THE INFLUENCE OF COMMUNITY SIZE ON CONSTITUENT ORDER: A COMPARISON BETWEEN EMERGING AND CONVENTIONALIZED SIGN LANGUAGES

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PLAGIARISM

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ABSTRACT

The current study examines the effect of community size on constituent order by comparing conventionalized sign languages (TID and LIBRAS) and emerging sing languages (CTSL and CENA) from two different countries. When the relevant literature is examined, it is observed that languages that emerge in communities with larger populations tend to have a more uniform structure, while languages that emerge in smaller and closed-knit communities exhibit greater diversity regarding their constituent order. Data was collected through an elicitation task comprised of 30 short video clips containing sentences with intransitive, transitive (reversible vs. irreversible events), and ditransitive structures. Significant relationships were found between community size and constituent order, revealing that conventionalized sign languages presented more uniform word orders in intransitive and ditransitive structures and transitive structures with irreversible events, whereas no significant relationship was detected for reversible events. The study contributes to the existing literature by demonstrating that languages from larger communities rely on commonly used constituent orders to describe events; in contrast, languages from smaller communities produce more uncommon constituent orders. The current study has practical implications for the relationship between sign languages in different stages of development and constituent order preferences, highlighting the developmental phases of language emergence and evolution.

Keywords: *Constituent order; emerging sign language; conventionalized sign language; community size*

ÖZET

Bu çalışma, yerleşik işaret dilleri (TID ve LIBRAS) ve gelişmekte olan işaret dilleri (CTSL ve CENA) arasındaki farkı inceleyerek toplum büyüklüğünün kurucu dizilimi [kurucu=öğe, İng. *constituent*] üzerindeki etkisini araştırmaktadır. İlgili alanyazın incelendiğinde, büyük toplumlarda ortaya çıkan dillerin tekdüze bir yapıya sahip olma eğilimlerinin daha fazla olduğu, küçük ve dışarıya kapalı toplumlarda ortaya çıkan dillerin ise kurucu dizilimi açısından daha büyük çeşitlilik göstererek tekdüzelikten uzak bir yapıya sahip oldukları görülmektedir. Veriler, 30 kısa videodan oluşan ve geçişsiz, geçişli (çift taraflı veya tek yönlü durumlar) ve çift geçişli yapıları içeren bir betimleme deneyi ile toplanmıştır. Toplum büyüklüğü ile kurucu dizilimi arasında kayda değer ilişkiler bulunmuş olup, yerleşik işaret dillerinin geçişsiz ve çift geçili yapılarında ve tek yönlü durumlara sahip geçişli yapılarında daha tekdüze bir kurucu dizilimi sunduğu, çift taraflı durumlar için belirli bir ilişki tespit edilmediği ortaya çıkmıştır. Çalışma, daha büyük toplumlardan gelen dillerin olayları tanımlamak için yaygın olarak kullanılan kurucu dizilimlerine güvendiğini, buna karşılık daha küçük topluluklardan gelen dillerin daha yaygın olmayan kurucu dizilmleri ürettiğini göstererek mevcut alanyazına katkıda bulunmaktadır. Bu araştırma, farklı gelişim aşamalarındaki işaret dilleri ve kurucu dizilimi tercihleri arasındaki ilişkiyi ortaya çıkarma açısından dikkate değer bir öneme sahiptir ve dilin meydana gelme ve evrim aşamalarını vurgulamaktadır.

Anahtar kelimeler: *Kurucu dizilimi; gelişmekte olan işaret dili; yerleşik işaret dili; toplum büyüklüğü*

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1. INTRODUCTION

Communication is one of the primal needs of human beings, and every individual on the planet has some means to communicate. There are about 7000 languages in the world that vary to a great extent, and how these languages are formed and evolved is one of the most researched questions in the field of linguistics. Nevertheless, such questions are also challenging to investigate because finding concrete evidence is a difficult task to achieve, yet not impossible. Lately, many researchers are focused on studying sign languages that recently came into existence because this way, it is possible to carefully observe how these sign languages are being created from scratch and how they evolve throughout generations (Almeida-Silva & Nevins, 2020; Brentari, Ergin, Senghas, Cho, Owens & Coppola, 2021; Ergin, Meir, Ilkbasaran, Padden & Jackendoff, 2018; Ergin, 2022; Kirton, 2021). The main objective of such studies is to have a deeper understanding of the evolution of spoken languages by investigating emerging sign languages.

Word order is a crucial element in investigating and understanding languages. Some researchers have been focusing on word order in their emerging sign language studies because it is considered that investigating word order in these newly emerging sign languages can provide us with an understanding of the evolutionary stages of language conventionalization. A language can acquire several different word orders as dominant word orders, and they vary considerably between languages worldwide. Such differences bring these questions to mind: “Which factors are in play?” and “Is it possible that society and community size can affect such differences?”. Previous studies suggest community size can be an influencing factor over language structures and word order (Meir, 2012; Brentari et al., 2021; Kocab, Goldberg, & Snedeker, 2019; Raviv, Meyer, & Lev-Ari, 2019), and emerging sign languages carry a high value in studying community size since some of them are currently being formed in small and isolated communities which creates a chance to see if community size can be a factor. Yet, the current literature does not hold any large-scale cross-linguistic study where emerging sign languages are compared to sign languages from larger communities. With this gap in the literature in mind, this study is aimed at

investigating the influence of community size on constituent order by comparing emerging sign languages to conventionalized sign languages.

1.1. Communities and Languages

Languages, by their nature, are bound to be affected by the structures and characteristics of their societies. In the literature, numerous studies that differ in methodology contribute to the idea that high-level diversity in languages and their properties can be the outcome of different community sizes and network structures of the populations (Kirby, Cornish, & Smith, 2008; Kocab et al., 2019; Lupyan & Dale, 2010; Raviv et al., 2019; Trudgill, 2009). Specifically, community size is argued by some scholars to be one of the main reasons for shaping language features. But when we say "the influence of community size," it can come across as too general. What type of influence is it? In what ways does community size impact the emergence and development of languages? Numerous historical and cross-linguistic studies approach the topic with different language properties. For instance, in a study conducted by Trudgill in 2009, it is proposed that with sparsely populated and isolated communities, there is more redundancy in terms of morphological systems, which results in more complex and irregular languages. Another research found that languages spoken in smaller communities tend to have a smaller phonemic inventory than those from larger communities (Hay & Bauer, 2007). Lastly, through an examination of 2,236 languages, Lupyan and Dale (2010) came to the conclusion that languages that are a part of small, isolated, and closed communities tend to be more resistant to regularity and have more complex structures, while larger communities showed less complexity. Many studies later supported this finding throughout the years, contributing to understanding the relationship between community size and language structure (Meir, Israel, Sandler, Padden, & Aronoff, 2012; Raviv et al., 2019; Trudgill, 2011).

Several other studies attempted to determine the effect of community size from other potentially influencing factors so that the extent to which a community size affects the development of an emerging sign language can be understood more clearly. Studies were conducted using computational modeling, and the results showed little to no influence in terms of community size on explaining cross-linguistic patterns (Gong, Baronchelli, Puglisi & Loreto, 2012; Lou-Magnuson & Onnis, 2018). In stark contrast with these results, some other computational modeling

studies suggest a strong relationship between language and community size (Spike, 2017; Reali, Chater & Christiansen, 2018). When these contradictory results are considered all together, it is apparent that there is a need to investigate this subject further.

1.1.1 Linguistic Niche Hypothesis

In an attempt to provide an account for the nature of the relationship between languages and the environments in which they appear, Lupyan and Dale (2010) put forth the *Linguistic Niche Hypothesis*. According to this hypothesis, such a connection can be explained by combining both social and cognitive factors. The authors claim that language development depends on the learners' preconceptions and the limitations in learning and how such limitations take part in the expansion of the population. When learning a new language as an adult, some challenges originate from the complexity of the grammar. With larger groups, language use will expand to larger populations, and adult language learners will eventually stop using the properties causing complexity, which in turn may result in languages becoming more simplified over time. On the other hand, language learners in smaller groups will communicate less with adult speakers from outside of the group and instead will have more child learners within their community. This will cause more redundancies and, therefore, morphological complexity in the language. All in all, Lupyan and Dale's work have shown that languages can be influenced by the environments they are used in.

Similarly, this notion can be seen in earlier papers by Trudgill, also mentioned as the *"Interrupted Transmission Hypothesis"*. In his 2004 and 2009 papers, he suggests that individuals who are in an age where it is not possible to acquire a language as their native language, known as the critical period to acquire a language, often struggle to learn languages and face challenges. This causes a decrease in morphological categories, also referred to as language simplification. He further claims that in situations where adult language learners are part of small and isolated communities, the range of language contact becomes very limited, which in turn causes more irregularity and complexity. Over the course of many years, numerous supporting papers were published that demonstrate how the size of a community and its societal type might influence the characteristics of a language, resulting in various

language structures (Raviv et al., 2019; Raviv, Meyer & Lev-Ari, 2020; Lupyan & Dale, 2016; Meir et al., 2012).

1.1.2 Esoteric vs. Exoteric Communities

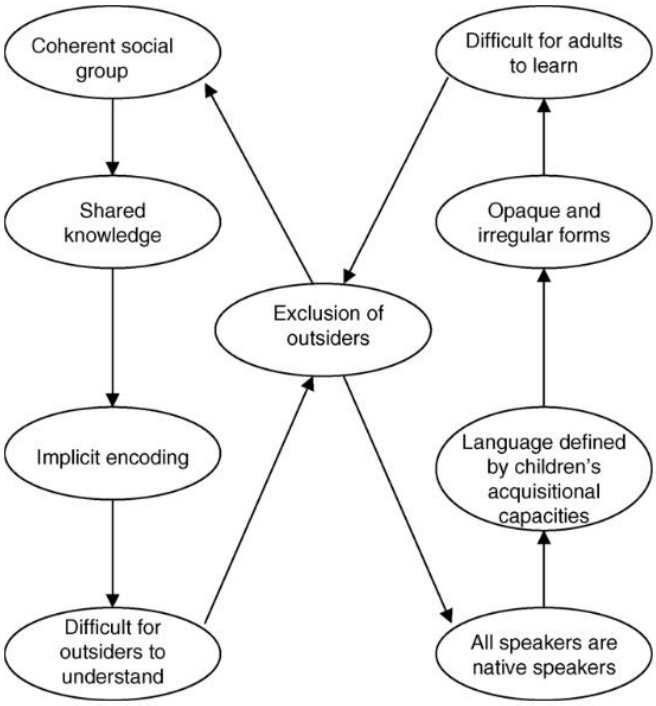
In relevant literature in linguistics, along with Trudgill and Lupyan & Dale, many researchers have categorized communities into two: *esoteric* and *exoteric communities* (Raviv et al., 2020; Roberts & Winters, 2012; Wray & Grace, 2007). The primary assumption is that how individuals communicate in certain social environments changes the characteristics and structure of the language. The idea was originated by Wray and Grace (2007), with the influence of earlier research conducted by Thurston (1987, 1989, 1994). Initially, Thurston talked about the difference between esoteric and exoteric *languages*; however, Wray and Grace approached it as esoteric and exoteric *communication*, aiming to clarify the distinction between language and the way it is used by the community.

1.1.2.1. Esoteric communities

According to Wray and Grace, esoteric communities are small social groups that are isolated and close-knit, where there is esoteric communication. They suggest that languages used in esoteric communities tend to be more morphologically complex and have characteristics that are irregular -that is, complex and uncommon phonemes and distinct lexical items (Wray & Grace, 2007; Trudgill, 2004, 2009, 2011). The authors put forward a diagram (See Figure 1) that lays out the interrelated factors that are likely to be the most influential in the emergence of such complex structures. It is argued that esoteric communities are homogenous -the community members share the same background and history, resulting in members having shared knowledge about each other and their environment collectively. As well as being in a homogenous society with esoteric communication helps individuals to transmit and receive the message with minimal required knowledge, it also makes it difficult for people from outside of the community to interact and communicate with the members in the same way. This situation will create an environment where there are no outsiders to the group, and the majority of language learners will be the children of the society. In sum, small, close-knit, and homogeneous societies -i.e., esoteric communities- with just native speakers and no new adult learners contribute to the emergence and development of languages with irregular and complex structures.

Figure 1

The perpetuation of esoteric communication in a closed community



Note. Reprinted from "The consequences of talking to strangers: Evolutionary corollaries of socio-cultural influences on linguistic form" by Wray & Grace, (2007). Lingua. 117. 543-578. 10.1016/j.lingua.2005.05.005.

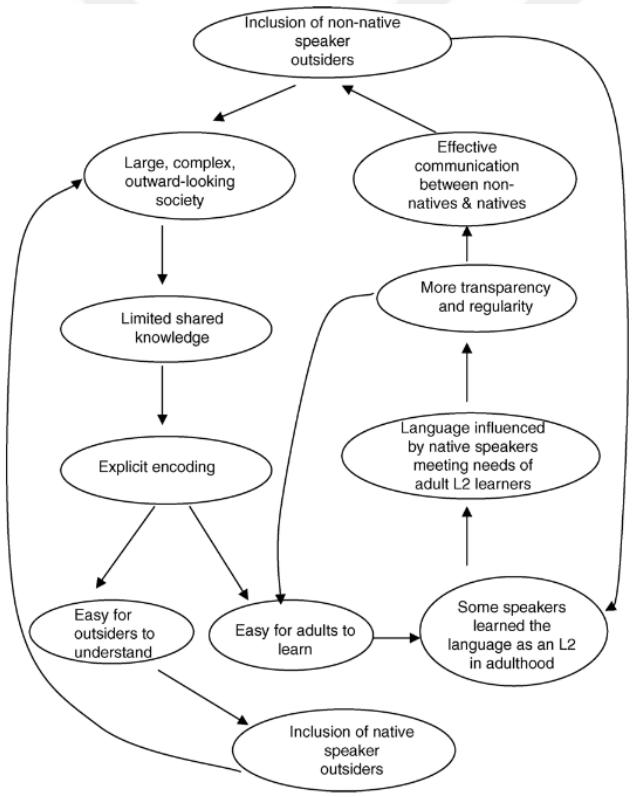
1.1.2.2. Exoteric communities

In contrast to communities with esoteric communication, exoteric communication tends to develop in groups where the speakers of the language are not familiar with one another, therefore have different cultural backgrounds and do not share any common knowledge with other members of the group. Individuals who are members of such groups will not be able to rely on shared knowledge to communicate with each other because they come from other cultural environments, and the message that needs to be conveyed should not include irregularity and complexity; otherwise, the communication will not be efficient. As the population of speakers expands, the complexity of language increases due to various linguistic inputs from different adult speakers. Eventually, the language becomes more systematic and compositional through simplifications to generate a communication system that is understandable by most (see Figure 2). Thus, languages used in exoteric environments are inclined to be

simpler and systematic, or, as in the words of Wray and Grace (2007), “Languages that are customarily used exoterically will tend to develop and maintain features that are logical, transparent, phonologically simple and, significantly, learnable by adults” (p. 551). Many linguistic studies support the notion of esoteric and exoteric communication and demonstrate that language learners can improve their ability to categorize and generalize within the expansion of the learner population (Lev-Ari, 2016, 2018; Perry, Samuelson, Malloy, Schiffer, 2010; Raviv, Meyer, & Lev-Ari, 2019b).

Figure 2

The perpetuation of exoteric communication in an outward-looking community.



Note. Reprinted from “The consequences of talking to strangers: Evolutionary corollaries of socio-cultural influences on linguistic form” by Wray & Grace, (2007). Lingua. 117. 543-578. 10.1016/j.lingua.2005.05.005.

1.2. Word Order

In the field of linguistics, one of the most studied linguistic concepts is word order. This is unsurprising given that languages are externalized (i.e., put to use) in a

strictly linear fashion, in at least spoken languages. It is considered one of the significant components and plays a crucial part in understanding the semantic roles in a sentence. A clear understanding of "*Who did what to whom*" only comes with the uniform use of word order in that language. In the case of transitive constructions, *subject* (S), *object* (O), and *verb* (V) are the three constituents that form six different orders: SOV, SVO, OSV, OVS, VOS, and VSO. In a comprehensive book called The World Atlas of Language Structures (Haspelmath, Dryer, Gil & Comrie, 2005), about 2650 languages were investigated regarding their structural properties. Many of them (86%) were found to be using one of the orders more frequently than the others (i.e., dominant word order). The general conclusion of the study is that different languages have different preferences towards leading word order, and it is not equally spread across languages. While SOV (e.g., Turkish, Korean, and Japanese) and SVO (e.g., English, Portuguese, Italian) are the most commonly used orders -approximately %48 and %41, others appear to be used rather infrequently -less than 8% (Dryer, 2013). Apart from spoken languages, sign languages also seem to favor one order over the others. Napoli and Sutton-Spence (2014) researched 42 sign languages and reported that SOV and SVO were the most common leading orders, as is also the case in spoken languages. Such findings suggest that regardless of whether it is spoken or sign language, SOV and SVO are predominately leading word orders. Then what causes such tendencies? Which factors are in play in the uneven distribution of dominant word orders? Why do the majority of both spoken and sign languages prefer some orders over others? Over the years, these questions have been studied through different methodologies to reveal how one order exceeds others in the course of generational transmission.

According to Newmeyer (2000), SOV was the primary word order in the initial stages of language evolution; however, in time, the use of SVO has increased due to various proficiency demands. Maurits & Griffiths (2014) conducted a Bayesian phylogenetics study with 671 languages from different language families. It was suggested that in a hypothetical situation where there is a mutual ancestor of all these language families, SOV would be the most probable dominant word order. They further explain the SVO preference as a drift towards a change in the word order. In an experimental study on the same subject, participants were introduced to four artificial languages with different word orders, and the results revealed that the most

commonly used word orders lead to better and faster performance (Tabullo, Arismendi, Wainselboim, Primero, Vernis, Segura, Zanutto & Yorio, 2012), proposing that some word orders are preferred more because they are easier to learn and use. A study conducted with the silent gesture paradigm reveals that participants who differ in native languages mostly favour SOV during experiments, regardless of the dominant word order used in their native languages (Goldin-Medow, So, Ozyurek, & Mylander, 2008), which suggests that preferences of word order might be under the influence of certain cognitive factors (Meir 2010; Meir, Aronoff, Börstell, Hwang, Ilkbasaran, Kastner, Lepic, Ben-Basat, Padden & Sandler, 2017; Gibson, Piantadosi, Brink, Bergen, Lim & Saxe, 2013; Hall, Mayberry & Ferreira, 2013).

1.2.1. Animacy: Reversible vs. Irreversible Events

The concept of animacy is highly essential to human beings. From the very early stages of life, humans can recognize whether a creature is alive (Mandler, 1992; Becker, 2014). According to Dahl (2008), animacy is an ontological classification where there is a separation of animate and inanimate entities. He suggests that an interaction of semantic roles with the concept of animacy can imply how we perceive sentences because animate entities are most likely to be presumed as the agent of sentences.

Reversible events are the events where the agent and the patient are both animate. When both the subject and the object constituents of a sentence, such as “THE GIRL HIT THE BOY”, are specified as human, the semantic role that maps to the subject is agent, and to the object is patient. Notice, however, that without any consideration of linear order, both constituents could be identified as agents, for they can potentially act as agents in virtue of bearing the semantic feature of human, which may potentially render an ambiguity in terms of who is the agent and who is the patient. Since the dominant word order is SVO, this sentence would be rather clear in a language like English. However, when the utterance is without a proper word order, it is not transparent who is hitting whom. On the other hand, semantic roles in *irreversible events* cannot be changed because the agent would be an animate character, and the patient is inanimate. In a sentence like “THE GIRL PULLS THE TREE”, the animate agent -girl- can perform the ‘pull’ action whereas the patient -tree- cannot. Even if the sentence was produced without an order, the recipient would

understand the message without difficulty because it would be impossible for the tree to pull the girl. [1]

1.2.1.1. The noisy channel account

Studies that tested animacy on constituent order have shown that frequently used word orders in reversible scenarios are typically SVO, and for irreversible scenarios, it is mostly SOV (Hall et al., 2013; Gibson et al., 2013; Goldin-Meadow et al., 2008). Gibson and colleagues (2013) introduced the *noisy channel account* to characterize the causes for such preferences. According to this approach, the prevalence of Subject-Object-Verb order in irreversible scenarios is caused by a cognitive tendency to introduce subjects first, whereas the shared preference for Subject-Verb-Object order in reversible scenarios stems from blocking the "noise" in the conveyed message by placing the verb between the subject and the object. Futrell et al. (2015) later supported the hypothesis by revealing that in a silent gesture experiment, speakers of SVO languages and speakers of VSO languages both preferred to place subjects first and verbs last for irreversible events regardless of their language's dominant word order, whereas they used the SVO order the most for reversible events.

1.2.1.2. The principle of agent-first

Jackendoff (2002) put forward an Agent-first principle proposing that people are cognitively inclined to place the agent of the action first. In cases where a fully developed communication model is absent, it is not likely to rely on an established constituent order. Therefore, challenges created by the ambiguity of two animate characters are resolved by placing agents first. He suggests that a sentence like "*Eat apple Fred*" is an irreversible event which is why it is recoverable regardless of the word order. However, contrary to irreversible scenarios, reversible events imply uncertainty in an order like "*Hit tree Fred*" given that the tree comes before Fred. According to this principle, since it is likely that the tree can hit Fred and it precedes him in the order, one would infer that the agent is in fact the tree in this sentence. In sum, Jackendoff argues that constituent orders of conventionalized languages are shaped according to the Agent-first principle; however, several emerging sign

[1] Although it is argued that some sentences do not conform to such circumstances. In a sentence like "The rock hit Bill" the subject, the rock, is an inanimate entity. In the absence of a strict word order convention such a sentence will always be interpreted as Bill as the agent, whereas it is the rock who performs the "hit" action.

language studies reported contradicting results to such a claim (Ergin et al., 2018; Meir et al., 2017).

Meir et al. (2017) investigated word order preferences in three different sign languages, with two being newly emerged sign languages. The findings revealed that participants preferred SOV for irreversible events while favoring both OSV and SOV for reversible events. Ergin et al. (2018) later contributed to these results with a study conducted on CTSL, reporting that SOV was the prevalent order in events with inanimate objects and OSV in events including animate objects. Contrary to previous conclusions, both emerging sign language studies have not reported any preference towards SVO but reported OSV instead. Meir et al. (2017) explained such inconsistencies with the *"human first principle"* - signers of emerging sign languages prefer to place human arguments before inanimate arguments. This notion provides a different angle to the "*agent-first*" principle by suggesting that human saliency is a crucial influence on the order of constituents rather than the semantic role of the characters.

1.3. Conventionalized Sign Languages

Sign languages are considered natural languages that are fully developed and conventionalized (Stokoe, 1960). More than 100 conventionalized sign languages are actively used today (Dikyuva, Makaroğlu & Arik, 2017), and just like spoken languages, they have unique grammar and vocabulary that can be studied from all linguistic aspects. Such sign languages are used by heterogeneous groups -namely, deaf individuals that extend to distant parts of the population, therefore considered as communities with exoteric communication. Most sign languages used today came into existence when deaf individuals from various backgrounds were present in the same environment and formed a shared communication system over a long period of time (Meir et al., 2012). Within the scope of this thesis, we investigated two national sign languages from two different countries, Turkey and Brazil. In chapters 1.3.1 and 1.3.2, we will introduce detailed information about Turkish Sign Language (TID) and Brazilian Sign Language (LIBRAS).

1.3.1. Turkish Sign Language (TID)

Turkish Sign Language (Türk İşaret Dili; TID) is a fully developed sign language used by the deaf communities in Turkey, and the number of users is

predicted to be over 100.000 (Dikyuva et al., 2017). TID is believed to be one of the oldest sign languages in the world, and it is considered an indigenous sign language that has developed over many years without any substantial influence from another sign language (Zeshan, 2003). There is currently no evidence suggesting a relation between TID and any other sign language on both historical and linguistic terms.

Historical sources state that various sign languages took place in Turkey's geographical area. It has been revealed that there were deaf individuals living in Anatolia for almost 3500 years and that they were using their hands to communicate with each other (Kemaloğlu & Yaprak Kemaloğlu, 2012). Additionally, evidence has been found by Miles (2000) showing that "mute" and "deaf" servants of the Ottoman court and some of the Royalty members were using highly complex sign language for more than several centuries. However, it is worth noting that current sources do not indicate any continuity linking the sign language used in the Ottoman court and the sign language used in Turkey today. If there were to be such continuity, then Turkish Sign Language would be the oldest sign language in world history.

The establishment of the first school for the deaf goes back to the 19th century, corresponding to Sultan Abdulhamid II's times. Grati Efendi founded the first school for the deaf between the years 1889 and 1897, and Pekmezyan was the first deaf teacher (Dikyuva et al., 2017). In 1925, sign language began to be restricted and prohibited in Turkish deaf schools with the influence of oralism, and it was excluded from deaf education in 1953. However, the actions toward sign language started to change even though oralism was still a strong approach in the 1980s. The Ministry of National Education started conducting studies on sign languages in 1983 and later in 1995 published a guidebook including 2.000 signs. With the guidebook, the Ministry aimed to encourage the use of a unified sign language among deaf individuals in Turkey. Turkish Sign Language was officially recognized by the Disability Code in 2007, and the fingerspelling alphabet was accepted with the first national Turkish Sign Language workshop held in the same year (Dikyuva et al., 2017).

There are many deaf schools in Turkey today that are mostly educating at the primary and high school levels. Many children born into hearing families learn TID through their peers in these schools. TID is the primary means of communication for most deaf individuals in Turkey. Mouthing and lip reading are also used as a means of

communication, especially when communicating with hearing individuals, and this can often be the case since the Deaf community and the Turkish-speaking community are constantly interacting with each other.

Turkish Sign Language is a natural language that is used by deaf individuals from all around Turkey. It has its own grammar, and there has not been any influence from other sign languages. As part of their research, Dikyuva et al. (2017) studied the syntax of TID and found that the Subject-Object-Verb order is the most common one in TID. When it is broken down into different verb types, the most commonly seen word order for intransitive events is Subject-Verb (SV); for transitive events, it is Object-Verb (OV); and for ditransitive events, the word order is Subject-Indirect Object-Object-Verb (SIOV). Earlier studies also support the finding that SOV is the dominant word order of the Turkish Sign Language. (Gokgoz, 2011; Gokgoz & Arik, 2011).

1.3.2. Brazilian Sign Language (LIBRAS)

LIBRAS is a conventionalized sign language and the only national sign language used in Brazil. While there is little information about its origin, the records show that its birth can be traced back to 1857 when the first school for the deaf, The National Institute of Deaf Education (INES), was established in Rio de Janeiro. The foundation of the institute was led by Don Pedro II, the emperor in Brazil, and it was a French deaf teacher named Father Huet that also helped the establishment of INES and used his own methods that contained French signs to teach deaf children. Before the institution was formed, the members of the deaf community in Brazil were already using signs of their own, but after the teachings of Father Huet, LIBRAS was born as a sign language that included both French and local signs (Xavier & Agrella, 2015).

LIBRAS's official recognition as Brazil's national sign language was with the “Libras Law” in 2002. The Libras Law is essential in the sense that it represents LIBRAS as a natural language. With this law (and later with the resulting decree 5626 in 2005), LIBRAS was included in university courses to train interpreters, lecturers, and speech therapists. Deaf communities were given the right to get official interpreters and official translations of documents.

De Quadros (1999) conducted a study on the syntactic structure of LIBRAS, where she investigated its word order and syntactic operations. According to her

study, SVO is the dominant word order in LIBRAS; however, it can change depending on the verb type. De Quadros claims that sentences with directional verbs may show more word order flexibility than plain verb sentences. De Quadros further suggests that participants generate verb-final sentences if they contain handling verbs, classifier verbs, or inflecting verbs (Xavier & Agrella, 2015).

1.4. Emerging Sign Languages

Emerging sign languages are recently formed natural languages that are still in the process of conventionalization. There are two types of emerging sign languages: *village sign languages* and *deaf community sign languages*. *Village sign languages* emerge when a small community has a considerable number of inhabitants who are hereditarily deaf and in need of communication with the other deaf and hearing members of the community who are also their friends and families. According to Brentari et al. (2021), such languages are not created purposefully but rather start off as gestures and then evolve into more regular systems of communication because these are the only primary tools used to interact with each other. The authors further state, "A key ingredient needed for a sign language grammar to emerge is therefore thought to be the system's use as a primary communication system." (Brentari et al., 2021, p. 573). One of the most studied village sign languages is Al-Sayyid Bedouin Sign Language, which emerged within the last century with the increasing number of deaf children in a small community in Israel (Kisch 2000; Sandler, Meir, Padden & Aronoff 2005). Alternatively, *deaf community sign languages* are formed in educational settings (e.g., schools), where already signing deaf individuals (e.g., home signers) from different places gather and create a novel communication system. A popular example of a deaf community sign language would be the Nicaraguan Sign Language which was formed by deaf children in various local schools around the year 1977 and forward (Senghas, Kita & Ozyurek, 2004). Both village and deaf community sign languages are formed and developed without the influence of conventionalized sign languages due to geographical or educational reasons. The members of these close-knit and isolated communities mainly rely on shared knowledge when communicating rather than following the strict rules of language. Therefore, they lack the systematicity and complexity of the established sign languages.

1.4.1. Word Order in Emerging Sign Languages

SOV is claimed to be the prominent word order in the initial phases of language emergence (Goldin-Meadow et al., 2008; Gibson et al., 2013), yet there are puzzling findings in the literature. Research on word order tendencies in early natural language systems has shown no regularity in using word orders in the primary periods of the young language systems (Coppola, Senghas, Newport & Supalla, 1997; Washabaugh, 1988). On the other hand, Sandler et al. (2005) conducted a study on Al-Sayyid Bedouin Sign Language and found that signers as early as the second-generation preferred SOV the most. However, a study on Nicaraguan Sign Language found that even though some signers preferred SOV, there was still a significant amount of word order variation (Flaherty, 2014). The results were replicated by Meir (2010), indicating that the first two generations of Israeli Sign Language signers used different orders. Research conducted on Central Taurus Sign Language shows that SOV is one of the most frequently used word orders; however, there is also diversity in terms of word orders in ditransitive structures (Ergin et al., 2018).

Previous work on novel communication systems discovered an additional strategy that signers use to minimize difficulties during communication. In certain events including two animate arguments, signers use *successive one-argument structures* (terminology from Ergin et al. 2018) described as “One such strategy is to restrict each unit to one animate character per action” (Ergin et al., 2018, p. 615). For instance, in an event like “the woman pushes the girl”, signers produce responses such as WOMAN PUSH / GIRL FALL (See Figure 3). Such constructions are seen in sign languages like NSL (Coppola et al., 1997), CTSL (Ergin et al., 2018), and ISL (Meir et al., 2010). This strategy enables the signers of newly emerging sign languages to easily convey the message of who is doing what to whom.

Figure 3

A CENA participant describing the video clip of "the woman pushes the girl" in successive one-argument structures.

1.4.2. Horizontal and Vertical Contact

Emerging sign languages are used in close-knit communities that are disconnected from the outside world. Such circumstances result in a community where the members are homogenous -that is, they all share the same history and have shared knowledge of one another. As previously mentioned, small and isolated communities involve esoteric communication in which the language users interact with almost only one another and therefore have a certain level of intimacy. This creates two different interaction types: *horizontal contact* and *vertical contact.* Typically, horizontal contact develops when initially the first home signers in the community interact with each other. This forms the first generation of signers of the novel communication system, creating an immature linguistic model for the next generation. When signers start communicating with the younger members of the community, it creates vertical contact, in which the linguistic model is transmitted through generations of signers. According to Senghas, Senghas & Pyers (2005), both contact types become crucial in systematizing linguistic structure. In their work on Nicaraguan Sign Language, they presented results indicating that the emergence of a language takes at least two generations of signers and that both children and adults have substantial parts in forming a viable language. Studies such as Senghas et al. (2005) demonstrate the significance of investigating newly developed sign languages because they discover valuable information on the developing stages of language evolution. And in the current study, we introduced Central Taurus Sign Language (CTSL) and CENA -newly emerged sign languages from Turkey and Brazil, which we will present more information about in chapters 1.4.3 and 1.4.4.

1.4.3. Central Taurus Sign Language (CTSL)

Central Taurus Sign Language is a village sign language developed naturally and spontaneously in a small village near Gülnar/Mersin in southern Turkey (Ergin et al., 2018; Ergin, 2022; Ergin, Kürşat, Hartzell, Jackendoff, 2021). The village is located in an isolated mountainous area in the Central Taurus Mountain Range. CTSL has developed over half a century without any access to a language model as a means of communication for the increasing deaf population in this close-knit community. The reason for the increasing deaf population (approx. 4.6% of the population) is believed to be the result of hereditary deafness caused by members of the community marrying their relatives or deaf members marrying other deaf individuals in the community.

Residents of this small and close-knit village make their living by animal husbandry and agriculture, and the geographical, financial, and social conditions led the residents to be isolated from the outside world. The deaf children in the community could not be schooled due to financial difficulties and the remote location of the village. This resulted in CTSL being developed on its own by the deaf members of the community without the influence of Turkey's national sign language (Turkish Sign Language).

As of today, CTSL is being used in three small villages in the same area, and it has 25 deaf signers, with 17 of them using CTSL as their sole language. There are also hearing signers of CTSL with varying proficiencies, and the population is believed to be approximately 80 people.

Like in many other emerging sign languages, CTSL has no settled grammar and therefore does not involve a dominant word order. However, a study done by Ergin (2018) on CTSL's word order indicates some word order preferences in different types of argument structures. For instance, participants seem to prefer SV for one-argument structures, SOV and SV(o) for irreversible scenarios in two-argument structures, and OSV and SV/OV for reversible scenarios in two-argument structures. However, there is no clear tendency for three-argument structures as the participants use many different word order variations.

1.4.4. CENA

CENA is a village sign language that emerged around the 1950s in an isolated village called Várzea Queimada. The village is in Piauí, an area located in the northeastern part of Brazil. There are currently 900 members of the community, with a deaf population of 34 (Stoianov, da Silva, Freitas, Almeida-Silva & Nevins, 2022). Currently, three generations in the village use this emerging sign language, with the youngest signers around the ages of 13-15. Most deaf individuals use CENA as their sole language, however, the degree to which they use the language varies between generations, especially with the younger signers. Some of the younger signers of CENA have attended school and had access to the internet and therefore were exposed to LIBRAS, whereas the older generation had little or no exposure to LIBRAS due to underdeveloped living conditions. Like CTSL and many other emerging sign languages, CENA was developed in a community where communication with the outside world was limited or not present, therefore, it was developed without the influence of LIBRAS or any other sign language. At present, some signers, especially younger ones, are influenced by LIBRAS and are borrowing some lexical items; however, the older generation remains mostly uninfluenced.

The language was named CENA by the hearing members of the community, which means “scene” as in “making a scene” (Almeida-Silva & Nevins, 2020). The first study on CENA was done by Pereira (2013), in which the villagers’ social life and day-to-day functions are described in detail. Both hearing and deaf members of the community rely primarily on animal husbandry, agriculture, trading, and government benefits (Stoianov et al., 2022). There is an asymmetry, however, between the lives of hearing and deaf villagers. Even though the hearing villagers can sign CENA in varying proficiencies, the standard of living of the two groups is still different from each other. For instance, the fact that there is very limited education for the deaf inhabitants of Várzea Queimada creates a somewhat asymmetry between the social status of the members.

The study of Almeida-Silva and Nevins (2020) includes some work on CENA, where they present information on its linguistic properties. However, there is still very little research on word order, and with this paper, we aim to reveal the characteristics of CENA’s word order in detail.

1.5. Aim and Hypothesis

The present study aims to demonstrate that community size is a key influencing factor on language emergence and development by comparing the constituent orders of naturally developed emerging sign languages, Central Taurus Sign Language (CTSL) and CENA, with conventionalized sign languages, Turkish Sign Language (TID) and Brazilian Sign Language (LIBRAS). An examination of the relevant literature suggests that studies on emerging sign languages do not offer a comprehensive cross-linguistic comparison of the interaction between group size and constituent order. Therefore, the present study is thus aimed at essentially filling a gap in the literature by shedding light on the initial stages of language formation and evolution by examining how novel communication systems are evolving into established languages.

According to Wray and Grace (2007), languages used in esoteric communities tend to be more complex and morphologically irregular, whereas languages used in exoteric communities are more uniform and systematic. It is argued that such structural differences can be attributed to reduced communication challenges originating from shared backgrounds and knowledge. (Trudgill, 2004, 2009, 2011; Wray & Grace, 2007; Raviv et al., 2019b). Furthermore, previous work on word order suggests SOV as the dominant word order in the earlier phases of language development (Goldin-Meadow et al., 2008; Gibson et al., 2013). It is further claimed that regarding event types, SOV is the prevalent word order in irreversible scenarios, whereas it is SVO in reversible scenarios (Hall et al., 2013; Gibson et al., 2013). However, recent studies on novel sign languages revealed that in reversible scenarios where the subject and the object are human entities, participants preferred OSV rather than SVO, suggesting an influence of human saliency (Meir et al., 2017), rather than the cognitive tendency to introduce subjects first. One of the supporting studies was conducted on CTSL (Ergin et al., 2018), replicating the same results.

In light of previous work, we predict that emerging sign languages, CENA and CTSL, will show more word order variations compared to conventionalized sign languages, TID and LIBRAS. Correspondingly, our further hypotheses are as follows: (a) Due to age, community size, and structure similarities, CENA signers will resemble CTSL signers regarding word order in different event types and argument structures. Due to the absence of an object in intransitive (one-argument) structures

and the cognitive bias towards subject-first, (b) all four sign languages will prefer SV the most. Considering the findings reported by Ergin et al. (2018), it is hypothesized that (c) in transitive (two-argument) structures, CTSL and CENA signers will most commonly use SOV in irreversible events and OSV in reversible events. Since TID and LIBRAS are conventionalized sign languages with established grammar, (d) the most frequently used word orders in each event type will be the dominant orders of the languages (i.e., SOV for TID and SVO for LIBRAS) regardless of whether a sentence involves a reversible event or an irreversible one. In connection with earlier work on TID (Dikyuva et al., 2017), (e) the most frequently used word order in ditransitive (three-argument) structures will be SIOV, however, since research on LIBRAS suggests different word order in specific situations (De Quadros, 1999; Xavier & Agrella, 2015), (f) it is predicted that in events including ditransitive structures, LIBRAS will include more diverse word orders than TID.

2. METHODS

2.1. Participants

2.1.1. Turkish Sign Language (TID)

In the current study, 20 native deaf signers of Turkish Sign Language (14 females, 6 males; mean age = 26.8 years, *SD* = 6.3 years, range = 18-35) were tested. Deaf signers who participated in the study were all selected from those living in the city of Ankara to prevent potential region-based variations in TID. All participants indicated TID as their native language, with nine also stating Turkish as their native language. Fifteen participants noted they were either at the beginner or intermediate level in International Sign Language (IS), and only five participants in total noted having either American Sign Language (ASL) (*n* = 1), German Sign Language (DGS) (*n* = 1), or English (*n* = 3) as their second language and Bulgarian (*n* = 1) as their third language. All participants were at least high school graduates, with thirteen having either an associate's or bachelor's degree.

All participants filled out a consent form preceding the experiments. The form comprised Turkish texts and TID translations of those texts recorded by two native Deaf signers of TID. Within the consent form, participants were asked to answer demographic questions and consent to the experiment's recording. All given responses were checked by the leading experimenters prior to the experiment session. The experimenters did not proceed with the sessions if the participants did not consent to be recorded during the experiments.

Participant roles as director and matcher were determined prior to the experiment session, and these roles remained the same throughout the experiment session.

2.1.2. Central Taurus Sign Language (CTSL)

Fifteen deaf signers of CTSL were tested (9 females, 6 males; mean age = 37.9 years, *SD* = 11.2 years, range = 16-53). All participants are native signers of CTSL and are residents of the village. The first signers of CTSL are referred to as the first generation, consisting of older siblings who were the first-born deaf children in the family. The first generation of signers had very limited or no language input because no sign language model existed before them. The younger siblings of the first

generation were considered second-generation signers because, unlike their older siblings, deaf signers in the second generation did have language input from birth by seeing their older siblings sign. The children of the deaf signers from the first and second generations are the third generation of CTSL signers. The first and second-generation signers did not attend school and were not exposed to TID. However, three signers in the third generation are among the village's youngest residents, and they attended school for a short period and were exposed to TID in varying degrees.

2.1.3. CENA & Brazilian Sign Language (LIBRAS)

Participants from Brazil comprised 19 deaf CENA signers (9 females, 10 males; mean age = 39.42 years, *SD* = 11.9 years, range = 13-59) and 20 deaf LIBRAS signers (unfortunately, the Brazil team could not collect the age information of LIBRAS participants). All CENA participants are residents of Várzea Queimada and reported having CENA as their native language. Most signers have not acquired any other sign language besides CENA, and most are illiterate; however, some of the youngest members were briefly exposed to LIBRAS in educational settings (Stoianov et al., 2022). As with other participants in the study, all LIBRAS participants were also native signers and reported some fluency in written Portuguese.

Table 1

Participant summary table.

Language Type	Language	Country	N	Age range
Conventionalized Sign Language	TID	Turkey	20	18-35 (14F, 6M)
Conventionalized Sign Language	LIBRAS	Brazil	20	N/A
Emerging Sign Language	CTSL	Turkey	15	16-53 (9F, 6M)
Emerging Sign Language	CENA	Brazil	19	13-59 (9F, 10M)

2.2. Materials

Thirty short video clips from the study of Sandler and her colleagues (2005) were used for the experiment of all languages (See Appendix A). The clips included 12 intransitive (one-argument structure), 12 transitive (two-argument structure), and 5 ditransitive (three-argument structure) events. Initially, there were 30 clips in Sandler et al.'s study; however, the clip of "water falling" was later excluded from the

experiment due to the majority of participants depicting the clip in a way where the recovered meaning is “water is being poured down” instead of “water is falling by itself”, causing a shift from intransitive structure to a transitive structure (see Figure 4).

Figure 4

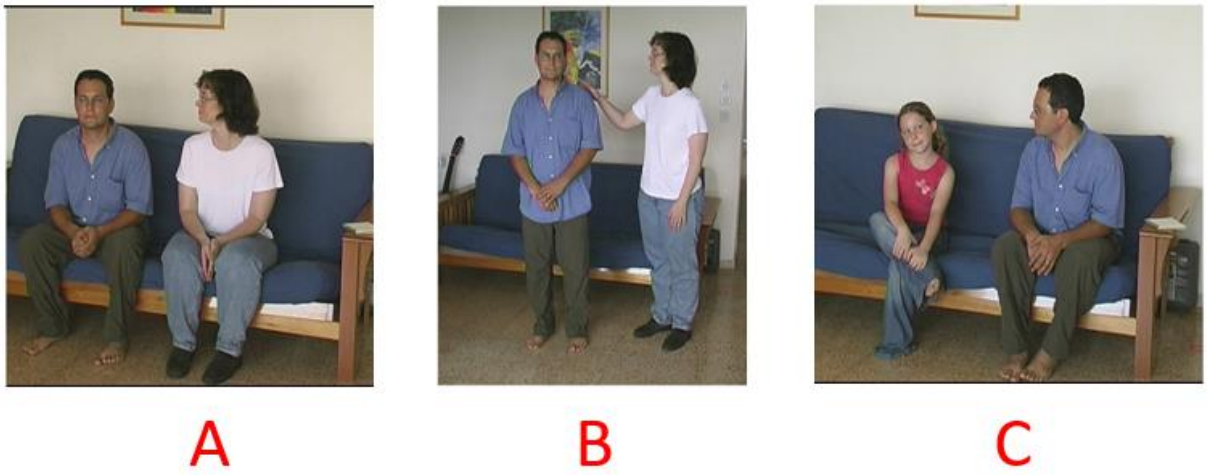
The excluded video clip of “Water falling”.

The intransitive clips consisted of seven events with animate agents (e.g., the woman runs) and five with inanimate agents (e.g., the bag falls). Half of the transitive events were irreversible scenarios where the agent is animate and the patient is inanimate (e.g., the woman throws the ball), and the other half were reversible scenarios where both the agent and the patient are animate (e.g., the girl pulls the man). All ditransitive events included an indirect object with an animate agent and patient (e.g., the woman takes scissors from the girl).

The comprehension arrays were formed using three pictures to identify if the directors’ responses were clearly understood by the matchers (See Figure 5). One of the pictures displayed the target event, while the other two displayed distractor events. The distractor events included at least one of the entities from the elicited items so that they could function as a distractor. In this way, it is ensured that the correct event selection would depend on the communication between participants rather than a mere guess.

Figure 5

The comprehension pictures for the video clip "the woman looks at the man".



2.3. Procedure

The experimentation of all four sign languages followed the same procedure and was conducted face-to-face. At each experiment, at least two leading experimenters were present, and at least one deaf native signer accompanied them to help participants with the consent form, instructions, and additional questions. In each session, two participants were paired up; one was assigned as the "director", while the other was assigned as the "matcher" and seated in the opposite direction across the table. Two leading experimenters sat alongside the participants during the experiment sessions to present them with the stimuli and comprehension pictures. The director was asked to carefully watch the stimuli on the computer screen and describe them to the matcher using only sign language. After the director responded, the matcher was asked to select the corresponding event from an array of three comprehension pictures using fingerspelling or simply pointing. The leading experimenter overtly scored the matchers' responses as "true" or "false". When a response was "false", the director was asked to repeat the event one more time and continued to do so until the matcher gave an accurate response. At this point, it is worth mentioning that even though consequentially, the matchers reached the correct answer by the end of the first two attempts, there were cases where the matchers asked directors to reconstruct the responses without looking at the comprehension arrays or where the matchers consistently gave wrong answers at each attempt because they either kept

misinterpreting the responses or took more than few responses to understand the event. (See Appendix B for a representation of the task).

2.3.1. Coding Procedure

The order of the arguments in the producer's descriptions of video clips was coded for word order analysis. For the sentences that include transitive events, the agent performing the action was coded as *subject* (S), the patient experiencing the action was coded as *object* (O), and the action was coded as *verb* (V). Additionally, the goal of the sentence was coded as an *indirect object* (I) for ditransitive events. And since some intransitive sentences do not include an agent, the patient experiencing the action was coded as the syntactic subject (e.g., SV for the "ball bounces").

In cases where the matcher made an incorrect selection from the comprehension array, the director was asked to repeat the response and did so until the matcher selected the correct event. However, in situations where the matcher could not identify the correct picture and consistently gave incorrect answers, the leading experimenters skipped the item and moved on to the next one. All attempts of the director and selections of the matcher were included in the coding.

Each participant was coded by two coders independently from each other under the supervision of a professional native translator. In order to determine and resolve disagreements between coders, the final codings of both coders were compared to each other, and an *intercoder reliability* (ICR) score was formed based on the matching codings of each item. All scores were reported to have a 95% or higher accuracy rate.

2.4. Data Analysis

In the current study, a total of 2766 responses were analyzed (See Table 2). The occurrence percentage of each word order from all four languages (e.g., TID, LIBRAS, CTSL, CENA) in four different structures (e.g., intransitive, transitive with irreversible events, transitive with reversible events, and ditransitive) was calculated. The analysis included all attempts in cases where participants gave multiple responses to a single item. Additionally, responses with comprehension scores of "0" were also included in the analysis because the matcher sometimes may fail to comprehend the event of the clip regardless of the word order. For each structure and event type, the percentages of responses from the four languages were compared by performing a

Chi-Square Test of Independence to detect whether constituent order preferences differ between sign languages from different community sizes.

Table 2

The number of total responses for each argument structure and event type.

Argument Structure	Event Type	N of Responses
Intransitive	-	997
Transitive	Irreversible	621
Transitive	Reversible	548
Ditransitive	-	600

2.4.1. Exclusion Criteria

Various exclusion criteria were applied during the coding process of all four sign languages in order to clear out the noise in the analysis. The responses were excluded by the agreement of both coders if:

- The target verb was missing [i.e., GIRL BOY (SO) for “the girl hits the boy”],
- There was only one argument present [i.e., only GIRL (S), MAN (O), or PULL (V) for “the girl pulls the man”],
- Any of the signs were ambiguous, resulting in unrecoverable arguments [i.e., GIRL GIRL PUSH (either SOV or OSV) for “the woman pushes the girl”],
- The director did not understand the event of the clip and gave a response including an unrelated event (i.e., GIRL SCISSORS CUT for “the woman takes scissors from the girl”),
- The response was too long to be recoverable (i.e., VOSOSVOS for a transitive structure),
- The director got interrupted during the response either by the matcher or the experimenter,
- Both coders did not agree on the word order of the response.

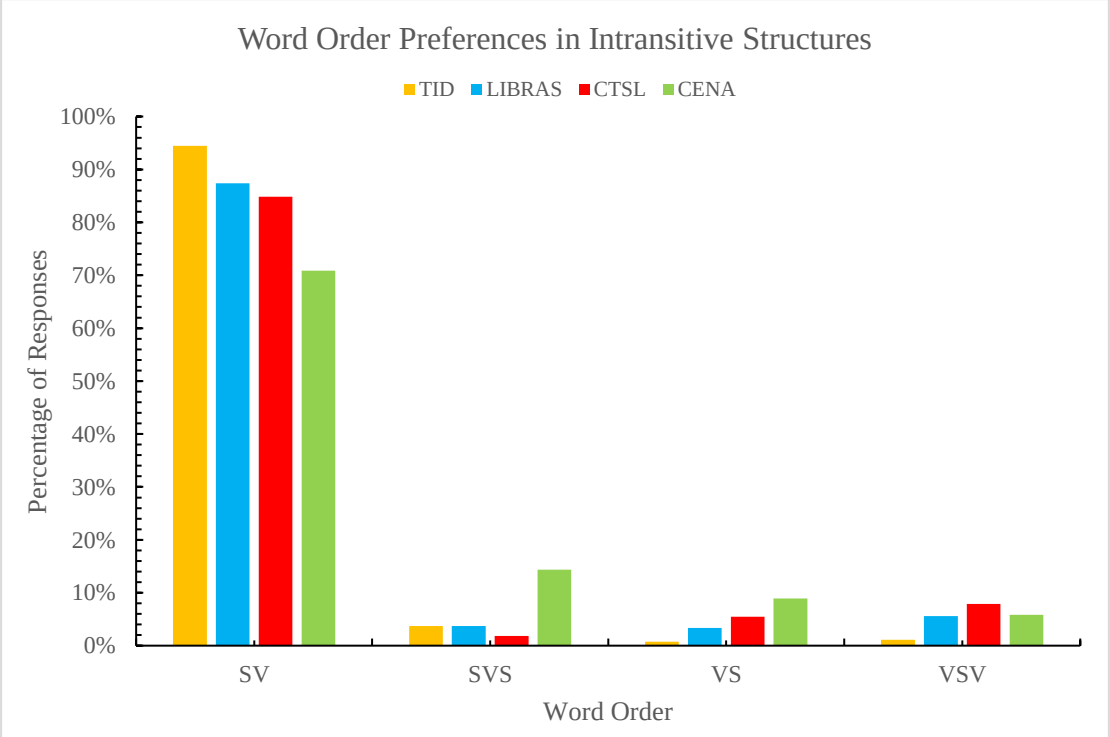
3. RESULTS

3.1. Word Order Preferences in Intransitive Structures

A total of 997 responses were analyzed for intransitive structures. The word order analysis on intransitive structures for all four sign languages revealed that while all four languages exhibited a preference for the SV order, the degree of preference varied across languages. Specifically, TID responses showed the highest preference for SV at 95%, while CENA responses showed the lowest at 70.9%. LIBRAS and CTSL fell in between, with 87.4% and 84.8% of participants selecting the SV order in intransitive structures, respectively. The rest of the responses also include SVS, VS, and VSV orders, with most at 14.4% and below (See Figure 6).

Figure 6

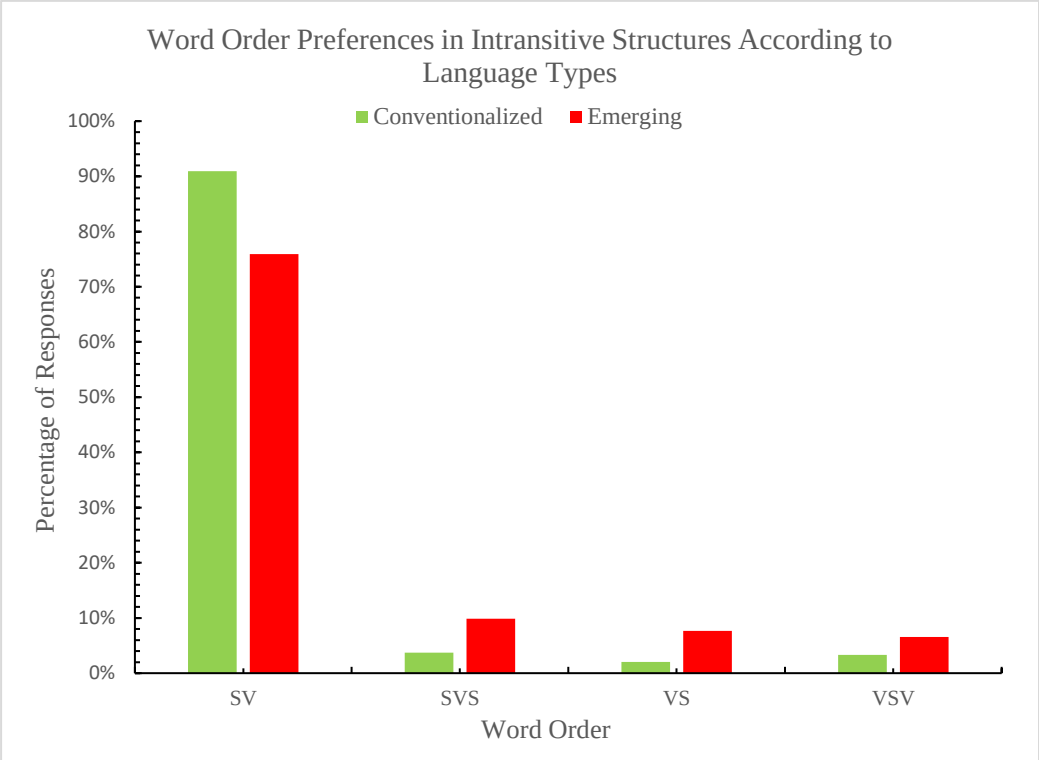
The percentage of word order preferences of all four sign languages (CENA, CTSL, LIBRAS, and TID) in intransitive structures.



The preference towards SV was significantly higher than other word orders (X^2 (3, N = 997) = 1854.9, p = <.001), and the responses of conventionalized sign languages were significantly higher than the responses of emerging sign language signers (X^2 (1, N = 997) = 6.9, p = .009) (See Figure 7).

Figure 7

The percentage of word order preferences intransitive structures according to different language types (Conventionalized vs. Emerging Sign Languages).



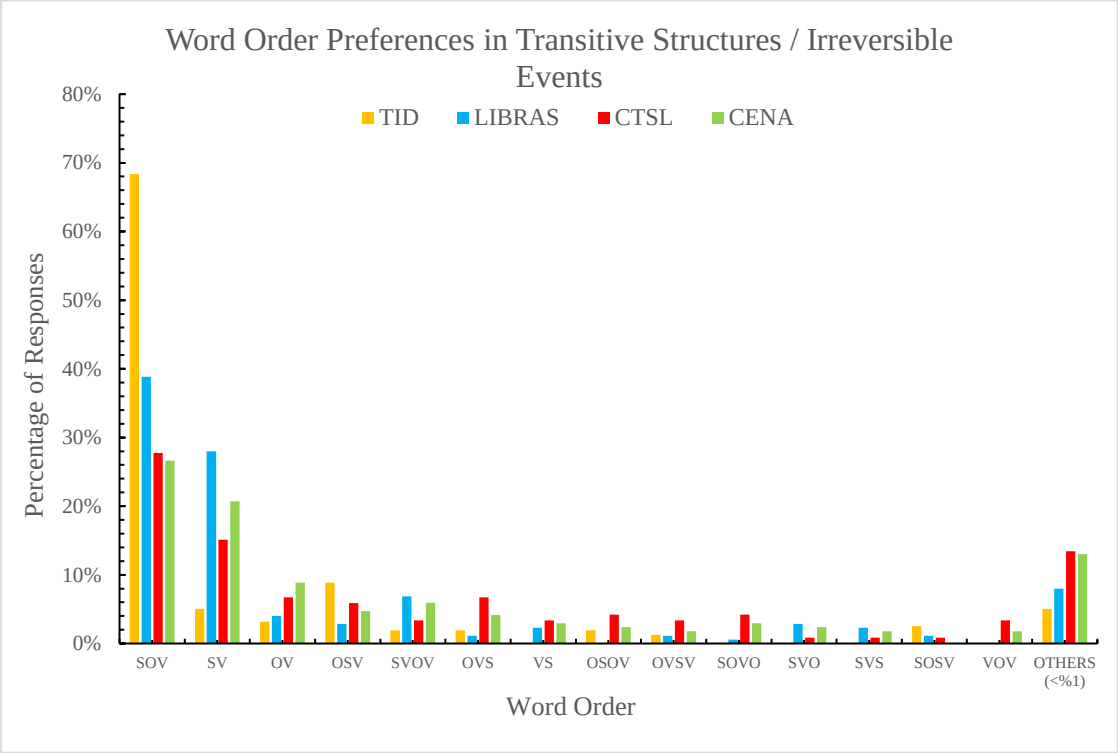
3.2. Word Order Preferences in Transitive Structures with Irreversible Events

For transitive structures with irreversible events, a total of 621 responses were analyzed. The results indicated that, in transitive structures with an animate agent and inanimate object, the majority of TID responses included the SOV order with a frequency rate of 68.4%, while OSV (9%) was the second most frequently used order, followed by SV (5.1%), the "*Others*" category (5.1%) and some additional word orders below 3%. The " Others " category was formed to classify responses that did not conform to common word orders, including responses with a frequency proportion of 1% or less, corresponding to 3 or fewer occurrences in the dataset. Furthermore,

the responses given by the LIBRAS users for irreversible events were more evenly distributed among the two categories, with 38.9% in SOV and 28.0% in SV order, and the "Others" category was the third most used word order at 8.0%. The results coming from CTSL exhibited a similar trend, with 27.7% in SOV and 15.1% in SV; however, the "Others" category comprised 13.4% of the total responses, making CTSL the highest in the category. Finally, CENA had the lowest percentage of SOV order (26.6%), with 20.7% in SV order and 13.0% in "Others", making it the language with the most similar frequency proportions to CTSL (See Figure 8).

Figure 8

The percentage of word order preferences of all four sign languages (CENA, CTSL, LIBRAS, and TID) in transitive structures with an animate subject and inanimate object.

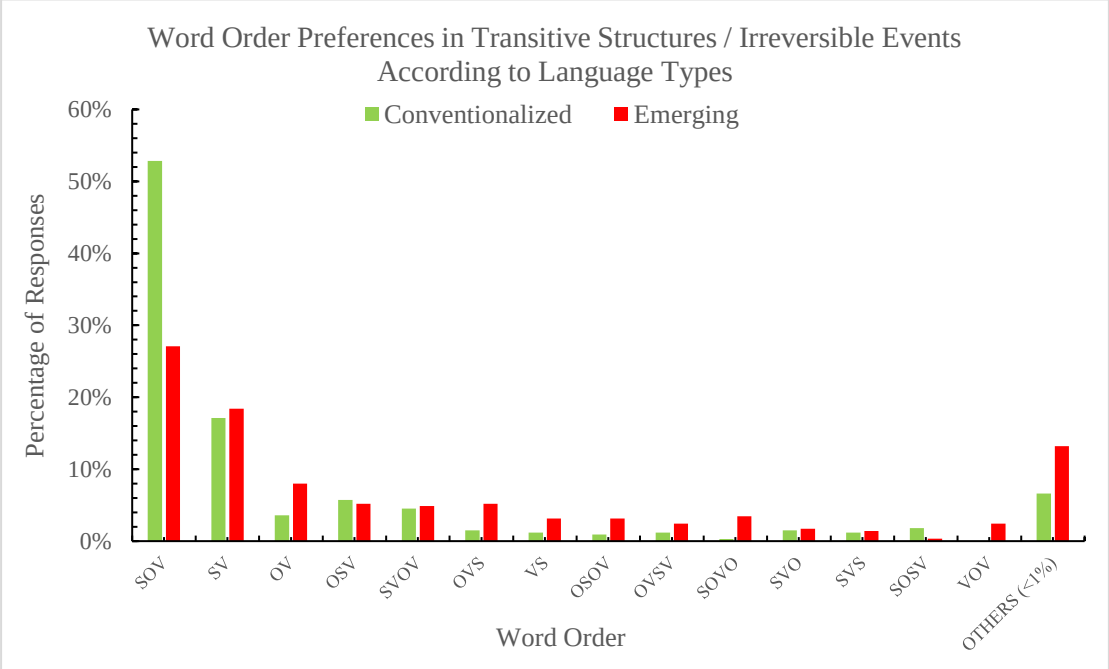


The analysis of overall frequencies of SOV, SV, and "Others" revealed that SOV was significantly higher than SV (X^2 (1, N = 354) = 56.9, p = <.001), and "Others" (X^2 (1, N = 314) = 119.8, p = <.001). While the TID preference for SOV was significantly higher than LIBRAS (X^2 (1, N = 176) = 9, p = .003), CTSL (X^2 (1, N = 141) = 39.9, p = <.001), and CENA (X^2 (1, N = 153) = 25.9, p = <.001), the SOV difference between CENA and CTSL was not significant (X^2 (1, N = 78) = 1.8, p =

.174). Similarly, there was a non-significant relationship between CENA and CTSL regarding the use of word orders that fall into the "Others" category (X^2 (1, N = 38) = .95, p = .330); however, they differed in SV (X^2 (1, N = 53) = 5.45, p = .020). Results further showed that LIBRAS participants' preference for SV differed between CTSL (X^2 (1, N = 67) = 14.3, p = <.001) and TID (X^2 (1, N = 57) = 29.5, p = <.001), but there was no difference when compared to CENA (X^2 (1, N = 84) = 2.3, p = .127). When the two language types are compared to each other, the results reveal that conventionalized sign languages have a significantly higher preference towards SOV than emerging sign languages (X^2 (1, N = 204) = 107.4, p = <.001). However, we see the opposite pattern in the "Others" category, where emerging sign languages are higher than conventionalized sign languages (X^2 (1, N = 60) = 4.3, p = .039). Lastly, a non-significant relationship exists between SV responses of both sign language types (X^2 (1, N = 110) = .145, p = .703) (See Figure 9).

Figure 9

The percentage of word order preferences in transitive structures with irreversible events according to different language types (Conventionalized vs. Emerging Sign Languages).

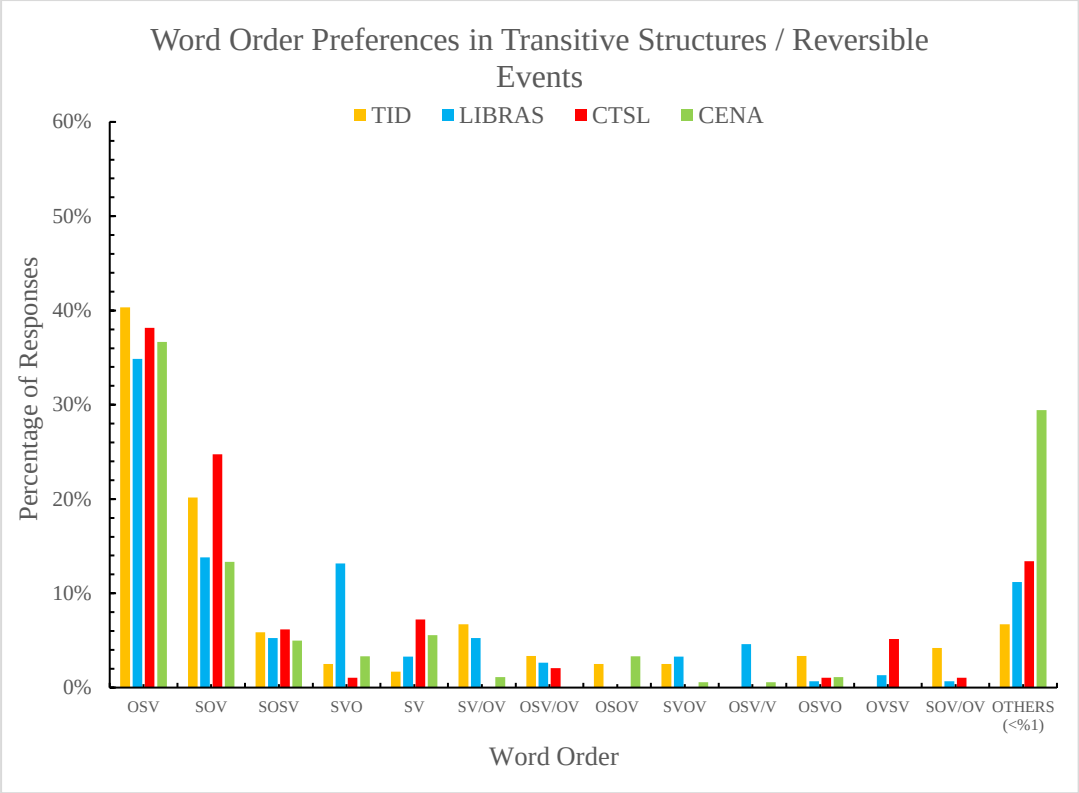


3.3. Word Order Preferences in Transitive Structures with Reversible Events

The analysis focusing on transitive structures with reversible events encompassed a total of 548 responses, and the results revealed that OSV was the most frequent word order for all sign languages, with TID having the highest percentage at 40.3%, followed by CTSL at 38.1%, CENA at 36.7%, and LIBRAS at 34.9%. The second most common order was SOV, in which CTSL (24.7%) and TID (20.2%) had a higher preference than LIBRAS (13.8%) and CENA (13.3%). After favoring OSV and SOV to describe the clips, participants from all languages preferred to produce orders that are not common -a total of 3 occurrences or less- therefore grouped under the category of “Others”. Participants with the highest percentage in the “Others” category were from CENA at 29.4%, while TID participants were at the lowest with 6.7%. In addition, CTSL and LIBRAS participants showed similar preferences, with 13.4% and 11.2%. Lastly, when the total frequency percentage of four languages in SOSV and SVO is calculated, results showed identical percentages at 5.5%; however, the language frequencies varied within the word orders. With a 13.2% preference rate, LIBRAS participants produced SVO more than the other languages, which ranged from 1% to 3.3%. Nonetheless, calculations for SOSV displayed more evenly distributed preferences with a percentage range of 5.0%-6.2% (See Figure 10).

Figure 10

The percentage of word order preferences of all four sign languages (CENA, CTSL, LIBRAS, and TID) in transitive structures with an animate subject and object.

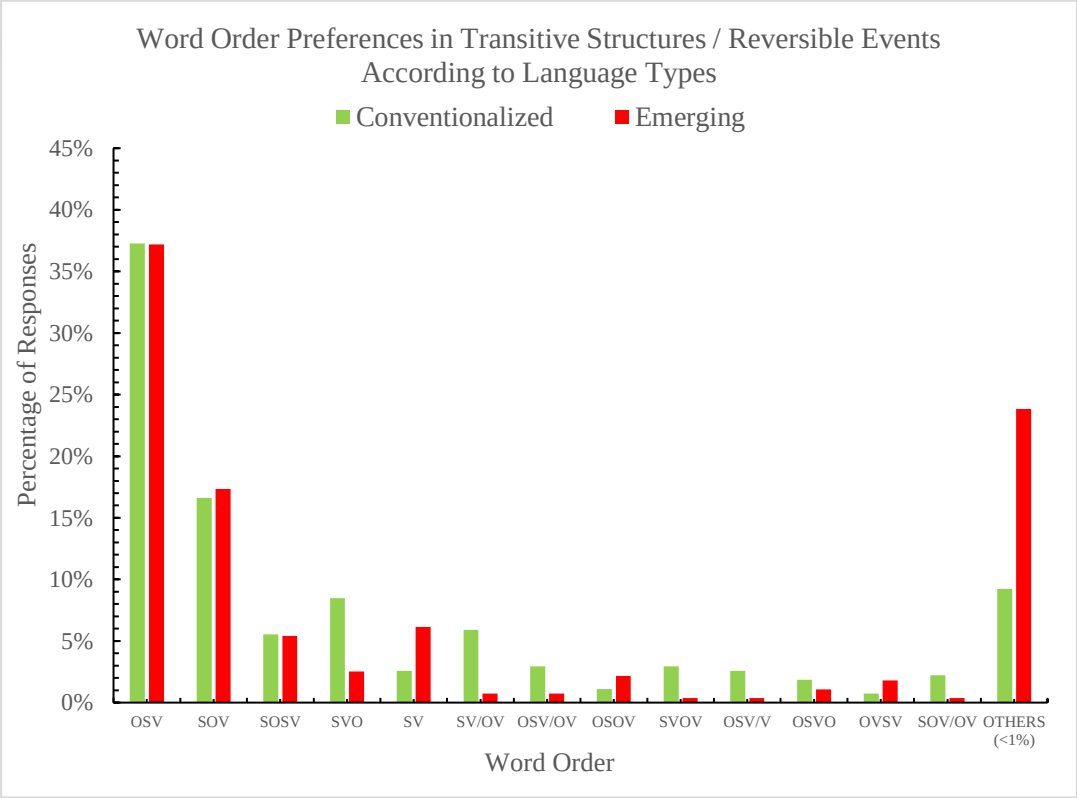


The Chi-Squared Independence Test revealed a non-significant difference between the four languages in the production of OSV (X^2 (3, N = 204) = .347, p = .951). On the other hand, CTSL had the highest percentage for SOV (X^2 (3, N = 93) = 17, p = <.001), while CENA and LIBRAS had similar percentages (X^2 (1, N = 45) = .200, p = .655). CTSL and TID responses for SOV are also significantly higher than CENA and LIBRAS (X^2 (1, N = 93) = 4.5, p = .034). Additionally, when the overall preference of all sign languages in OSV and SOV was tested, OSV was found to be favored more than SOV (X^2 (1, N = 297) = 41.5, p = <.001). Analysis of the "Others" category revealed that CENA participants produced more uncommon word orders than the other three languages (X^2 (3, N = 91) = 55.4, p = <.001), but there was a non-significant relationship between CTSL, TID, and LIBRAS (X^2 (2, N = 38) = 3.2, p = .201). Finally, the difference between the total frequencies of SOSV and SVO was not significant (X^2 (1, N = 60) = .000, p = 1.00), as well as the SOSV frequency between all languages (X^2 (3, N = 30) = .667, p = .881). And within the SVO order, LIBRAS was significantly higher when compared to other sign languages (X^2 (3, N = 30) =

29.5, p = <.001). The comparison analysis of emerging sign languages and conventionalized sign languages reveal that there is no difference in the preference of OSV (X^2 (1, N = 204) = .020, p = .889) and SOV (X^2 (1, N = 93) = .097, p = .756); however, they differ in terms of "Others" category (X^2 (1, N = 91) = 18.5, p = <.001) (See Figure 11).

Figure 11

The percentage of word order preferences in transitive structures with reversible events according to different language types (Conventionalized vs. Emerging Sign Languages).



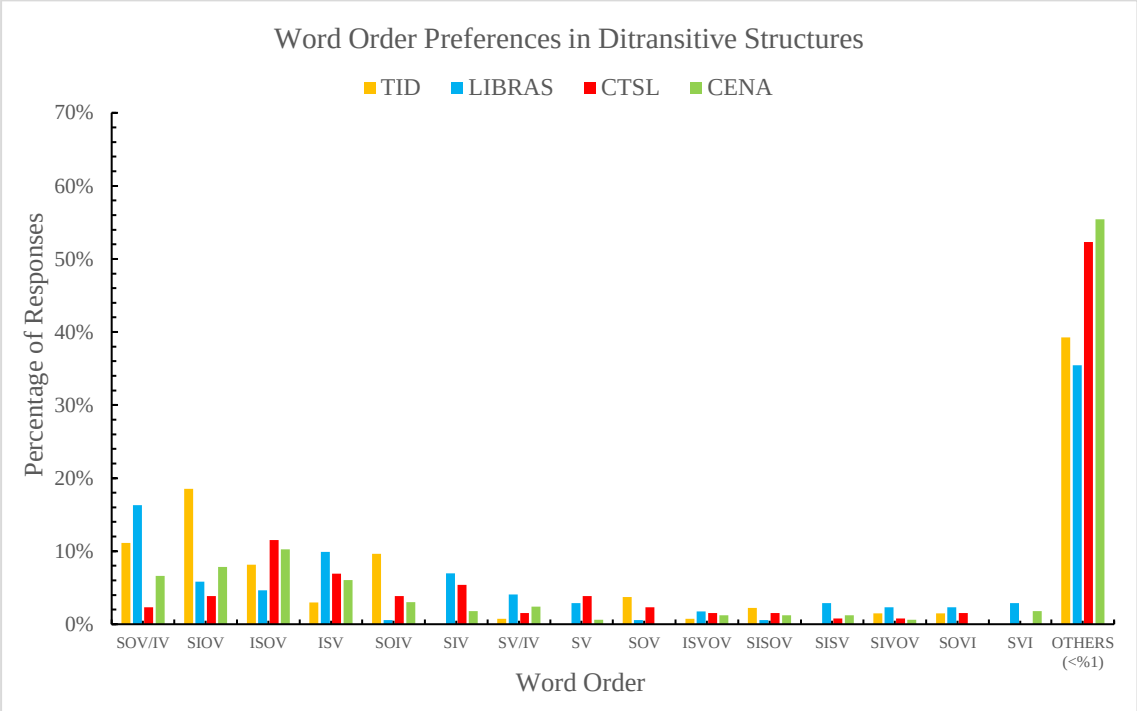
3.4. Word Order Preferences in Ditransitive Structures

Word order analysis for ditransitive structures comprised 600 responses. The results revealed that the "Others" category has the highest percentage, comprising 45.4% of the entire ditransitive responses. The distribution of the "Others" category in ditransitive structures varied across the sign languages. CENA had the highest percentage of "Others" at 55.4%, followed closely by CTSL at 52.3%. LIBRAS exhibited a comparatively lower percentage of "Others" at 35.5%, while TID had the lowest percentage at 39.3%. Regarding the distribution of SOV/IV in ditransitive

structures, it was observed that this category was less prevalent across all sign languages, with a cumulative percentage of 9.5%. Signers of LIBRAS had the highest percentage of SOV/IV responses at 16.3%, followed by TID at 11.1%, whereas CENA and CTSL exhibited a relatively lower SOV/IV percentage at 6.6% and 2.3%. The results further disclosed that the percentage of responses for SIOV (8.8%) and ISOV (8.5%) were similar, with TID being the highest in SIOV at 18.5% and others ranging between 7.8%-3.8%. Furthermore, in the ISOV responses, CTSL (11.5%) and CENA (10.2%) exhibited rather similar percentages, whereas TID was slightly lower at 8.7%, followed by LIBRAS, with the lowest at 4.7% (See Figure 12).

Figure 12

The percentage of word order preferences of all four sign languages (CENA, CTSL, LIBRAS, and TID) in ditransitive structures.

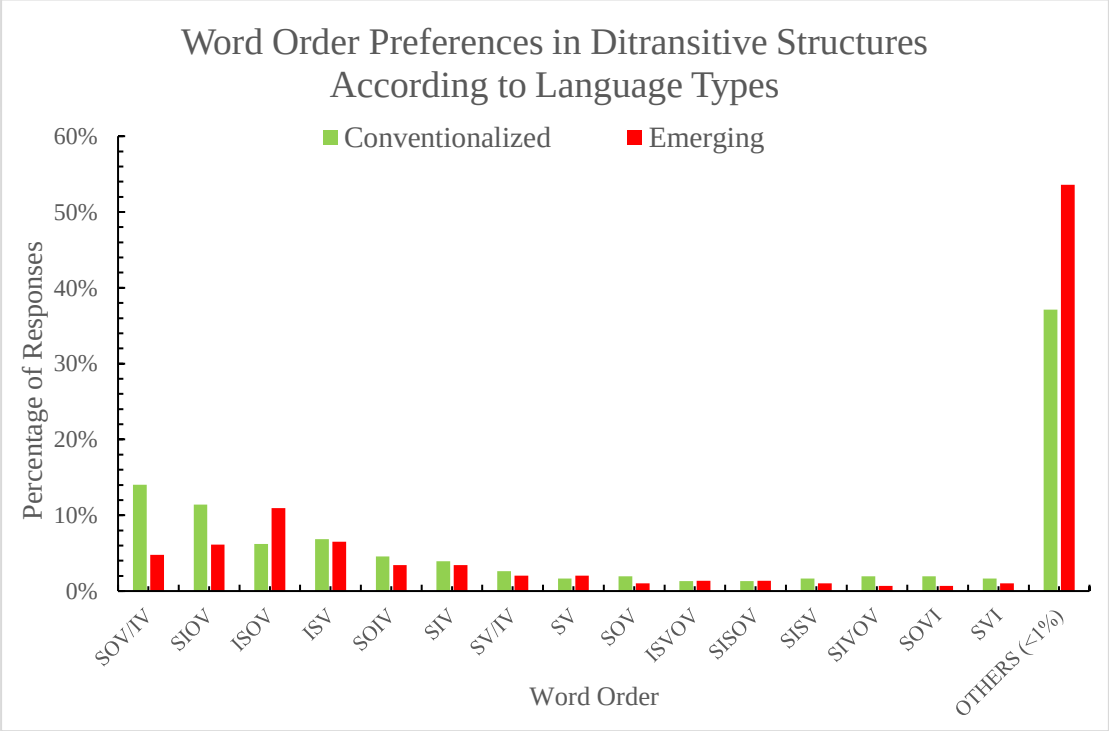


The analysis of the "Others" category in ditransitive structures presented significant differences between emerging sign languages, CTSL and CENA, and conventionalized sign languages, TID and LIBRAS, (X^2 (1, N = 271) = 6.8, p = .009), in which the relationship between CTSL and CENA (X^2 (1, N = 157) = 3.4, p = .066), and TID and LIBRAS (X^2 (1, N = 114) = .561, p = .454) were non-significant. Within the SOV/IV responses, LIBRAS was significantly higher than other sign languages (X^2 (3, N = 57) = 22.9, p = <.001), and the sign language with the second highest

percentage, TID, also exhibited significant results when compared to CTSL and CENA (X^2 (2, N = 29) = 7.7, p = .021). Furthermore, TID participants produced more SIOV than the participants from other sign languages (X^2 (3, N = 53) = 16.4, p = <.001); however, there was no significant relationship between the sign languages for the ISOV preference (X^2 (3, N = 51) = 3.8, p = .281) (See Figure 13).

Figure 13

The percentage of word order preferences in ditransitive structures according to different language types (Conventionalized vs. Emerging Sign Languages).



3.5.Discussion

Building upon the aim of the study, which is to assess the influence of community size on constituent order, four sign languages were compared according to their word order responses in different argument structures and event types. The results of word order in intransitive structures revealed an SV prevalence for all sign languages, contributing to Jackendoff's agent-first principle (2002). Yet, there is insufficient evidence to suggest that human saliency is another contributing factor (Meir et al., 2017) since experimental clips also include inanimate subjects (e.g., Ball bounces). Results also revealed that signers of conventionalized sign languages exhibited higher SV preference than those of emerging sign languages, which have

implications for a community size impact over constituent order in one-argument structures.

Further in the study, we analyzed responses for transitive structures with irreversible scenarios. The results revealed that SOV was the most produced word order in all four languages, and TID had the highest proportion of responses. This result is parallel with the work of Dikyuva et al. (2017), in which SOV was suggested to be the dominant word order of TID. Furthermore, the SOV prevalence in irreversible scenarios suggests a cumulative preference towards SOV, which provides evidence to the notion that it is, in fact, the primary word order in all language types (Napoli & Sutton-Spence, 2014; Newmeyer, 2000). Similar trends were also observed in the study of Meir et al. (2017) and the study of Ergin et al. (2018), where SOV was the most frequently used word order in irreversible events regardless of the language or language type (e.g., spoken vs. sign or conventionalized vs. emerging). Though, contrary to expectations, LIBRAS participants also favored SOV the most even though it was suggested that SVO was the dominant word order of LIBRAS (De Quadros, 1999); however, it was also claimed that word order preference might change depending on the word type. Moreover, LIBRAS has the highest percentage of SV responses, which may be interpreted as participants producing SV instead of SVO because it still conveys a recoverable meaning of the action without producing the object.

The analysis of irreversible events further indicates that SOV was the prevalent word order in both CENA and CTSL, and the “Others” category was at the same percentage of use. It is evident from the data that novel communication systems, such as emerging sign languages, prefer SOV the most. This claim was supported by the previous work of Sandler et al. (2005) on Al-Sayyid Bedouin Sign Language, however, some studies also presented findings suggesting no prevalent word order in emerging sign languages (Meir, 2010; Flaherty, 2014). In addition, results show that CENA and CTSL exhibited substantially similar percentages in responses for transitive structures with irreversible events, specifically for SOV and the “Others” category. These observed relationships can be attributed to similarities in both languages’ characteristics, such as community structure, group size, and language age.

Lastly, the findings revealed that for transitive structures with animate subjects and inanimate objects, conventionalized sign languages favored SOV more than emerging sign languages, whereas it was the opposite for the “Others” category, where emerging sign languages used more scarce word orders in comparison to conventionalized sign languages. It is likely that full-blown sign languages produced more common word orders because the signers are from larger groups of society and rely on uniform word orders when interacting with other signers. On the other hand, being from the same community and having shared knowledge of one another can be why signers of emerging sign languages construct more responses with random orders. These results contribute to the understanding of esoteric and exoteric communities where the type of communication that originates from the structure of the community is claimed to have an impact on language structure (Wray & Grace, 2007, Trudgill, 2004, 2009, 2011). Thus, these findings have important implications in that the size of the community can be an influencing factor over word order preferences, hence the formation of constituent order in language development.

The analysis of word order preference in transitive structures with reversible events revealed that OSV was the most used word order for all four sign languages suggesting that when both agent and the patient are animate characters, signers prefer to place the object before the subject. Previous work shows similar findings for reversible events (Ergin et al., 2018; Meir et al., 2010; Hall et al., 2013); however, there are also studies indicating that there is a higher preference towards other word orders instead of OSV (Gibson et al., 2017; Goldin-Meadow et al., 2008; Futrell et al., 2015). The findings of this study contribute to the principle of human-first (Meir, 2017), which claims that human entities are placed before inanimate objects due to the saliency of humans. She further claims that such a principle can also explain findings where OSV is prevalent in events with an animate subject and object because the human is still placed at the beginning. However, we observed an additional factor for OSV prevalence upon close examination of the response clips. Participants from all four sign languages could disambiguate the semantic roles by putting the object first because they placed the object in a location in the space and then performed the action on that location. For instance, to describe an event like “the girl pulls the man”, the participants would sign FATHER [He is here (Location-1)] CHILD PULL (Location-1) (See Figure 14).

Figure 14

A TID participant describing the video clip of "the girl pulls the man" in Object-Subject-Verb (OSV) order.

FATHER HERE (Location-1) CHILD PULL (Location-1)

While this adds a dimension to the human-first account (Meir et al., 2017), it does not contribute to the noisy channel account (Hall et al., 2013) in the sense that placing both object and subject before the verb to describe reversible events would not disambiguate the semantic roles.

Further analysis of reversible events reveals that total responses of SOV and the "Others" category exhibit similar percentages, suggesting that signers in all sign languages prefer to produce either SOV or an uncommon word order after producing OSV the most. When the languages are examined individually in both SOV and the "Others" category, it is observed that CTSL and CENA show differences. While CTSL signers favored SOV more than the CENA signers, it is the opposite for the category of "Others". Such findings indicate that CENA signers do not refer to the use of common word orders as much as CTSL signers do and instead try to overcome ambiguities without any uniformity. The reason for such tendencies might be that CTSL signers have developed a further understanding of the influence of constituent order over ambiguity, whereas CENA signers rely more on the shared knowledge of the other signer. Overall, the results implicate that although they resemble in age and community size, CENA and CTSL exhibit differences in constituent order preferences for structures with reversible scenarios.

Additionally, the study presents results that TID is observed to have a high percentage of SOV responses, whereas LIBRAS is the highest in the SVO responses. Contrary to expectations, using dominant word orders for reversible cases was not the first preference of LIBRAS and TID signers since the data indicates that they used

dominant word orders after referring to OSV the most. The findings have implications that the word order preference of fully developed sign languages like TID and LIBRAS often exhibit shifts from dominant word order to strategies mentioned before (i.e., describing the action on the object after placing the object in a specific location), resulting in OSV prevalence, and indicating a human-first principle (Meir et al., 2017). Moving forward with the analysis, it is observed that conventionalized and emerging sign languages do not differ in terms of preference toward OSV and SOV orders. Also, results from the "Others" category suggest that responses from emerging sign languages signers contained more uncommon word orders than responses from conventionalized sign language signers, however, such an assumption might be a misinterpretation since CTSL includes the most responses among the emerging sign languages whereas the percentage of CENA responses are closer to conventionalized sign languages. Given all the findings, it is likely that community size has no effect on constituent order regarding two-argument structures with animate subjects and animate objects.

In the next phase of the study, we analyzed how responses are distributed among sentences with a ditransitive structure. The results demonstrated no consensus on a single word order, as the "Others" category has the highest percentage in all languages. When languages are individually examined, it is observed that SIOV is the second most frequently preferred word order in TID. A notable difference between this study and others is that Dikyuva et al. (2017) suggested SIOV as the most frequently used word order for ditransitive structures, whereas our results revealed it to be the prevalent word order only after signers preferred to produce uncommon word orders the most. Moreover, findings reveal SOV/IV to be the most produced word order after the "Others" category, suggesting that signers attempted to use the strategy of successive one-argument structures (Ergin et al., 2018) to describe ditransitive sentences, although SOV/IV is not comprised of one-argument structures per se. Thus, in this case, it would be more suitable to use the term "split-sentence constructions" suggested by Napoli and Sutton-Spence (2014). The findings present contradicting results to relevant studies where it was argued that the strategy of split-sentence constructions was adopted by the signers of emerging sign languages (Coppola et al., 1997; Ergin et al., 2018); however, our results indicate that the signers of TID and LIBRAS, fully-fledged sign languages, implemented the strategy more

than CENA and CTSL signers. Additionally, analysis concerning ditransitive responses of CENA and CTSL exhibits findings where both have similar percentages in SOV/IV, SIOV the “Others” category, suggesting that both CENA and CTSL signers follow the same word order preference in ditransitive responses. Such results may be attributed to similarities in language properties and community characteristics between CENA and CTSL.

Expanding on the analysis of ditransitive structures, the findings reveal some significant differences between emerging and conventionalized sign languages. The signers of emerging sign languages formed more scarce word orders than those of conventionalized sign languages, whereas it was the opposite case for the SOV/IV preference. Considering all findings on ditransitive structures, the observed patterns have implications that neither the signers of fully developed sign languages nor newly developing sign languages rely on rigid word order to describe three-argument structured sentences, though when compared to emerging sign languages, the signers of conventionalized sign languages are more inclined to produce common word orders such as SOV/IV or SIOV. As mentioned in the earlier sections of the study, the reason for such variations in the responses of both CENA and CTSL can be attributed to the communication between signers, which is shaped by the structure and the size of the community (Wray & Grace, 2007; Raviv et al., 2020; Lupyan & Dale, 2016). Thus, the findings highlight the influence of community size over constituent order in ditransitive structures.

4. CONCLUSION

In conclusion, the findings suggest that in intransitive structures, signers of TID, LIBRAS, CTSL, and CENA exhibited a prevalence of SV word order, supporting the agent-first principle (Jackendoff, 2002). Similar trends were also observed in transitive structures with irreversible events, where SOV was the prevalent word order in all four sign languages. This finding aligned with previous research suggesting that SOV is the most commonly used word order in irreversible scenarios (Meir et al., 2010; 2017; Gibson et al., 2013; Ergin et al., 2018). Similar to the work of Dikyuva et al. (2017), TID responses presented the highest percentage of SOV in irreversible cases. However, it was unexpected that LIBRAS, which was believed to have SVO as its dominant word order (De Quadros. 1999; Xavier & Agrella, 2015), also favored SOV. On the other hand, in addition to OSV being the most frequently used word order in reversible cases, TID and LIBRAS were among the highest percentages in their dominant word order. OSV was also the most produced word order in CENA and CTSL responses, suggesting an OSV prevalence in reversible events, which contributes to the notion of the human-first principle (Meir et al., 2017), whereas it fails to support the claims of the noisy channel account (Hall et al., 2013). Continuing with the irreversible analysis, CENA and CTSL responses demonstrated similar frequency rates of SOV and the category of “Others”, likely stemming from being newly developed sign languages that formed over 70 years and belonging to close-knit communities with esoteric communication. While such findings were replicated in the analysis of ditransitive structures, the responses for transitive structures with reversible events revealed opposite findings, suggesting that word order preferences of CENA and CTSL essentially demonstrate similarities, however, it may vary depending on the animacy of arguments.

Findings on ditransitive structures revealed that the prevalence of any word order was absent, and all languages preferred to produce uncommon word orders with a frequency of three or less, suggesting that signers of both conventionalized and emerging sign languages do not rely on word order to describe three-argument structures. It is likely that there are other communicative mechanisms or strategies that the signers implement, which future studies should aim to investigate further.

The comparison of emerging and conventionalized sign languages revealed that in transitive structures with animate subjects and inanimate objects, conventionalized sign languages showed a higher preference for SOV than emerging sign languages. Conversely, emerging sign languages exhibited more diverse and uncommon word orders. This difference could be attributed to the more uniform use of grammar in fully developed sign languages, while emerging sign languages relied more on shared knowledge among signers, resulting in various constituent orders. Such implications can also be applied to findings of intransitive and ditransitive structures, as both emerging and conventionalized sign languages showed contrasts in responses. Nonetheless, such a difference was absent for reversible events. The findings have important implications for the influence of community size on constituent order, though such an effect does not apply to two-argument structures with animate subjects and animate objects.

In summary, the current study demonstrated that community size is an influencing factor on constituent order in sentences of intransitive and ditransitive structures and irreversible events. The findings shed light on the initial stages of sign language emergence, highlighting the relationship between community size and constituent order.

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APPENDIX A: The list of stimuli displayed by argument structure and event type.

No.	Argument Structure	Event Type	Event
1.	Transitive	Reversible	The woman looks at the man.
2.	Transitive	Reversible	The girl pulls the man.
3.	Transitive	Reversible	The woman pushes the girl.
4.	Transitive	Reversible	The girl combs the woman's hair.
5.	Transitive	Reversible	The man taps the girl.
6.	Transitive	Irreversible	The woman moves the box.
7.	Transitive	Irreversible	The girl pulls the cart.
8.	Transitive	Irreversible	The woman rolls the ball.
9.	Transitive	Irreversible	The man knocks on the melon.
10.	Transitive	Irreversible	The girl tears the paper.
11.	Transitive	Irreversible	The man washes the plate.
12.	Transitive	Irreversible	The man puts a book on the shelf.
13.	Intransitive	-	The bottle falls.
14.	Intransitive	-	The girl falls.
15.	Intransitive	-	The water falls.
16.	Intransitive	-	Man stands.
17.	Intransitive	-	The girl runs in a circle.
18.	Intransitive	-	The bag floats.
19.	Intransitive	-	The woman runs.
20.	Intransitive	-	The woman walks.
21.	Intransitive	-	The ball bounces.
22.	Intransitive	-	The man sleeps.
23.	Intransitive	-	The woman writes.
24.	Intransitive	-	The ball rolls.
25.	Intransitive	-	The girl cries.
26.	Ditransitive	-	The woman gives a shirt to the man.
27.	Ditransitive	-	The woman takes scissors from the girl.
28.	Ditransitive	-	The man shows the woman a picture.
29.	Ditransitive	-	The man tosses a ball to the girl.
30.	Ditransitive	-	The girl feeds the woman.

APPENDIX B: The representation of the elicitation task.

Step 1: The director describes the video clip to the matcher.

Figure 15

Video clip of a man showing a picture to a woman.

Step 2: The matcher chooses the corresponding picture using fingerspelling or pointing.

Figure 16

Comprehension pictures of the video clip.

A B C

Step 3: If the matcher chooses correctly, the experimenters move on to the following clip. If the matcher chooses incorrectly, the experimenters return to Step 1.