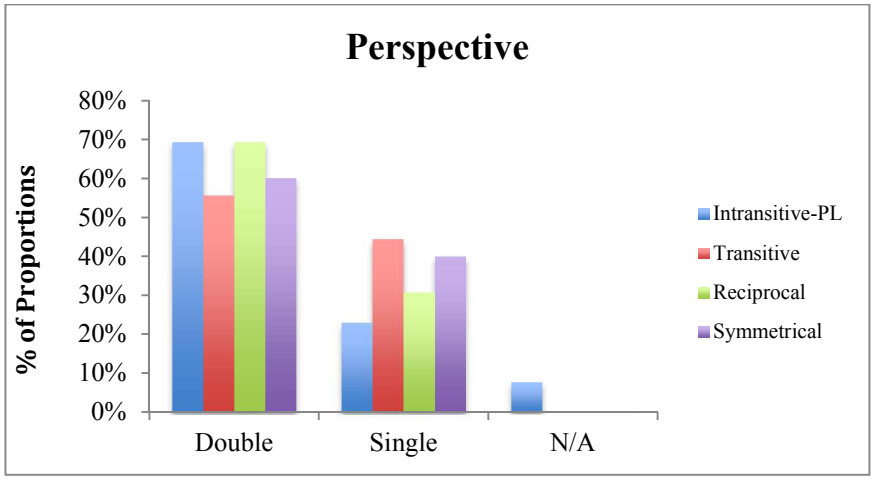


Figure 45 The distribution of perspective in homesign system (n_{total} =66, $n_{intransitive}$ = 31, $n_{transitive}$ = 12, $n_{reciprocal}$ = 13, $n_{symmetrical}$ = 10).

Finally, similar to CTSL signers, the family signer also uses lexical markers denoting different relations. Some of the lexical items are illustrated in Figure 46:

a. facing each other b.to each other

c. together d. side by side f. side by side

Figure 46 illustrates various lexical markers produced by the family signer.

He uses the lexical marker in 46-a for reciprocal actions. Right and left hands represent each character in the event. 46-b is a variation of 46-a. The repetitive movement of hands in 46-b tells that it is a reciprocated event between two parties. The lexical item in 46-c signals a joint action. The signs in 46-e and 46-f are the variations of "side by side".

Figure 47 shows that use of a lexical marker is not very common in this family sign system. Therefore, it is not possible to make claims about the status of a lexical marker as a distinctive marker symmetry in reciprocal and symmetrical events.

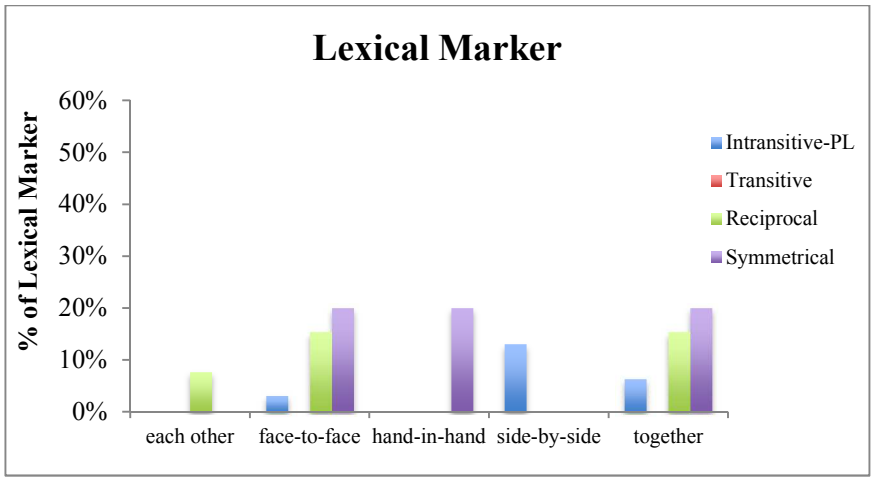


Figure 47 Distribution of the lexical marker in the family sign system

All in all, *first*, temporal sequencing is reserved for reversible transitive actions in this family sign system. *Second*, mirrored articulators and body segmentation are used both for reciprocal and symmetrical actions. This is how reciprocal and symmetrical actions differ from transitive actions. However, there is not a systematic marking strategy that separates symmetricals from reciprocals. *Third*, use of space and perspective are not distinctive markers of any of the verb classes (see Table 14). *Finally*, a lexical marker is helpful in limited number of responses.

Table 14: Summary of the Results for Family sign

Device	Intransitive	Transitive	Reciprocal	Symmetrical
Temporal Sequencing	▯	▯	▯ / ▯	▯
Body Segmentation	▯	▯	▯	▯
Mirroring	▯	▯	▯	▯
Referential Use of Space	▯ / ▯	▯ / ▯	▯ / ▯	▯ / ▯
Perspective	Double	Double/Single	Double	Double/Single

As a final note, this family sign system differs from CTSL in that CTSL-2 and CSTL-3 signers differentiate between reciprocal and symmetrical events by temporal sequencing (i.e., reciprocal events are temporally sequenced while symmetrical events are not). CTSL-1 signers have a lower tendency such this distinction. Like CTSL-1 signers, this family signer does not have a specific device exclusively reserved for reciprocal actions. Furthermore, this family signer uses double perspective for all of the event types including transitive events. This is possibly because he relies on serial verb constructions more often and produces what each individual is doing, rather than holistically and distinctively expressing the event structures of each verb class.

4.7. Summary and discussion:

To summarize, this study has revealed the roots of linguistic organization for different verb classes and the incremental development of these verb classes in a very young language. These findings present evidence for how a brand-new system incrementally converges on distinctive shared devices that differentiate between verb classes in a systematic way. The conceptual differences in *symmetric*, *asymmetric* and *non-symmetric* events are reflected on the surface structure of CTSL, whereas they are not entirely reflected in a family sign system.

The greatest challenge to CTSL structure posed in this chapter was the double and equal semantic roles of the characters involved in the event, which made the investigation interesting. In Chapter 3, serial verb constructions (i.e., SV/SV) helped convey the message unambiguously in reversible transitive events. In reciprocal events, breaking down the event into SV/SV/SV/SV might have been a solution produced by CTSL

signers. However, in such a serial verb construction, coherence of the sub-events and the hierarchy in the semantic roles of the arguments in each sub-event may become vulnerable to meaning loss. The results of this study show that CTSL signers found other ways to segmenting reciprocal events. They still divide them but instead of doing it temporally, they segment the event morphologically, for instance, by using one side of their bodies for one of the characters, and the other side for the other character. By doing do, CTSL signers link multiple arguments to a single event with a holistic mechanism enriched by various devices (i.e., mirrored articulators, use of space, single/double perspective and lexical marker).

CHAPTER 5

MORPHOLOGICAL PROPERTIES OF CTSL

5.1. Introduction

Previous studies on language typology have revealed many similar patterns across spoken languages. One of the widely accepted linguistic universals across spoken languages is the distinction they make between nouns and verbs (e.g., Robins, 1952; Sapir, 1921). The universal status of this distinction continues to be unchallenged (e.g., Givón, 1979; Hawkins, 1988; Hopper & Thompson, 1984; Schachter, 1985; Thompson, 1989). For a pattern to be generalized as a linguistic universal, it must be far too common across natural languages to be an outcome of a coincidence. Therefore, if the distinction between nouns and verbs is uncontested, then it should be realized in signed systems as well. Not surprisingly, Supalla and Newport (1977) present evidence for such a distinction in American Sign Language (ASL) based on sign movement: Nouns in ASL are produced through a reduplication process of the same movement whereas predicates do not exhibit this repetitive movement. In addition, Brentari, Coppola, Jung, and Goldin-Meadow (2013) report that noun-verb distinction is one of the acquisition milestones, and deaf children acquiring ASL systematically distinguish between these two word classes as of age four by using distinct hand shape classifiers for each category. In brief, previous

studies suggest that the noun-verb distinction is present not only in spoken but also in sign languages.

In order to investigate the distinction between nouns and verbs, previous studies on various sign languages have focused on reference to objects in agentive/non-agentive contexts. This is because such an opposition is fundamental to semantic and syntactic structure, and it has a long history in linguistic theory (e.g., Pustejovsky, 1991).

One of the important parameters marking semantic and syntactic structure in sign languages is handshape classifiers. Two of the frequently used handshape classifier types in sign languages are *object handshapes* (OHSs), which represent the class, size, or shape of objects, and *handling handshapes* (HHSs), which represent how objects are handled or manipulated. The difference between the two is illustrated in Table 15.

Table 15 Examples for OHSs and HHSs

Object-HSs	Handling-HSs
1. A flat object (e.g., book) 	1. Handling a flat object (e.g., book) 
2. Small round object (e.g., coin) 	2. Handling a small object (e.g., coin) 
3. Long-thin object (e.g., pen) 	3. Handling a thin object (e.g., pen) 

Work on sign languages has shown that OHSs tend to be used more when the object is acting on its own or not acting at all, as in (1) and (2) (Brentari, Branchini,

Fenlon, Horton, & Tang, 2016; Brentari, Renzo, Keane, & Volterra, 2015). We will call these "non-agentive contexts."

(1) The lollipop falls.

(2) The lollipop is on the table.

HHSs tend to be more frequent when the object is being acted upon by an agent, as in (3). We will call these "agentive contexts".

(3) The man puts the lollipop on the table.

Previous studies have found that the distribution of these handshapes in classifier predicates varies systematically and functions productively as a morphological marker to distinguish between agentive vs. non-agentive events in several sign languages, including ASL (Benedicto & Brentari, 2004; Janis, 1992; Mazzoni, 2008; Schick, 1987), Nicaraguan Sign Language (NSL: Brentari et al., 2015; Goldin-Meadow, Brentari, Coppola, Horton, & Senghas, 2015), Italian Sign Language (LIS: Mazzoni, 2008), British Sign Language (BSL: Brentari et al., 2016), Hong Kong Sign Language (HKSL: Brentari, Tang, & Benedicto, 2001) and Sign Language of the Netherlands (NGT: Zwitserlood, 2003). In a cross-linguistic study conducted on ASL, BSL, HKSL and LIS, Brentari et al. (2016) report that the use of HHSs is more frequent in agentive contexts, and the use of OHSs is more frequent in non-agentive contexts.

Other studies have shown that some sign languages display a preference for OHSs in instrument *nouns* (e.g., toothbrush), while others prefer to use HHSs. For instance, M Aronoff, Meir, Padden, and Sandler (2009) and C. Padden et al. (2013) explored the distribution of two types of handshape (HS) iconicity in sign language instrument nouns: a) "hand-as-hand" iconicity, which is analogous to HHSs in this study, b) "hand-as-

object" iconicity, which is analogous to OHSs. They found that American, Swedish, Danish, and Al-Sayyid Bedouin Sign Languages make use of OHSs in instrument nouns, while British, New Zealand, Israeli, and Japanese Sign Languages prefer to use HHSs. This handshape preference in nouns varies across sign languages but on the whole, *within* a single language, noun forms are quite stable. The handshape preference in verb phrase classifiers, on the other hand, varies based on the agentive or non-agentive nature of the verb. The different distributions of OHSs and HHSs in nouns and verbs have been used as evidence for a distinction between nouns and verbs (Goldin-Meadow et al., 2015).

In this study, we explore the conditions behind these distinctions in CTSL and compare this case to parallel investigations into other sign languages. The goal of this chapter, *first*, is to investigate the distribution of morpho-syntactic properties of handshape classifiers in CTSL; *second*, to contribute to the crosslinguistic theoretical discussion concerning handshape preference. To the best of our knowledge, while there is some research on classifiers in village sign languages (de Vos, 2012; de Vos & Zshan, 2012), previous research investigating the agentive/non-agentive distinction has only looked at classifiers in community sign languages (e.g., LIS: Mazzoni, 2008; BSL: Brentari et al., 2016; HKSL: Brentari, Tang, & Benedicto, 2001; NGT: Zwitserlood, 2003).

5.2. Methods

5.2.1 Participants

We tested 7 deaf CTSL signers for this study (M_{age}=37.7; Range=18-55; 4 females and 3 males; 1 CTSL-1 signer, 4 CTSL-2 signers and 2 CTSL-3 signers). Six

deaf participants are the members of the same extended family in Village 1. Only one of the participants is from Village 2; however, he is married to a deaf woman from Village 1.

5.2.2 Materials and Procedure

The stimulus set involves a total of 88 short video clips and still images of eight different objects (i.e., *book*, *lollipop, marble, TV, tweezers, coin, airplane* and *pen*) being depicted in situations with and without a human agent. The stimulus items and the situations are illustrated in Table 16.

Table 16 illustrates the situations in which the stimulus items were depicted.

Stimulus items for the agentive/non-agentive opposition	
No Agent	1. picture with [object] alone on the table
	2. picture with [object] alone in a strange position (e.g., upside down)
	3. picture with multiple [objects] of the same kind on table with a regular arrangement in row
	4. picture with multiple [objects] of the same kind in strange positions (i.e., random arrangement)
	5. video clip of an [object] falling on its own
Agent	6. video clip of an [object] alone being manipulated by an agent
	7. video clip of an [object] alone being manipulated by an agent in strange manner (i.e., being put on table upside down)
	8. video clip of multiple [objects] of the same kind being manipulated in a regular arrangement
	9. multiple [objects] of the same kind being manipulated in a random arrangement
	10. the function of the [object] in use
	11. the [object] being used by an agent in an unusual way

The stimuli were presented on a computer screen and participants were asked to describe what they saw. All of the signers viewed the stimulus items in the same randomized order. Each signer was paired up with another CTSL signer to whom they described the stimulus items.

This stimulus set elicited systematic variation between OHSs and HHSs in ASL, BSL, HKSL, LIS and NSL (Brentari, Branchini, et al., 2016; Brentari, Coppola, Cho, & Senghas, 2016; Brentari, Coppola, Mazzoni, & Goldin-Meadow, 2012; Brentari et al., 2015; Coppola & Brentari, 2014; Goldin-Meadow et al., 2015; Horton, Goldin-Meadow, Coppola, Senghas, & Brentari, 2015; Mazzoni, 2008). We used the same stimulus set on purpose in order to collect comparable data with those in the previous studies.

5.2.3 Coding Procedure

The responses of the participants for each stimulus item were cut into individual video files and transcribed using ELAN (Crasborn & Sloetjes, 2008), a tool developed at the Max Planck Institute for Psycholinguistics, Nijmegen for the analysis of language, sign language, and gesture. There were *two* main coding tiers in our coding schema:

1) Label/Event tier: The signs identifying the target objects were annotated as *label*; the signs describing what happened were annotated as *event*; and everything else was annotated as *extra information*.

Because CTSL is a de novo style system and we do not have any suggestive evidence yet regarding the existence of syntactic categories, there is no a priori list of characteristics differentiating between a noun and a verb in CTSL. Therefore, we devised

our own operational definitions for these categories. Following Sapir (1921), we categorized a "noun" as something to talk about whereas a "verb" as something giving information about the noun with which it is associated. Nouns tend to be concrete concepts like a person or a thing and appear as the subject in discourse. Verbs, on the other hand, tend to be concepts of activity and describe what happens in discourse (Sapir, 1921, p.119). Based on these operational definitions, the *label* tier in our coding schema is associated with nouns, and the *event* tier is associated with verbs. The signs that label the objects are considered as nouns whereas the signs describing the event are considered as verbs.

2) H1 representation type tier: The shape of the signer's dominant hand was coded based on how it represented the target object in the given conditions. The representation types included *object* (representing the object as a whole), *handling* (representing how an agent would hold or manipulate the target object), *both* (participant's hand changes between OHSs and HHSs, or it's unclear whether it is OHS or HHS), *descriptor* (representing a specific dimension of the object such as its size or thickness) and *other* (representing everything else).

For instance, in Figure 48-a, a CTSL-2 signer uses an OHS for the object *airplane*. The flat horizontal hand shape represents an airplane flying in the air in response to a non-agentive vignette. In 48-b, he uses a HHS for the toy *plane*. The handshape represents how the object is handled in an agentive context.

Figure 48. Picture on the left illustrates an OHS representing the shape of a toy "airplane". Picture on the right illustrates an HHS representing how the toy plane is handled.

5.3. Results

We analyzed signers' productions of objects and actions (n=1737) in order to determine the distribution of OHSs and HHSs. Our results based on this analysis indicate that the handshape preference in the entire task is not stable across cohorts. CTSL-1 (n=272) shows a preference for HHSs, whereas CTSL-2 (n=966) and CTSL-3 signers (n=499) exhibit an OHS preference in the entire task (Figure 49). We observe double dissociation for HS preferences as of CTSL-2, which transforms CTSL in a relatively short period of time into a system that is either mixed using both HHS and OHS, or which favors OHSs. This finding must be viewed with caution, however, since there was only one signer in cohort 1.

In the next two sections we analyze the event description (verb phrases) and the labels of objects (nouns) separately.

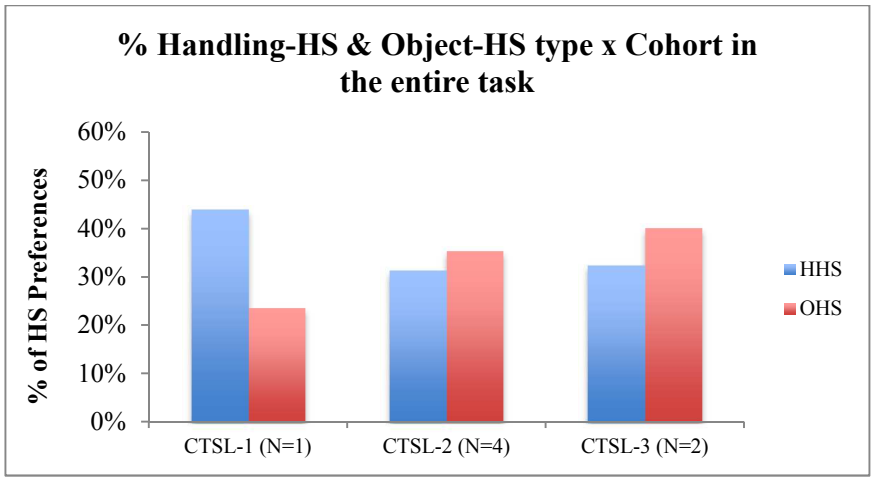


Figure 49. Overall proportion of HHSs and OHSs in the entire task is illustrated (n=1737). Y axis stands for the percentage of handshape preferences. X axis stands for CTSL-1, CTSL-2 and CTSL-3, respectively. Blue and red bars represent HHSs and OHSs, respectively.

5.3.1 Verbs

Figure 50 shows the results in verbs phrases alone (n=855). We find that in CTSL the agentive/non-agentive distinction appears in classifier predicates in all three cohorts, with a more frequent use of HHSs in agentive contexts (n=636), and of OHSs in non-agentive contexts (n=219). These findings are in accord with previous findings in ASL, NSL, LIS and in family sign systems (Goldin-Meadow et al., 2015; Brentari et al., 2015).

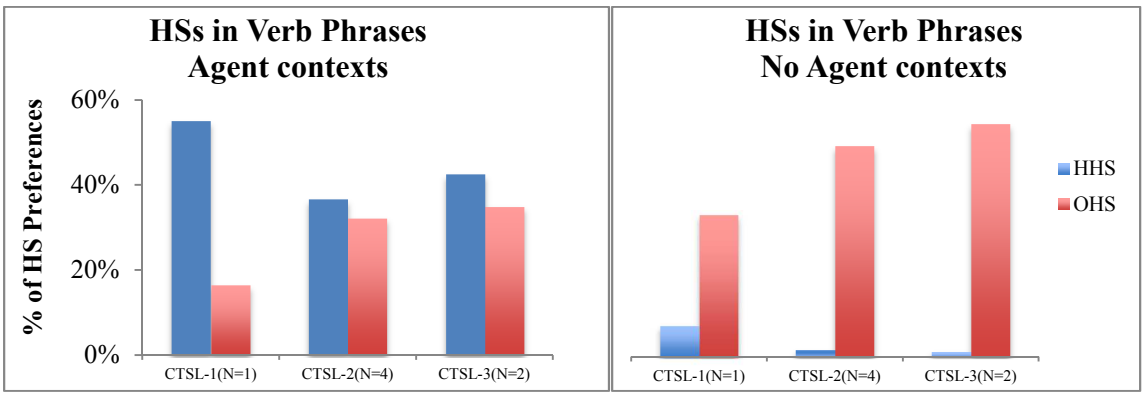


Figure 50. Proportions of HHSs and OHSs in the verb phrases in agentive contexts (on the left) and non-agentive contexts (on the right) are illustrated (n=855). Y axis stands for the percentage of handshape preferences. X axis stands for CTSL-1, CTSL-2 and CTSL-3, respectively. Blue and red bars represent HHSs and OHSs, respectively.

5.3.2 Nouns

The handshape distinction for agentive/non-agentive contexts is not evident in nouns (n=882) (Figure 51). The use of HHSs and OHSs in nouns is relatively stable across both contexts; that is, a single invariant form is used for each noun in both contexts. As can be seen in Figure 51, the proportions of use in agentive (n=456) and non-agentive forms (n=426) do not vary a great deal compared with those of Figure 50. These results concur with previous findings concerning *stability of form in nouns* (Goldin-Meadow et al., 2015).

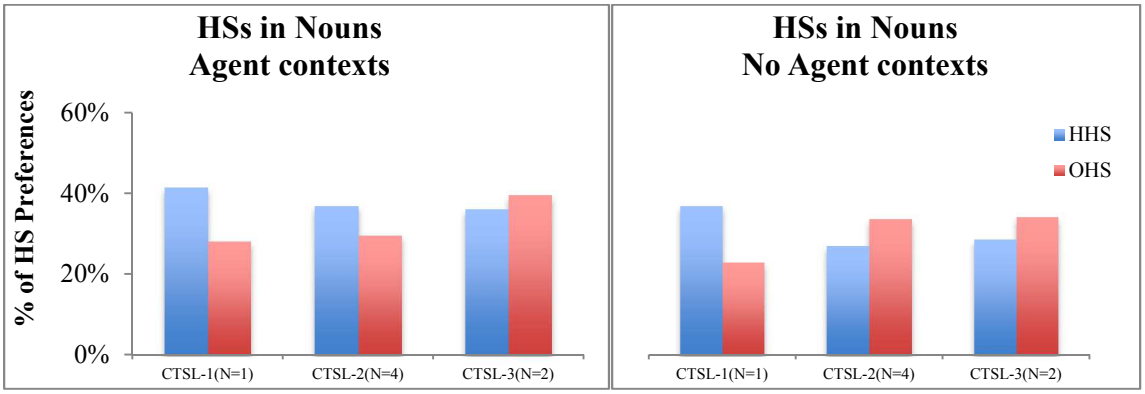


Figure 51. Proportions of HHSs and OHSs in object labels in agentive contexts (on the left) and non-agentive contexts (on the right) are illustrated (n=882). Y axis stands for the percentage of handshape preferences. X axis stands for CTSL-1, CTSL-2 and CTSL-3, respectively. Blue and red bars represent HHSs and OHSs, respectively.

In brief, from the noun and verb analyses, we see that there is ample evidence for a distinction between nouns and verbs based on the distribution of OHSs and HHSs.

5.3.3. Variation by Object

The distribution of the OHSs and HHSs varies across objects in a number of ways; see Figure 52 for the HHS and OHS distribution by object. The noun forms exhibit only a little variation across agentive and non-agentive contexts; that is, the forms are

relatively stable. “Book”, “coin”, and “plane” exhibit an OHS noun form across Cohorts. “Marble”, “pen” and “tweezers” exhibit an HHS noun form across cohorts. For TV, the noun form is an “other” form (i.e., “tracing”[39]). In addition, the object label for “lollipop” varies in CTSL-1 and CTSL-2, suggesting that there may not be a stable noun for this object in CTSL. It is rather clear, therefore, that the nature of the object itself has an effect on HHS and OHS distributions.

In verb phrases, by contrast, seven of the eight objects exhibit the agentive/non-agentive opposition. The one exception is “book”: Irrespective of the context, CTSL signers from all three cohorts exhibit a strong preference for an OHS for “book” both in labeling objects (nouns) and describing events (verbs). In other words, the preference for an OHS is so strong that the agentive/non-agentive distinction does not appear in the verbs phrases involving it.

[39] A size and shape specifier produced through drawing an entity’s size/shape in space.

LABELS **EVENTS**

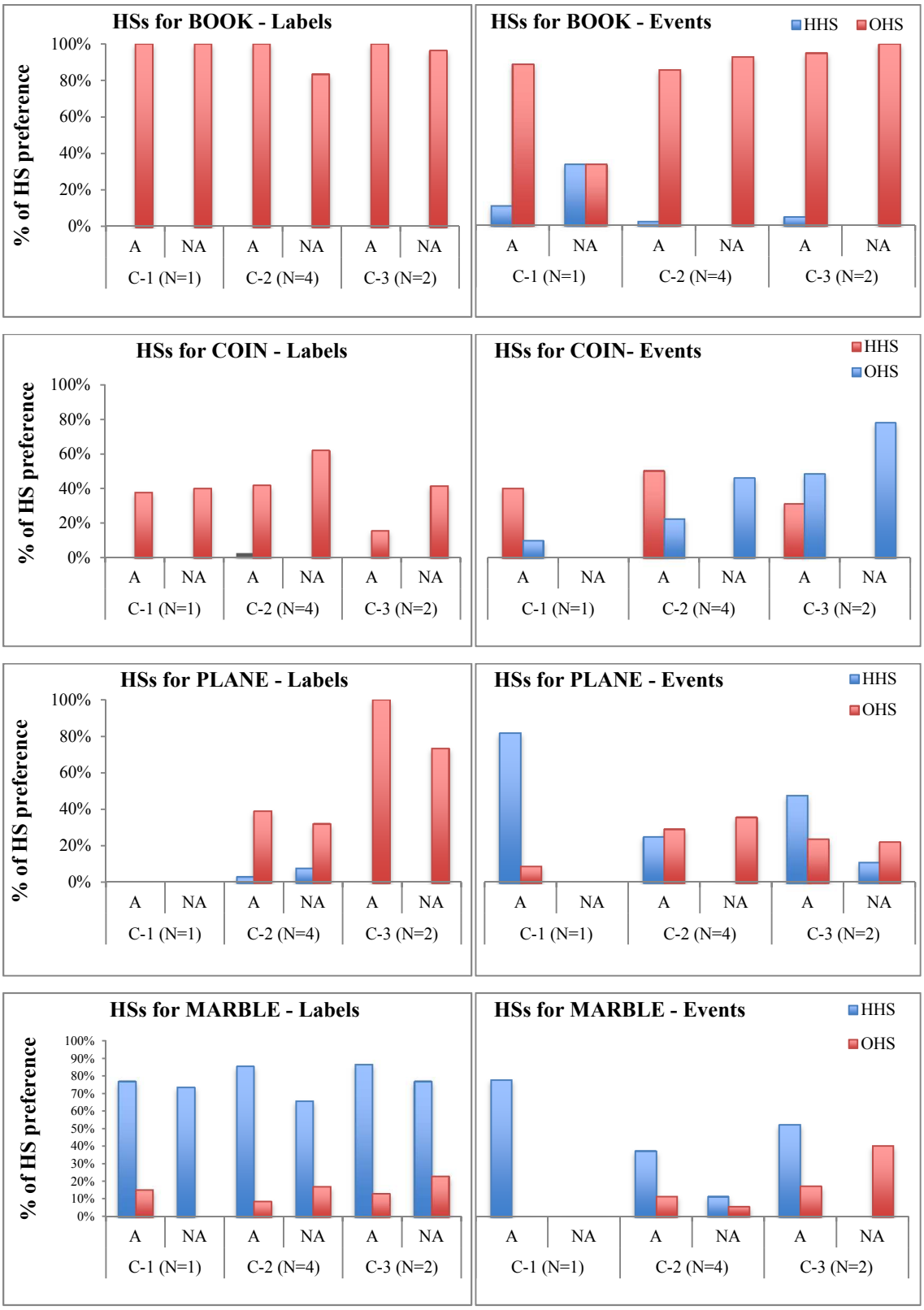


Figure 52. Distribution of HHSs and OHSs for each object in the noun phrases (on the left) and in the verb phrases (on the right) are illustrated. Y axis stands for the percentage of handshape preferences. X axis stands for agentive (A) vs. non-agentive (NA) contexts, and CTSL-1, CTSL-2 and CTSL-3, respectively.

5.4. Discussion and future directions

In this study we have looked at the distribution of handshapes in a very young village sign language. The patterns found across both established sign languages, such as ASL, BSL, HKSL, NGT, and in NSL have been found in CTSL as well, both with respect to relative stability of form in nouns, and, within verb phrases, with respect to the agentive/non-agentive opposition shown in handshape type. It has been argued that handshapes in sign languages interact with morphological and syntactic rules. Previous studies have presented evidence for the use of OHS classifiers in non-agentive contexts and HHS classifiers in agentive contexts (e.g., Brentari et al., 2015, 2016). In this study, we have the same type of evidence for the morphological status of handshape as an agentive/non-agentive marker in event descriptions in CTSL, which suggests that these handshapes are functioning as classifiers.

The CTSL data suggest, for this small set of signers, that the preference for HHS or OHS can vary across signers and individual objects, and potentially across cohorts in the emergence of a sign language. The single CTSL-1 signer showed a HHS preference across both noun and verb forms, while the CTSL-2 and CTSL-3 signers showed an OHS preference across both noun and verb forms. Our analyses suggest further that a signer's handshape preference applies to both nouns and verbs to some extent. In nouns this preference is unfiltered, since this is all we see, while in verb phrases, the preference is somewhat masked by the handshape's use as an agentive/non-agentive marker.

In the studies cited in the introduction, the verbs in the contexts in (1) "fall", and (2) "is" have been characterized as "non-agentive" versus the context in (3) "put", which is "agentive". This distinction appears in CTSL as well.

We also see a difference in the distribution of forms in labels for objects (nouns), which tend to be more stable across contexts, and the event descriptions (verb) forms whose classifiers vary systematically according to the agentive/non-agentive distinction. In keeping with previous studies, we have characterized these distinctions in form in terms of nouns versus verbs. However, we wish to emphasize that these syntactic categories have been used for convenience. Our investigation of CTSL for HS preferences in agentive/non-agentive contexts does not necessarily provide syntactic evidence for a noun-verb distinction. There is no evidence thus far for such a difference in characteristic patterns of inflection, modification, or associated functional categories (e.g. determiner vs. auxiliary) neither in labeling objects nor describing events. Rather, all the data discussed here can be characterized in semantic terms: *object* vs. *action*. It begs the question to assume that object words are nouns and action words are verbs. In particular, in a language with a genuine noun-verb distinction (e.g., English), it is possible to have syntactic nouns that denote actions or events, such as action, event, concert, game, etc. However, in such a young language, we are skeptical of the existence of these syntactic categories. And CTSL is not alone in this respect: Gil (2014) argues that Riau Indonesian, a vocal language with several million speakers, lacks a noun-verb distinction.

In order to determine if the noun forms are truly stable within and across participants, the specific handshapes produced for each object will need to be analyzed in the future work.

CHAPTER 6

CONCLUDING REMARKS

We, the human race, are born with the urge to name the world and express our own inner worlds, unlike any other species. Even in the most remote corners of the planet and even in the most underdeveloped communities, a language is used to meet the acute need of our species to communicate. Like thousands of others, CTSL is a natural language, but, unlike thousands of others, it was born at a specific point in time in the most organic way possible without any discernible parent languages. Thus, CTSL is an illustration of a very young system going from nothing to something. Despite being in its infancy; therefore, not being a well-established language yet, not having strict structural constraints and not having a completely standardized system of expressing the intended messages, but instead involving many idiosyncrasies (e.g., pantomime-like individualistic gestures), certain innovations reflect the beginning of a linguistic system in CTSL.

Chapter 3 has shown that CTSL displays the emergence of distinct word order preferences for different semantic configurations, which is partially analogous to what Turkish, as fully established language, does. While Turkish conveys the message with a 100% success with no further attempts to convey the message, CTSL conveys the intended messages with lower success rates and frequently with further attempts in

semantically complex structures. Yet, CTSL in its second generation starts to create devices that unambiguously mark the argument structure of varying degrees of semantic complexity, just as Turkish clarifies the semantic roles at a morphosyntactic level through case assignment. Silent gesture and family sign systems, on the other hand, lack the argument structure devices that CTSL has been developing.

Chapter 4 has proved that CTSL has differential markers of distinct verb classes: Body segmentation is frequently used to express the identical participation of two human characters in an event structure, mirrored articulators are exclusively reserved for reciprocal and symmetrical actions to express the bidirectional nature of these events, and reciprocal actions differ from symmetrical actions in that the former uses temporal sequencing whereas the latter does not. Again, silent gesture and family sign systems do not reflect the existence of these differential devices that CTSL has.

Furthermore, Chapter 5 has shown that CTSL displays systematic morphological variation between agentive and non-agentive contexts for handshape preferences in verb phrase classifiers. The differences that we captured in the use of handshapes pull out the agentive utterances, and distinguish nominal from predicative signs.

All in all, the studies reported within the scope of this dissertation present evidence, *first*, for the emergence of sentential and phrasal structures that rely on such distinctions including animacy and affectedness and acting on objects, and *second,* for the gradual conventionalization of these structural patterns across cohorts.

In the course of its development, CTSL-2 signers took the impoverished input involving unsystematic gestures from CTSL-1 and gave it systematic patterns and initiated the emergence of structural constraints, without which CTSL would be pure

linguistic anarchy today. Then, CTSL-3 signers took it even further and increased the expressive power of the system by introducing more effective new devices to the language (e.g., referential use of space). This developmental pattern shows that language learning in CTSL environment followed an atypical path in which a generation of signers received the system of their older peers but they did not transmit it to their younger peers as it was. They, rather, transformed the system into a more efficient one by filling out the missing linguistic functions. Similar developmental patterns were reported in NSL (Senghas, 1995; Senghas et al., 1997; Senghas & Coppola, 2001) and also in ABSL (e.g., Sandler et al., 2005). Not only in emerging sign languages but also in pidgins and creoles, similar observations were made. The expressive power of pidgins is limited to train of simple clauses that lack inflection and structural embedding, whereas creoles exhibit many hallmarks of an established human language. It is the children born into a pidgin-speaking community who take the structure of imperfect models they are exposed to one step further, and give it a grammar (e.g., Bickerton, 2009; Bickerton, 2015; McWhorter, 1999; Mufwene, 2008, etc.).

The developmental path that these emergent systems take triggers the following questions: What drives the emergence of new structure, and what is the reason for change? Once you invent a strategy that is fairly successful to express a particular meaning, like a semantic role, why do you need to change it? What role does acquisition play in this process? What role does communication success or failure play?

Two forces of acquisition and communication will have different effects: Acquisition devices will lead to predictable reanalysis and restructuring on the part of the listener/learner, whereas communication failure will lead to recasting on the part of the

speaker/signer, and maybe result in some types of patterns' being dropped or altogether new patterns being created. Acquisition devices obviously played a role in the development of CTSL as of its second generation. CTSL-2 and CTSL-3 signers did not start creating the language from scratch. They were born into a distinct linguistic environment than that of CTSL-1 signers', and they got exposed to some language input provided by an imperfect model that CTSL-1 signers created. CTSL-2 and CTSL-3 signers not only acquired what was available to them, but they also built upon what they got exposed to. They shaped the language and gave it new structures possibly because of communicative pressures.

CTSL data show that communicative pressures arising from missing linguistic functions play a role in the emergence of new structures. For instance, CTSL-1 did not have a structural solution for reversible transitive contexts, which frequently failed their utterances to get the intended message across. In order to compensate for this missing linguistic function in CTSL-1, CTSL-2 signers invented serial verb constructions. Although this strategy helped CTSL-2 signers communicate their messages, it did not help them to do so without pushing information into context. CTSL-3 signers, on the other hand, further developed spatial verb agreement, which enabled them, *first*, to reduce context-dependency and increase the expressive power of a language for novel situations, and *second*, to express the intended meaning in a less cumbersome and in a more coherent way with a minimal risk for meaning loss. Such gradual development shaped by acquisition devices and communicative pressures represents the very nature of the emergence and evolution of the structural patterns in a very young system. This is an

important contribution of CTSL to our understanding of language emergence and evolution.

Another contribution of CTSL to our understanding language development is the social conditions in which it emerged. Language emergence comes with a cost: it requires a language community. Our results in Chapter 3 and 4 show that a family sign system develop regularities, which is often interpreted as the evidence of structure in homesign systems (e.g., Goldin Meadow et al., 1990; Maylander & Goldin-Meadow, 1991; Goldin-Meadow & Maylander, 1998). However, these systems lack, for instance, the differential devices for distinct verb classes and disambiguation strategies in reversible contexts that CTSL has developed in its second generation. Apparently 12 deaf individuals, born in my mother's generation, was a big enough group to get the language going. Not only the number of deaf individuals, but also the frequent interaction of these deaf individuals with one another as a result of living in close proximity in a geographically isolated area, and also having an intimate relation from the very beginning undoubtedly paved the way for this functional signed system to come about and develop.

As a final note, there is now mounting evidence from family sign systems and emerging sign languages for the fact that it takes time to invent a language. As a very young language that emerged in the absence of a linguistic model, the developmental path that CTSL took proves that a developed system of grammar is not readily available in the human brain from the very beginning, or it does not arise fully-blown within a single generation, but rather it develops gradually over time. In addition, rather than abruptly moving from proto-language to language, as suggested by Bickerton (1990), naturally emerging sign languages follow a more gradient scale of developmental path

just as suggested by Jackendoff (1999). As the comparison of the system across cohorts for various different linguistic functions revealed, each generation of CTSL signers contribute to the system in their own unique ways and enrich the system by inventing its missing linguistic functions. Thus, we should conclude that language is a living mechanism, it is dynamic, and it does not arise as fully developed system within a single generation, and it does not abruptly change from being a protolanguage to being a fully-established language.

Appendix A: List of Village Sign Languages

Thirteen different village sign language communities across the world have been reported so far, and the list is as follows:

1. Al-Sayyid Bedouin Sign Language in Israel (e.g., Mark Aronoff et al., 2008; I. Meir et al., 2010)

2. Alipur Sign Language in India (Panda, 2012)

3. Algerian Jewish Sign Language in Israel and France (Lanesman & Meir, 2012)

4. Adamorobe Sign Language in Ghana (Nyst, 2007)

5. Ban Khor Sign Language in Thailand (Nonaka, 2004)

6. Chican Sign Language in Mexico (Delgado, 2012)

7. Kata Kolok in Bali (De Vos, 2012; Marsaja, 2008)

8. Konchri Sain in Jamaica (Cumberbatch, 2012)

9. Inuit Sign Language in Canada (Schuit, 2014)

10. Mardin Sign Language in Turkey (Dikyuva, 2012)

11. Yolgnu Sign Language (Maypilama & Adone, 2012)

12. Kafr Qasem Sign Language in Israel (Kastner et al., 2014).

13. Central Taurus Sign Language (e.g., Ergin et al., 2016; Ergin & Brentari, 2017)

Appendix B: Stimulus Set for Argument Structure

Elicitation Sentences[40]

1. A woman puts a box on the table	1. Non-reversible, transitive
2. A woman gives a shirt to the man	2. Reversible, di-transtive
3. A girl pulls the shopping cart	3. Non-reversible, transitive
4. A woman looks at the man	4. Reversible, transitive
5. Bottle falls	5. Intransitive
6. Girl falls	6. Intransitive
7. A woman rolls the ball	7. Non-reversible, transitive
8. A woman takes scissors from a girl	8. Reversible, di-transitive
9. A man taps the watermelon	9. Non-reversible, transitive
10. A girl pulls a man's arm	10. Reversible, transitive
11. Water pours	11. Intransitive
12. Man stands up	12. Intransitive
13. A girl runs in a circular direction	13. Non-reversible, transitive
14. A man shows a picture to a woman	14. Reversible, di-transitive
15. A girl tears the paper	15. Non-reversible, transitive
16. A woman pushes the girl	16. Reversible, transitive
17. Bag falls	17. Intransitive
18. Woman runs	18. Intransitive
19. Woman walks	19. Intransitive
20. A man throws a ball to the girl	20. Reversible, di-transitive
21. A man washes the plate	21. Non-reversible, transitive
22. A girl combs the woman's hair	22. Reversible, transitive
23. Ball bounces	23. Intransitive
24. Man sleeps	24. Intransitive
25. A man places a book into the bookstore	25. Non-reversible, transitive
26. A girl feeds woman	26. Reversible, di-transitive
27. Woman writes on the refrigerator	27. Intransitive
28. A man taps girl's arm	28. Reversible, transitive
29. Ball rolls	29. Intransitive
30. Girl cries	30. Intransitive

[40] The actions in the video clips are listed in the table above in the same order as they were shown to the signers.

Appendix C: CTSL Signers by cohorts

	Participant No	Gender	Age[41]	Village	Schooling	Addressee
CTSL-1	1. Durana	Female	53	1	No	Her cousin, deaf native CTSL signer, age: 43, not schooled
	2. Hamza	Male	49	1	No	His son, hearing, native CTSL signer, age: 17, from Village 1, schooled
	3. Ali	Male	46	1	No	His sister, deaf native CTSL signer, age: 41, not schooled
	4. Durana	Female	43	Originally from Village 1 but lives in Village 3	No	Her sister, hearing, native CTSL signer, age: 39, from Village 1, schooled (5 years)
	5. Mehmet	Male	41	2	No	His brother, deaf, native CTSL signer, age: 38, from Village 2, not schooled
CTSL-2	6. Serife	Female	45	1	No	Her niece, deaf native CTSL signer, age: 15, from Village 1, schooled (for 4 years)
	7. Fatma (Aunt)	Female	43	1	No	Her niece, hearing, native CTSL signer, age: 15, from Village 1, schooled (for 4 years)
	8. Fatma	Female	43	1	No	Her cousin, deaf native CTSL signer, age: 45, not schooled
	9. Bayram	Male	38	2	No –	Neighbor, deaf native CSTL signer, age: 22, schooled
	10. Zafer	Male	38	1	No	His nephew, hearing, native CTSL signer, age: 17, from Village 1, schooled
	11. Ulku	Female	34	Originally from Village 1 but lives in Village 2	No	Her sister, hearing, native CTSL signer, age: 39, from Village 1, schooled (5 years)
CTSL-3	12. Mustafa	Male	22	2	Yes	With a deaf native CTSL signer (and also a TID signer) from Village 2, age: 38, not schooled
	13. Sengul	Female	20	1	Yes	Her aunt, deaf native CTSL signer, age: 43, from Village 1, not schooled.
	14. Ilknur	Female	16	1	For 4 years from the age 7 till 11	Her father, deaf individual from CTSL-2, age: 37, from Village 1, not schooled

CTSL-1, n=5, 41-53 years old; **CTSL-2**, n=6, 34-45 years old; **CTSL-2**, n=3, 16-22

[41] The ages of the participants are those in August 2013 when they were tested.

Appendix D: Elicitation Task for Argument Structure

Video clip: Woman puts a box on the table.

The pictures:

Appendix E: Stimulus set for Verb Classes

Stimulus set:

Order[42]	Stimulus item	Event type
58	A boy **waves** hand to the camera	Intransitive
1	Two women (standing side by side) **wave** hands to the camera	Intransitive-PL
13	A woman **waves** hand to the other woman	Transitive (Anim. pat.)
9	Two women (facing each other) **wave** hand at each other	Reciprocal
37	A boy gives a **kiss** to the camera	Intransitive
31	Two women (standing side by side) **kiss** towards the camera	Intransitive-PL
8	A woman **kisses** the other woman	Transitive (Anim. pat.)
2	Two women **kiss** each other	Reciprocal
20	Two men (standing side by side) **punch** towards the camera	Intransitive-PL
15	A man **punches** the wall	Transitive (Inanim. p.)
30	A man **punches** another man	Transitive (Anim. pat.)
43	Two men **punch** each other	Reciprocal
36	Two women (standing side by side) **hug** pillows	Intransitive-PL
52	A woman **hugs** a pillow	Transitive (Inanim. p.)
59	A man **hugs** a woman	Transitive (Anim. pat.)
7	Two women **hug** each other	Reciprocal
16	Two men (standing side by side) **tap** the table	Intransitive-PL
21	Two men standing side by side, one of them **taps** the table	Intransitive
14	A woman **taps** on the man's shoulder	Transitive (Anim. pat.)
3	A woman and a man **tap** each other's shoulders	Reciprocal
4	A man **collides** into a woman	Transitive (Anim. pat.)
22	A man **collides** into a poll	Transitive (Inanim. p.)
23	Two toy cars **collide** into each other	Reciprocal
24	A toy car **collides** into another toy car	Transitive (Inanimate agent & patient)
18	Two men **collide** into each other	Reciprocal
60	A woman and a man (side by side) play **sword-fighting** towards the camera	Intransitive-PL
46	A boy **plays with a sword** (to the camera)	Intransitive
29	A woman **attacks** a man **with a sword**	Transitive (Anim. pat.)
55	A man and a woman **sword-fight** with each other	Reciprocal
33	Two men (facing camera) **dance**	Intransitive-PL
41	A man **dances** alone to the camera	Intransitive
49	Two man (facing each other) folk **dance**	Reciprocal
40	A woman and a man **throw ball** to the camera	Intransitive-PL
53	A woman **throws ball** to the camera	Transitive (Inanim. p.)
44	A woman **throws a ball** to a man, the man does not catch it	Transitive (Anim.

[42] The order of the stimulus items as they appeared in the execution of the task

		goal)
35	A man and a woman **throw balls** to each other	Reciprocal
39	A man and a women (facing camera) **eat** yogurt	Transitive (Inanim. p.)
50	A man (facing camera) **eats** yogurt	Transitive (Inanim. p.)
54	A woman **feeds** a man with yogurt	Transitive (Anim. pat.)
47	A man and a woman **feed** each other with yogurt	Reciprocal
17	A man **spins** around a poll.	Intransitive
6	A man and a woman hold hands and **spin** around each other	Symmetrical
45	Four people play **tug-of-war**	Symmetrical
10	A woman and a man **high-five**	Symmetrical
38	Two man (facing camera) **raise their coffee cups**	Intransitive-PL
5	Two women standing side by side, one of them **raises a cup**	Intransitive
11	A man and a woman **toast** (with their coffee cups)	Symmetrical
32	A man and a woman **slow dance**	Symmetrical
19	One man **shakes his hands** on his own	Intransitive
28	Two men **shake hands**	Symmetrical
34	A man and a woman **walk side by side**	Intransitive-PL
42	A woman holds a bag and **walks alone**	Intransitive
61	A man and a woman **walk arm in arm**	Symmetrical
27	A man and woman **hold hands and walk**	Symmetrical
51	A woman and a man (side by side) plays **rope-jump**	Intransitive-PL
57	A woman and a man **hold a rope** from each end and spin the rope together	Symmetrical
48	A man and woman (side by side) try to **bend** a nail on a wooden stick	Transitive (Inanim. p.)
56	A woman and a man sit (side by side), man tries to **bend** a nail on a wooden stick	Transitive (Inanim. p.)
62	A woman and a man play arm-wrestling (trying to **bend** each other's arm)	Symmetrical
12	A woman (with both hands) hits a man's both hands	Transitive (Anim. pat.)
25	A ball hits a man	Transitive (Inanimate agent & animate patient)
26	Water pours on boy	Transitive (Inanimate agent & animate patient)

Appendix F: Elicitation Task for Verb Classes

Video clip: *Men punch each other*

Pictures:

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