The Development of Argument Structure in Central Taurus Sign Language

Rabia Ergin, Irit Meir, Deniz Ilkbaşaran, Carol Padden, Ray Jackendoff

Sign Language Studies, Volume 18, Number 4, Summer 2018, pp. 612-639 (Article)

Published by Gallaudet University Press
DOI: https://doi.org/10.1353/sls.2018.0018

RABIA ERGIN, IRIT MEIR, DENIZ ILKBAŞARAN,
CAROL PADDEN, AND RAY JACKENDOFF

The Development of Argument Structure in Central Taurus Sign Language

Abstract

One of the fundamental issues for a language is its capacity to express argument structure unambiguously. This study presents evidence for the emergence and the incremental development of these basic mechanisms in a newly developing language, Central Taurus Sign Language. Our analyses identify universal patterns in both the emergence and development of these mechanisms and in language-specific trajectories.

Central Taurus Sign Language (CTSL) is a newly discovered emerging village sign language of Turkey. It emerged and developed naturally in three neighboring villages within the last half century in a mountainous remote area in southern central Turkey with limited or no influence from any other sign language.[1, 2] It is a village sign language because it came into existence in these close-knit microcommunities, and it can also be considered emerging because of

Rabia Ergin is a research staff member at the Max Planck Institute for Psycholinguistics. Irit Meir was an associate professor in the Department of Hebrew Language and the Department of Communication Sciences and Disorders in the University of Haifa, and the associate director of the Sign Language Research Lab. Deniz Ilkbaşaran is a postdoctoral researcher at the Center for Research in Language at the University of California San Diego. Carol Padden is a professor at the Department of Communication and the dean of the Division of Social Sciences at the University of California San Diego. Ray Jackendoff is Seth Merrin Professor of Philosophy and emeritus co-director of Center for Cognitive Studies at Tufts University.

its limited time depth. CTSL provides us with a novel vantage point into how languages emerge, especially because its first creators are still alive today. Thus, its development and history can be traced in a way that is impossible for mature languages.

Central Taurus Sign Language

Adding to the list of approximately a dozen village sign languages reported in a survey by de Vos and Zeshan (2012), Central Taurus Sign Language (CTSL) is a village sign language that we discovered in 2012. There are two main reasons CTSL emerged apart from Turkish Sign Language (TID), which is used by deaf signers who live in major urban areas in Turkey and who attend schools for deaf children in these cities. The first reason is the higher than random proportion of deaf and hard of hearing individuals in the community as an outcome of hereditary deafness, as is the case in many other village sign languages such as Al-Sayyid Bedouin Sign Language (ABSL), Adamorobe Sign Language (AdaSL), and Kata Kolok (ibid.). The deafness in the CTSL community has persisted up until the present time due to the prevalence of consanguineous marriages among families with hereditary deafness. The second reason for CTSL to have emerged independently is related to the financial, geographical, and cultural conditions in the region. Up until the last couple of decades, sending deaf or hearing children away for education was not only unaffordable but also not consistent with the cultural lives of the villagers. It is a labor-intensive farming community where family members participate, as is the case in many such villages (cf. Kusters 2009). Before the 1990s, within the constraints of this social structure, *only* hearing children received compulsory elementary school education in the village school. And until the early 2000s, these factors inevitably led to the isolation of deaf individuals and prevented them from accessing formal deaf education in Turkey.

CTSL is named for its use within the Central Taurus mountain range. Signers are spread over three villages: village 1 with a population of 326 includes fifteen deaf individuals, village 2 with a population of 1,955 includes fourteen deaf individuals, and village 3 with a population of 182 includes one deaf individual (deaf population in each village: 4.6 percent,[3] 0.7 percent, 0.5 percent, respectively).[4] All

three villages are located within a fifteen-mile radius of each other, and most of the deaf individuals in these villages are connected to each other by birth or through marriage (see appendix A for further information about demographics).

Current Study

This study investigates how CTSL expresses semantic roles of the characters in one-argument, two-argument, and three-argument constructions. It is important to investigate the argument structure in a newly developing language because one of the very basic functions of human communication systems is communicating *who is doing what to whom*. Understanding how such a fundamental mechanism emerges and develops with no or limited influence from existing models can provide us with valuable insight into the initial stages of a brand-new system.

Argument Structure Markers

Overt grammatical marking is often redundant for clarifying semantic roles, as these roles can be inferred from the meaning of the words, supplemented by contextual clues and world knowledge. For instance, in an unmarked signed string like BREAD-MAN-CUT, whatever 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 impossible. 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 such scenarios, the semantic properties of the individual words alone are not sufficient for comprehending the event structure of the intended message. Instead, specific contextual clues and shared background knowledge will play a larger role in determining the meaning.

One of the basic syntactic resources to express argument structure is word order. Perhaps the most important manifestation of word order in language is the order of the three "core grammatical functions" in transitive constructions: subject (S), object (O), and verb (V) (Culicover 2009, 70). According to Dryer (2005), 86 percent of the world's spoken languages rely on word order as a strategy for encoding

syntactic and semantic arguments in a given proposition. The vast majority use SOV (e.g., Turkish [Göksel and Kerslake 2004]); SVO (e.g., English); and VSO (e.g., Welsh [Williams 1980]): 48 percent, 41 percent, and 8 percent, respectively. A small proportion of the world's 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 percent, .8 percent, and .3 percent, respectively.

Word order is frequently used to express argument structure in sign languages as well. Napoli and Sutton-Spence (2014) analyze data from forty-two different sign languages (SLs) including village SLs, community SLs, and established SLs. They observe that (a) as with spoken languages, SOV and SVO are the basic word order across sign languages; and (b) SOV is grammatical in all of these forty-two sign languages. In short, there is an overwhelming inclination for SOV and SVO order in world languages, irrespective of modality.

In addition to word order, spoken languages make use of case marking and verb agreement or a combination of these strategies, especially when word order alone cannot disambiguate the semantic roles in semantically reversible scenarios.[5] Similarly, SLs employ various alternative or additional strategies.

Successive One-Argument Structures. One such strategy is to restrict each unit to one animate character per action. In this way, identifying who performs the action and who undergoes it is conveyed separately. Evidence of this in Nicaraguan Sign Language (NSL) is shown in example 1 (Senghas, Newport, and Supalla 1997, 554).

Example 1.

MAN PUSH, WOMAN FALL
= The man pushed, and the woman fell
(English: "The man pushed the woman")

This utterance displays what might be called SV/SV word order in place of structures with all three arguments: S, V, and O. This strategy is found not only in NSL, but also in other SLs (Napoli and Sutton-Spence 2014).

Character Assignment to Present Individuals. Another strategy that signers use to resolve ambiguity is *character assignment*. Take, for example, the sentence, "The woman looks at the man." Signers can identify themselves, or someone else in the immediate physical environment, as one of the animate characters. Here are two similar examples from (Israeli Sign Language) ISL (Meir 2010):

Example 2.

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

Example 3.

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

In these examples, the signers identify the subject argument with themselves, and they may further associate the object argument with the addressee as in example 3. In doing so, they assign themselves the agent role and the addressee the patient role. The same strategy is found in a number of other sign languages (e.g., ASL [Padden 1986]; ABSL [Meir 2010]; and CTSL, as will be shown in this study).

It is important to notice that assigning a role to oneself and to the interlocutor are two different strategies. The former enables the signer to utilize their own body as a subject, whereas the latter enables them to utilize someone else's body as an argument. Both of them involve the construction of an event structure by using the iconicity of a contextually prominent individual as a stand-in for the intended argument. Character assignment, within the scope of this study, refers to all instances of such constructed actions (e.g., see Cormier, Smith, and Zwets 2013 for further information).

Referential Use of Space. Another common device used by sign languages is a spatially-based device: *verb agreement*. Sign languages frequently make use of verb agreement for actions having two animate arguments, and it is realized by introducing the animate arguments

first. For instance, in a three-argument construction, like "Man gives a box to woman," the nominal for MAN is signed, and then an abstract location in the signing space is indicated by means of a pointing sign. Then the nominal for WOMAN is signed and then another abstract location is again indicated by means of a pointing sign. In other words, these characters are associated with specific points in space, which are called "referential-loci" (Padden 1988). Then the transfer relation is signed by moving the handshape denoting the object from the referential-locus of the source (i.e., MAN) to the referential-locus of the goal (i.e., WOMAN)—the source and the goal are usually human characters.

Spatially based grammatical devices that use abstract loci are common in established sign languages (e.g., ASL [Padden 1988]; Sign Language of the Netherlands [Bos 1993]). However, some village sign languages have so far shown no evidence for such devices (e.g., ABSL [Aronoff, Meir, Padden, and Sandler 2008]; Yolngu Sign Language [Bauer 2014]; Kata Kolok [Marsaja 2008]).

Note that there are yet other alternative strategies for encoding argument structure in sign languages, such as the use of so-called agreement auxiliaries (Sapountzaki 2012). Within the scope of this study, only the previously listed strategies (i.e., successive one-argument structures, character assignment to present individuals, and referential use of space) are investigated.

The Picture So Far

Taking the previous findings into consideration, we predict that:

- If SOV and SVO tendencies are governed by universal pressures, then we should observe one of these orders in CTSL.
- If a newly developing language like CTSL does not have a conventionalized word order, that is, if word order alone cannot always reliably convey the message in semantically reversible scenarios, CTSL should also have developed additional or supplementary strategies for encoding argument structure. Even if it has not developed a systematic mechanism for such contexts, it should be on its way to doing so. Thus, we should be observing evidence for strategies other than word order.

- Sign languages in early developmental stages may take considerable time to establish a highly conventionalized mapping of meaning to form. We expect to observe differences in the manifestation of argument structure coding mechanisms across different age groups of CTSL.

Methodology

Materials

Participants watched thirty short video clips, originally developed by Sandler, Meir, Padden, and Aronoff (2005). The clips involved twelve intransitive (one-argument), twelve transitive (two-argument) and six ditransitive (three-argument) actions. Seven of the one-argument clips involved a human agent, and five of them involved an inanimate argument (e.g., a bottle falls). In the two-argument clips, a human agent acts on inanimate patients in six of the clips (e.g., a man taps a watermelon)—*irreversible contexts,* and on human patients in the remaining six clips (e.g., a man taps a girl's shoulder)—*reversible contexts.* All of the three-argument clips involved a transfer relation between a human agent and human goal with an inanimate theme changing location between these two animate characters (e.g., a man throws a ball to a girl) (see appendix B).

Participants

The deaf signers were divided into three cohorts. The distinction among cohorts was based on birth order as well as the ages of the signers. The older deaf siblings in each family were categorized as cohort 1 (CTSL-1), and 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 having created their own system de novo. Previous work identified distinct patterns in the signing of two cohorts (see Ergin 2017; Ergin and Brentari 2017). The children of CTSL-1 and CTSL-2 are categorized as cohort 3 (CTSL-3).

Fourteen deaf CTSL signers were tested: five CTSL-1 signers [M_{age} = 46.4, Range = 41–53, two females, three males]; six CTSL-2 signers [M_{age} = 40.2, Range = 34–45, four females, two males]; and

three CTSL-3 signers [M_{age} = 19.3, Range = 17–22, two females and one male]. See appendix C for further details about the participants.

CTSL-1 and CTSL-2 signers never attended school. One of the CTSL-3 signers attended school between ages 9–19, one of them between 10–18, and the other between 7–11. These three signers were exposed to TID.

Task

Deaf CTSL signers were paired up with either a deaf or proficient hearing CTSL signer as the addressee (e.g., a sibling of a deaf signer). The signer viewed the short clips on a computer screen and described them in CTSL to the addressee sitting in front of him/her, who then selected the corresponding picture from an array of three pictures for comprehension check (see appendix D). Following a failed attempt, signers could produce up to three attempts in total before they were asked to move on to the next clip.

Coding Procedure

The data were coded according to the following criteria:

A. For word order analysis, the utterances elicited with video clips were coded for the order of the arguments occurring in the signers' descriptions of the clips. The agent performing the action was coded as "subject" (S), the theme or the patient undergoing the action was coded as "object" (O), the goal in three-argument structures was coded as "indirect object" (I), and the action was coded as "verb" (V). In those sentences lacking an agent (e.g., Ball rolls), the theme undergoing the action was coded as the syntactic subject. It is important to note that we do not have clear evidence for the existence of syntactic categories such as noun, verb, subject, and object in CTSL. These syntactic terms are used only for convenience.

B. The strings involving *randomly repeated* arguments without a clear tendency for a certain order (e.g., SOVOV, SVSOVO, OSOSV, VSV, SVS, OIOVSISV) and strings not involving a verb (e.g., OS, SO, S, O, IOS, SIO) were coded as "other."

C. In spoken languages, speakers have to produce one word at a time. However, signed systems can physically afford simultaneous

articulation of objects and actions. The objects signed sequentially were indicated as "O." For instance, an utterance like WOMAN BOX LIFT (i.e., Woman lifts the box) was coded as SOV. However, objects can also be incorporated into the action. For instance, in an utterance like WOMAN BALL-ROLL (i.e., Woman rolls the ball), the sign for ball is incorporated into the sign for rolling. Such incorporated objects were coded as SV(o).

D. Responses involving both a sequentially and simultaneously signed object were coded sequentially in order to have a more uniform distribution of word orders. For instance, SOV(o) was coded SOV, and OSV(o) was coded as OSV.

E. In addition to word order, the data were coded for the other candidates for argument structure markers discussed in the Argument Structures section:

a. Successive one-argument structures
b. Character assignment to present individuals
c. Referential use of space for spatial verb agreement

F. Each response was coded for its success. Success was determined based addressees' correct choice of the pictures presented for comprehension check.

Results

The predominant word orders and alternative strategies clarifying the argument structure in one-argument, two-argument, and three-argument CTSL responses (i.e., intransitive, transitive, and ditransitive constructions, respectively) were determined by the relative frequency of occurrences of each strategy.

Both successful and unsuccessful attempts were included in the analysis. Important to note here is that success depends on shared structural knowledge between the signer and the addressee. Even if the signer follows a consistent strategy with their own utterances, they may still fail to communicate if the addressee does not share the same system (e.g., a CTSL-3 signer addressing a CTSL-1 signer). The rationale behind including the unsuccessful responses in the analysis is to investigate whether the argument structure markers in a newly emerging language are conventionalized across signers. The success

rates presented in this section are calculated based on the success of an utterance that is produced in any of the three attempts, not just its success in the first attempt.

Results for One-Argument Structures

Two hundred thirteen responses were analyzed for the word order in one-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 percent in CTSL-1, it increases to 80 percent in CTSL-2 and 94 percent in CTSL-3 (figure 1). The increase in the use of SV between CTSL-1 and CTSL-2 is significant (χ^2 (1) = 14.09, p = 0.0002, 95 percent CI [12.2, 40.7]), as is the increase between CTSL-2 and CTSL-3 (χ^2 (1) = 4.15, p = 0.0415, 95 percent CI [-0.35, 24.97]). Only a small proportion of the responses, 9 percent in CTSL-1 (specifically one CTSL-1 signer) and 1 percent in CTSL-2, display a preference for VS. Finally, the overall success rates of these word orders are as follows: CTSL-1 = 77 percent, CTSL-2 = 93 percent, and CTSL-3 = 95 percent.

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

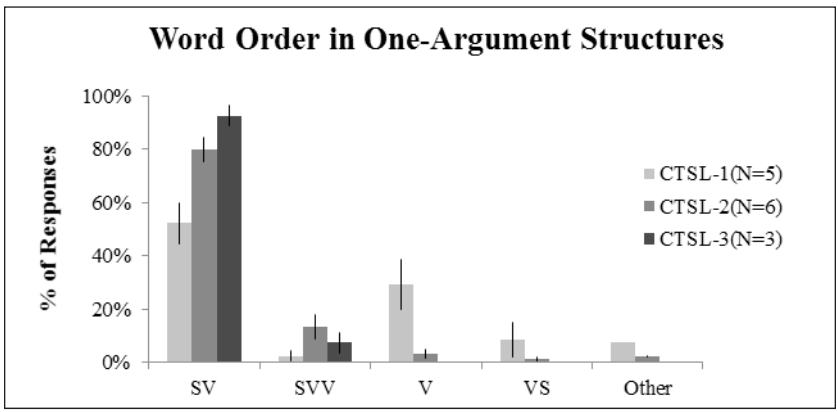

FIGURE 1. Word order preferences across cohorts in one-argument structures ($n_{\_total}$ =213, $n_{\_CTSL\text{-}1}$ = 82, $n_{\_CTSL\text{-}2}$ = 90, $n_{\_CTSL\text{-}3}$ = 41). The y-axis indicates the proportional frequency of the responses involving word orders on the x-axis.

Results for Two-Argument Structures

Two hundred forty-seven responses were analyzed to determine the word order in two-argument structures. As is illustrated in figure 2, CTSL signers' responses in all three cohorts vary. Besides the theoretically possible six orders that can be constructed with combinations of the core arguments (i.e., S,V, O), signers of all three cohorts introduce many new alternative orders; for example, object incorporation as in SV(o), argument omissions as in OV, and repeated arguments as in SOSV.

Figure 2 shows that, first, considering all the responses that are verb-final, we see a general verb-final tendency: CTSL-1 = 90 percent, CTSL-2 = 93 percent, and CTSL-3 = 93 percent;[6] and second, there is an increasing tendency for SOV (e.g., WOMAN BOX PUT), OSV (e.g., BOX WOMAN PUT), and SV(o) (e.g., WOMAN BOX-PUT) across cohorts. In addition to these general tendencies, there is also a tendency for SV/SV, particularly in CTSL-2. In this order, signers express a two-argument structure (e.g., Woman looks at the man) as two successive one-argument structures (e.g., MAN SIT, WOMAN LOOK), which we will come back to. Finally, the overall success rates of the word orders in figure 2 are as follows: CTSL-1 = 48 percent, CTSL-2 = 76 percent, and CTSL-3 = 76 percent. Compared to relatively higher proportions of a single word order (i.e., SV) and its

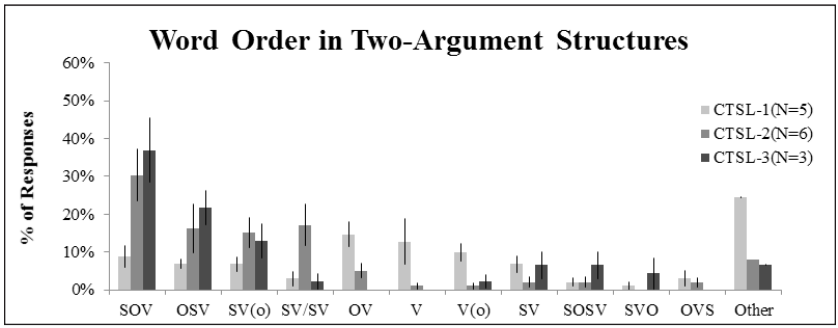

Figure 2. An image schema for the fist handshape. Word order preferences across cohorts in two-argument structures ($n_{\_\text{total}}$ = 247, $n_{\_\text{CTSL-1}}$ = 102, $n_{\_\text{CTSL-2}}$ = 99, $n_{\_\text{CTSL-3}}$ = 46). The y-axis indicates the percentage of the responses involving the word orders on the x-axis.

success rate in one-argument structures, the proportions for any single tendency and the success rates in two-argument structures are lower.

Although SOV, OSV, SV(o) and SV/SV seem to be standing out in figure 2, it is hard to make strong claims regarding the existence of a predominant word order in two-argument structures. Once the object argument is added to the event structure, mathematically many more possibilities become available to signers. The strength of word order preferences drops and the range of attempted word orders increase. This pattern may be interpreted in several different ways:

- Word order as a syntactic strategy is not conventionalized in CTSL. It is therefore not a very reliable way to encode argument structure in transitive constructions.
- Word order as a syntactic strategy in CTSL is still evolving. Therefore, there is no single word order that encodes argument structure; and these word orders are competing with each other. CTSL signers may eventually converge on a certain order, 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. When reversible and irreversible contexts are collapsed together as in figure 2, then SOV is the most frequent word order in the entire task. OSV, SV(o),[7] and SV/SV follow behind. When the irreversible contexts are considered by themselves ($n_{\_total} = 133$) as shown in figure 3, SOV is again the most frequent word order with a significant increase from CTSL-1 to CTSL-2 (χ^2 (1) = 19.1, $p < 0.0001$, 95 percent CI [18.4, 48.8]), and from CTSL-2 to CTSL-3 (χ^2 (1) = 3.948, $p = 0.046$, 95 percent CI [-1.65, 46.85]). This pattern indicates a change toward more uniformity in the language over time.

The second most frequent word order in CTSL-2 and CTSL-3 is SV(o); the tendency for OSV in irreversible contexts almost disappears. There is no tendency for SV/SV at all. In addition, CTSL-1

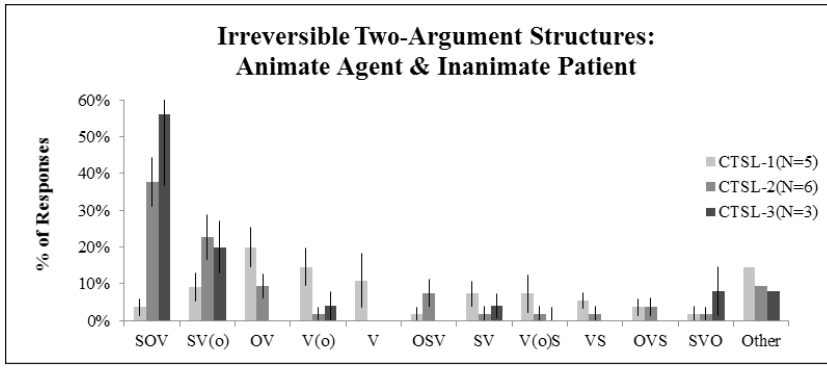

Figure 3. Word order preferences across cohorts in irreversible two-argument structures (i.e., involving an animate agent and an inanimate patient; $n_{\_total}$ = 133, $n_{\_CTSL\text{-}1}$ = 55, $n_{\_CTSL\text{-}2}$ = 53, $n_{\_CTSL\text{-}3}$ = 25). The y-axis indicates the percentage of the responses involving the word orders on the x-axis.

approximates SOV and SV(o) by omitting the subject as in OV and V(o). Important to note here is that V is never omitted, and there is an increasing verb-final tendency: CTSL-1 = 49 percent, CTSL-2 = 82 percent, and CTSL-3 = 83 percent. Finally, the overall success rates for these word orders are as follows: CTSL-1 = 60 percent, CTSL-2 = 85 percent, and CTSL-3 = 80 percent.

Animacy Factor II: Animate Agent, Animate Patient

Reversible scenarios ($n_{\_total}$ = 114) also display an increasing tendency for a verb-final pattern: CTSL-1 = 82 percent, CTSL-2 = 98 percent, and CTSL-3 = 100 percent. However, there are striking differences in the results for irreversible and reversible scenarios. *First,* in reversible cases, there is a tendency for OSV (e.g., GIRL WOMAN PUSH; ["Woman pushes the girl"]) rather than SOV (e.g., WOMAN GIRL PUSH), with an increasing consistency across cohorts (figure 4). In other words, the animate object precedes the animate subject in those contexts involving two human characters. The opposition between OSV and SOV in reversible versus irreversible contexts is significant (χ^2 (1) = 0.51, p = 0.0337, 95 percent CI [0.36, 21.67]). *Second,* there is less convergence on a single word order. *Third* is the appearance of SV/SV (e.g., WOMAN PUSH, GIRL GO AWAY) order in reversible scenarios, particularly in CTSL-2.

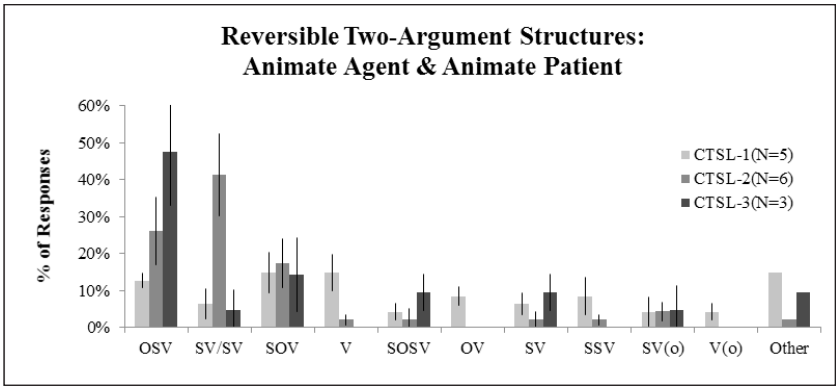

FIGURE 4. Word order preferences across cohorts in reversible two-argument structures (i.e., involving an animate agent and an animate patient; $n_{\text{total}} = 114$, $n_{\text{CTSL-1}} = 47$, $n_{\text{CTSL-2}} = 46$, $n_{\text{CTSL-3}} = 21$). The y-axis indicates the percentage of the responses involving the word orders on the x-axis.

Overall, OSV and SV/SV are almost exclusively reserved for two-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 (cf. Hall, Mayberry, and Ferreira 2013; Meir et al. 2017).

Finally, overall success rates of the word orders in figure 4 are as follows: CTSL-1 = 34 percent, CTSL-2 = 67 percent, and CTSL-3 = 71 percent. In comparison with success rates in irreversible contexts, the success rates for 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.

Results for Three-Argument Structures

One hundred fifty responses were analyzed for word order preferences. As in two-argument structures, there is a general tendency for a verb-final pattern: CTSL-1 = 84 percent, CTSL-2 = 98 percent, and CTSL-3 = 97 percent. However, as the number of arguments increase, word order combinations show huge variation (figure 5). What we have here is basically a flat distribution with no clear convergence on a certain word order, apart from the relative strength of SIV(o) (CTSL-1 = 8 percent, CTSL-2 = 11 percent, CTSL-3 =

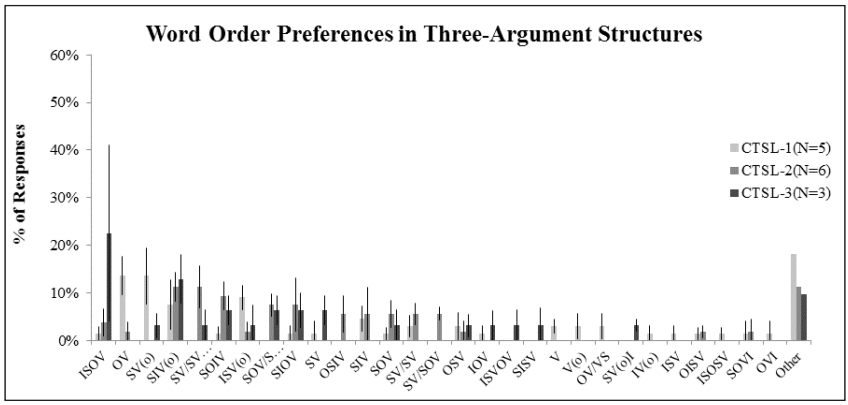

Figure 5. Word order preferences across cohorts for three-argument structures ($n_{\text{—total}}$ = 150, $n_{\text{—CTSL-1}}$ = 66, $n_{\text{—CTSL-2}}$ = 53, $n_{\text{—CTSL-3}}$ = 31). The y-axis indicates the percentage of the responses involving the word orders on the x-axis.

13 percent). Also, there is some tendency for SV/SV(o), SOV/SOV, and SV/SV[8] in CSTL-2 (11 percent). Although there appears to be a peak for ISOV in CTSL-3 (23 percent), this order only comes from a single participant and cannot be generalized to the group. Finally, when compared to the success rates of word orders in two-argument structures, the overall success rates in three-argument structures are much lower in all three cohorts: CTSL-1 = 24 percent, CTSL-2 = 58 percent, and CTSL-3 = 55 percent.

The variation in reversible scenarios both for two- and three-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 or supplementary devices to clarify thematic roles in reversible cases.

Alternative Strategies

Two hundred sixty-four responses from *reversible* contexts involving two- and three-arguments were analyzed in order to investigate the alternative strategies that were introduced in the methodology section. The results are as follows:

Successive One-Argument Structures. As is illustrated in figure 6, SV/SV responses are a general tendency in CTSL-2. Overall success rates

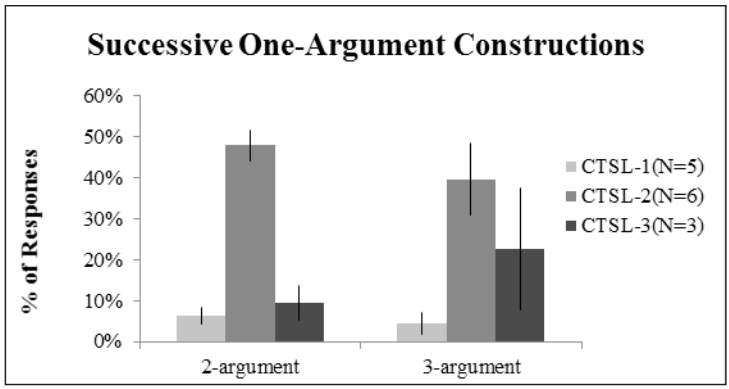

FIGURE 6. Use of structural simplification in reversible contexts ($n_{\text{two-argument}}$ = 114, $n_{\text{three-argument}}$ = 150). The y-axis indicates the percentage of the responses involving successive simpler clauses as a strategy.

for SV/SV constructions are CTSL-1 = 67 percent, CTSL-2 = 81 percent, and CSTL-3 = 67 percent. Two instances of this strategy produced by two different CTSL-2 signers are shown in examples 4 and 5.

EXAMPLE 4.

WOMAN PUSH, GIRL GO AWAY
(English: "A woman pushes a girl")

EXAMPLE 5.

MAN BALL THROW, GIRL CATCH
(English: "Man throws the ball to the girl")

The high amount of variability in three-argument responses by CTSL-3 is due to personal idiosyncrasies. One of the three signers prefers to use SV/SV constructions more frequently than the other two signers. This signer was exposed to TID for only four years, and it had been five years since she last used TID in an educational setting. Since then, she has been using CTSL more frequently in her daily interactions. The other two CTSL-3 signers are more fluent users of TID, and they use SV/SV constructions less frequently.

Character Assignment. The results indicate that CTSL-1 signers almost never use this device as a strategy. Starting with CTSL-2, there is an

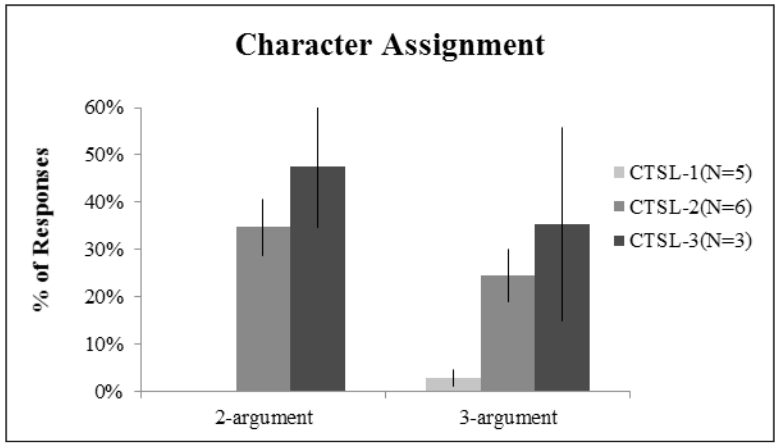

Figure 7. Use of character assignment in reversible contexts ($n_{\text{—two-argument}}$ = 114, $n_{\text{—three-argument}}$ = 150). The y-axis indicates the percentage of the responses involving "association with a character" as a strategy.

increasing tendency for this strategy across cohorts (figure 7). Overall success rates for this strategy are CTSL-1 = 0 percent, CTSL-2 = 69 percent, and CTSL-3 = 82 percent. Example 6 illustrates this strategy as produced by a CTSL-2 signer.

Example 6.

MAN POINT-TO-SELF BALL THROW, GIRL POINT-TO-ADDRESSEE BALL CATCH
= There is a man, that's me, and I throw a ball. There is a girl, that's you, and you catch the ball.
(English: "A man throws a ball to a girl")

The high variability in CTSL-3 responses, indicated by error bars, is again because the signer who was exposed to TID for four years uses this strategy more frequently than the other CTSL-3 signers.

Referential Use of Space. Our results indicate only bare traces of the referential use of space in both two-argument structures and in three-argument structures with the following success rates: CTSL-1 = 60 percent, CTSL-2 = 89 percent, and CTSL-3 = 71 percent. Two examples of this strategy are as shown in examples 7 and 8.

EXAMPLE 7.

MAN POINT-TO-LOC$_1$, GIRL POINT-TO-LOC$_2$, BALL THROW
(from LOC$_1$ to LOC$_2$)
= There is a man in this abstract location, there is a girl in this abstract location, a ball goes from the man's location to the girl's location
(English: "A man throws a ball to a girl")

EXAMPLE 8.

CHILD POINT-TO-LOC$_1$, POINT-TO-SELF MAN, SHOULDER, TAP-LOC$_1$
= There is a child in this location, I am the man, I tap girl('s location in the signing space) on the shoulder
(English: "A man taps a girl on the shoulder")

As is illustrated in figure 8, CTSL-3 signers are making a shift to using the space referentially. Previous cohorts do not make use of this device nearly as much as CTSL-3 signers do in both two-argument and three-argument structures. One possible reason for this shift might be the influence of TID on CTSL.

The high variability in the utterances for three-argument structures by CTSL-3 signers is mainly caused again by one of the fluent TID

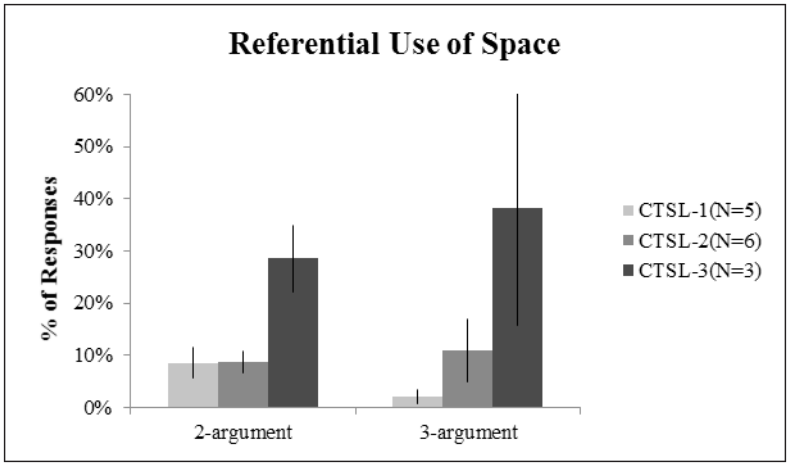

FIGURE 8. Referential use of space in reversible two- and three-argument contexts ($n_{\text{—two-argument}}$ = 114, $n_{\text{—three-argument}}$ = 150). The y-axis indicates the percentage of the responses involving referential use of abstract location in two- and three-argument structures as a strategy.

signers. The way she uses space referentially while communicating with other CTSL signers might be an outcome of exposure to TID.

Summary and Discussion

Our findings indicate that CTSL signers have gradually been tailoring their language to the communicative demands of a growing signing community, and certain inventions reflect the beginning of a linguistic system. First, CTSL displays a clearly increasing tendency for SV in one-argument structures. When it comes to two-argument structures, word order preferences show more variation. Yet CTSL has become more homogeneous in terms of word order preferences over time as CTSL-2 and CTSL-3 signers have converged on fewer word orders. In the entire task, there is an increasing tendency for SOV, OSV, and SV(O) orders for two-argument structures. Moreover, SOV and SV(O) are more frequently preferred in irreversible scenarios, while there is a tendency for OSV and (in CTSL-2) for SV/SV in reversible ones. The statistically prevalent SVO tendency both in spoken and sign languages is not found in CTSL (cf. Dryer 2005; Napoli and Sutton-Spence 2014). When it comes to three-argument structures, word order preferences vary to a great extent. Signers try all sorts of combinations without a clear convergence on a certain order.

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), either in reversible or in irreversible scenarios. Word order for CTSL-1 signers may be simply a linear ordering of information with little tendency for systematicity. Furthermore, none of the alternative argument markers is present in CTSL-1. CTSL-2 represents a stage of reliance on successive one-argument structures (i.e., SV/SV), but it also starts to use character assignment. In the next generation, CTSL-3 signers tend to leave successive one-argument structures behind. They adopt character assignment as a model from CTSL-2, but they also start shifting toward the use of an abstract verb agreement system. All in all, this developmental pattern suggests that signers of different cohorts recognize animacy differences, but they encode them in distinct ways.

Previous studies on the argument structure of emerging sign languages present evidence for similar developmental patterns similar to those of CTSL. Senghas et al. (1997) report that the use of successive one-argument clauses appears in the second generation of NSL signers. The same basic strategy is present both in ISL and ABSL. In reversible transitive contexts, ABSL displays a higher tendency (47 percent) for SV/SV than ISL (33 percent), which suggests that ABSL, as a village sign language, makes a preference for a simpler strategy than a more conventionalized signed system does (Meir, 2010). This opposition can be considered analogous to the decrease of SV/SV in the transition from CTSL-2 to CTSL-3.

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; ABSL signers do not use it at all (Meir 2010). This is also true for NSL, in that 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 and Coppola 2001).

These crosslinguistic findings suggest that newly emerging sign languages may adopt similar patterns. Yet they do not entirely follow the same developmental paths. For instance, Meir (2010) reports that ABSL signers came to rely mainly 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 the third generation (Meir 2010). CTSL signers, on the other hand, do not necessarily rely entirely on word order as a linguistic mechanism except for irreversible cases.

These differences in three emerging sign languages indicate that there is not a single universal path, nor a similar timetable for the development of argument structure marking. Languages may differ in argument marking strategies when they are conventionalized during the very early stages of their existence.

Notes

1. Okan Kubuş, PhD, a deaf native Turkish Sign Language (TID) signer, viewed several different spontaneous conversations involving CTSL signers and confirmed that their language is completely distinct from TID (pers. comm.).

2. Another village sign language recently discovered in Turkey is Mardin Sign Language (Dikyuva 2012). Mardin Sign Language and CTSL communities are geographically and culturally unrelated to each other.

3. Considering the 0.04 percent in Turkey this is a very high proportion of deafness within a tiny community (Demir and Aysoy 2002).

4. These are official numbers based on a 2011 population count. Accessed October 2, 2016. http://www.yerelnet.org.tr/koyler/koy.php?koyid=248633.

5. With some exceptions like Riau Indonesian: It is a flexible word order language without any linguistic devices other than pragmatics to express semantic roles (Gil 2009).

6. V(o) and V are excluded in figures 2, 3, 4, and 5 as it is not possible to make a word order judgment in an utterance involving a single sign.

7. We acknowledge that classifier predicates may affect word order preferences and create a bias for SV(o). Also, the type of the object and action combination may have a role in object incorporation. In our data set, clips depicting a human agent pulling a cart, lifting a box, and rolling a ball elicited most of the SV(o) responses.

8. The second "S" is the recipient.

References

Aronoff, M., I. Meir, C. A. Padden, and W. Sandler. 2008. The Roots of Linguistic Organization in a New Language. *Interaction Studies* 9(1): 133–53.

Bauer, A. 2014. *The Use of Signing Space in a Shared Sign Language of Australia,* vol. 5. Berlin: Walter de Gruyter.

Bos, H. 1993. Agreement and Prodrop in Sign Language of the Netherlands. *Linguistics in the Netherlands* 10(1): 37–47.

Cormier, K., S. Smith, and M. Zwets. 2013. Framing Constructed Action in British Sign Language Narratives. *Journal of Pragmatics* 55: 119–39.

Culicover, P. W. 2009. *Natural Language Syntax*. Oxford: Oxford University Press.

De Vos, C., and U. Zeshan. 2012. Introduction: Demographic, Sociocultural, and Linguistic Variation across Rural Signing Communities. In *Sign Languages in Village Communities: Anthropological and Linguistic Insights,* ed. U. Zeshan and C. de Vos, 2–23. Berlin: Mouton De Gruyter.

Demir, Ö., and M. Aysoy. 2002. *Turkey Disability Survey*. Ankara: State Institute of Statistics.

Dikyuva, H. 2012. Mardin Sign Language: Signing in a "Deaf Family." *Sign Languages in Village Communities: Anthropological and Linguistic Insights* 4: 395.

Donohue, M. 2002. Tobati. In *The Oceanic Languages,* ed. J. Lynch, M. Ross, and T. Crowley, 186–203. London: Routledge.

Dryer, M. S. 2005. Order of Subject, Object, and Verb. In *The World Atlas of Language Structures,* ed. M. Haspelmath, M. S. Dryer, D. Gil, and B. Comrie, 330–33. Oxford: Oxford University Press.

Ergin, R. 2017. Central Taurus Sign Language: A Unique Vantage Point into Language Emergence. PhD diss., Tufts University. Retrieved from https://search.proquest.com/openview/69f73091abbc97d1d2997408076c5301/1?pq-origsite=gscholar&cbl=18750&diss=y

———, and D. Brentari. 2017. Hand Shape Preferences for Nouns and Verbs in Central Taurus Sign Language. Paper presented at the Proceedings of the 41st annual Boston University Conference on Language Development, Boston.

Gil, D. 2009. What is Riau Indonesian? Paper retrieved from http://sastra.um.ac.id/wp-content/uploads/2010/01/PU-David-Gil-Riau-Indonesian-.-.-..pdf

Göksel, A., and C. Kerslake. 2004. *Turkish: A Comprehensive Grammar.* London: Routledge.

Hall, M. L., R. I. Mayberry, and V. S. Ferreira. 2013. Cognitive Constraints on Constituent Order: Evidence from Elicited Pantomime. *Cognition* 129(1): 1–17.

Kalin, L. 2014. The Syntax of OVS Word Order in Hixkaryana. *Natural Language & Linguistic Theory* 32(4): 1089–104.

Kusters, A. 2009. Deaf Utopias? Reviewing the Sociocultural Literature on the World's "Martha's Vineyard Situations." *Journal of Deaf Studies and Deaf Education* 15(1): 3–16.

Marsaja, I. G. 2008. *Desa Kolok: A Deaf Village and Its Sign Language in Bali, Indonesia.* Preston, UK: Ishara Press.

Meir, I. 2010. The Emergence of Argument Structure in Two New Sign Languages. In *Syntax, Lexical Semantics, and Event Structure,* ed. ed. M. R. Hovav, E. Doron and I. Sichel,, 101–13. Oxford: Oxford University Press

———, M. Aronoff, C. Börstell, S. -O. Hwang, D. Ilkbasaran, I. Kastner, . . . W. Sandler. 2017. The Effect of Being Human and the Basis of Grammatical Word Order: Insights from Novel Communication Systems and Young Sign Languages. *Cognition* 158: 189–207.

Napoli, D. J., and R. Sutton-Spence. 2014. Order of the Major Constituents in Sign Languages: Implications for All Language. *Frontiers in Psychology* 5: 376.

Padden, C. 1986. Verbs and Role-Shifting in American Sign Language. Paper presented at the Proceedings of the Fourth National Symposium on Sign Language Research and Teaching.

———. 1988. *Interaction of Morphology and Syntax in American Sign Language.* London: Routledge.

Potsdam, E. 2010. VSO Word Order in Malagasy Imperatives. *Austronesian and Theoretical Linguistics* 167: 231.

Sandler, W., I. Meir, C. Padden, and M. Aronoff. 2005. The Emergence of Grammar: Systematic Structure in a New Language. *Proceedings of the National Academy of Sciences of the United States of America* 102(7): 2661–65.

Sapountzaki, G. 2012. Agreement Auxiliaries. In *Sign Language. An International Handbook,* ed. R. Pfau, M. Steinbach and B. Woll, 204–27. Berlin: Walter de Gruyter.

Senghas, A., and M. Coppola. 2001. Children Creating Language: How Nicaraguan Sign Language Acquired a Spatial Grammar. *Psychological Science* 12(4): 323–28.

———, E. L. Newport, and T. Supalla. 1997. Argument Structure in Nicaraguan Sign Language: The Emergence of Grammatical Devices. In Proceedings of the 21st Annual Boston University Conference on Language Development, ed. E. Hughes and A. Greenhill, 550–61. Medford, MA: Cascadilla Press.

Williams, S. J. 1980. *A Welsh Grammar.* Cadiff: University of Wales Press.

Appendix A. Demographics

The data presented in this study mainly come from village 1, and we elaborate here on its demographics. The deafness in this village is within a single family, involving twenty-three* deaf members (fifteen deaf females and eight deaf males) and it can be traced back to eight generations (see figure 9 for family tree). 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 sixth generation, there were only one or two deaf members in each generation. None of them are alive today, except for one deaf signer who is from the fifth generation and who is in his sixties. Strikingly, the sixth generation included twelve deaf members (plus four deaf spouses), which is evidently a large enough group to accelerate development of the language through vertical

*Note that there are family members joining the family through marriage and not all of the deaf members of the family live in village 1.

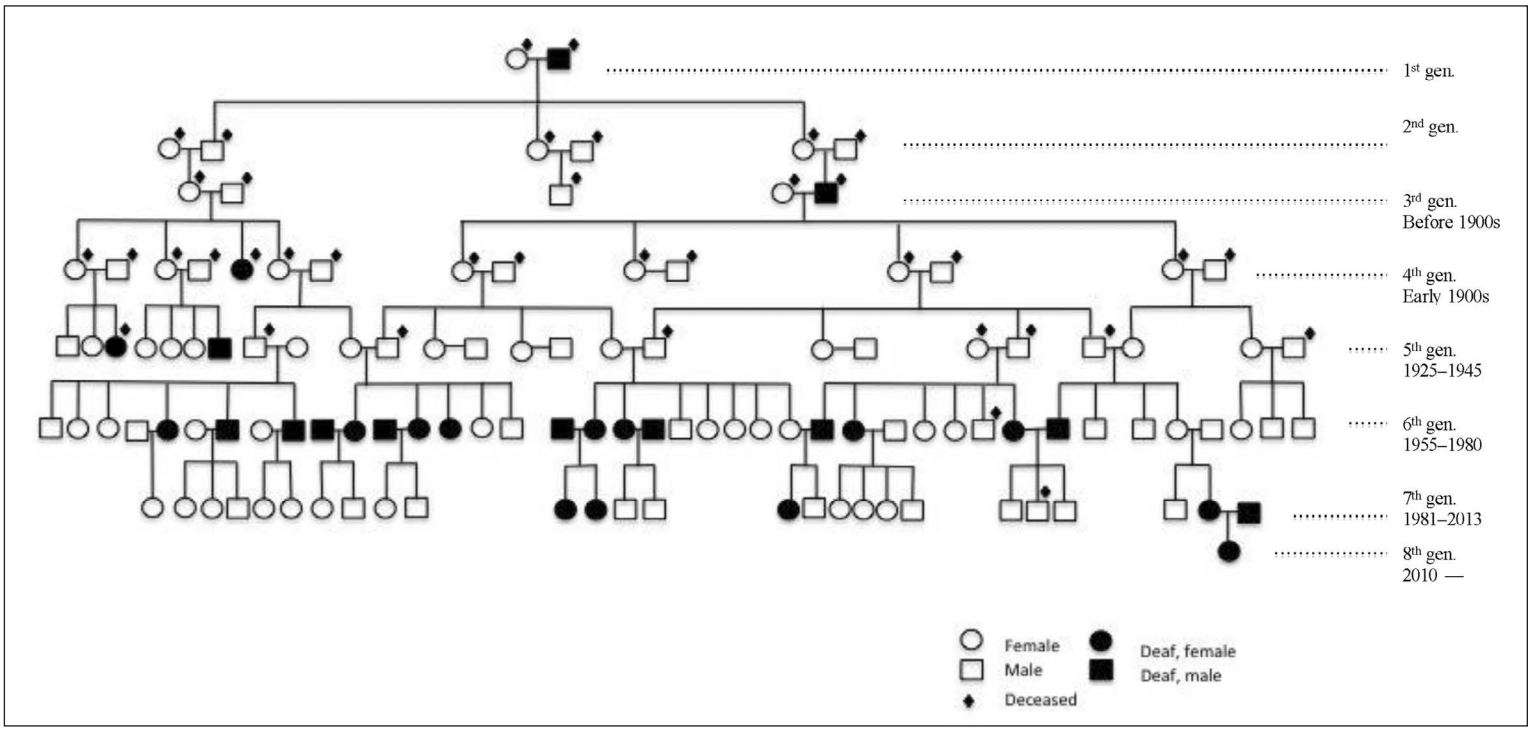

FIGURE 9. The family tree involving recessive deafness in village 1. Note that this is not a complete family tree. The deaf members and their genetic connections to one another are prioritized.

and horizontal social contact among the members of the same and different generations.* Today, three generations of deaf members exist simultaneously in the community, contributing to the formation and development of the language. In addition, many hearing members of the community sign CTSL at varying proficiency levels.

Before 2000, the closest school for the deaf was approximately one hundred seventy miles away from the village in the city of Adana. One of the families from the village moved to Adana in the 1970s. The family had two deaf children and sent them to the school for the deaf there. These two deaf sisters from the sixth generation were exposed to another deaf culture, starting in the 1970s, and they acquired Turkish Sign Language (TID) as a second language. They have not been living in the village since the 1970s, and visit the village only during holidays.

Another school for the deaf was founded in Mersin (approximately one hundred ten miles away from the village) in the late 1990s. In addition, the highways built after 2000 improved public transportation, and the Turkish government passed new laws and regulations to provide citizens with equal education rights irrespective of their restrictions. These changes made it easier for the deaf villagers to have access to the formal education of the country. Two of the deaf members from the seventh generation were sent to the school for the deaf in Mersin, where one was exposed to TID between the ages 7 and 11 (from 2005 until 2009), and the other between 9 and 19 (from 2003 till 2013). Aside from these two seventh generation members and the two deaf siblings from the sixth generation, the deaf members of the CTSL community had no exposure to TID. These four bilingual signers of TID and CTSL use a mixture of CTSL and TID among one another but they switch to CTSL to communicate with everyone else in the village.

*The first author is a member of the seventh generation of the family.

Appendix B. Stimulus Set for Argument Structure

Elicitation Sentences*

1. A woman puts a box on the table	1. Nonreversible, transitive
2. A woman gives a shirt to the man	2. Reversible, ditranstive
3. A girl pulls the shopping cart	3. Nonreversible, 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. Nonreversible, transitive
8. A woman takes scissors from a girl	8. Reversible, ditransitive
9. A man taps the watermelon	9. Nonreversible, 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. Nonreversible, transitive
14. A man shows a picture to a wom-an	14. Reversible, ditransitive
15. A girl tears the paper	15. Nonreversible, 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, ditransitive
21. A man washes the plate	21. Nonreversible, 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. Nonreversible, transitive
26. A girl feeds woman	26. Reversible, ditransitive
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

*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	Gender	Age*	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 (4 years)
	7. Fatma (Aunt)	Female	43	1	No	Her niece, hearing, native CTSL signer, age: 15, from village 1, schooled (4 years)
	8. Fatma	Female	43	1	No	Her cousin, deaf native CTSL signer, age: 45, not schooled
	9. Bayram	Male	38	2 (Married to Ulku from village 1)	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 (Married to Bayram from village 2)	No	Her sister, hearing, native CTSL signer, age: 39, from village 1, schooled (5 years)
CTSL-3	12. Mustafa	Male	22	2 (He went to school with Sengul)	Yes	With a deaf native CTSL 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 between ages 7–11	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-3**, n = 3, 16–22.

*The ages of the participants are those in August 2013 when they were tested.

Appendix D. Elicitation Task for Argument Structure

FIGURE 10. Video clip: Woman puts a box on the table.

FIGURE 11. The pictures used as an indication for comprehension.