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Argument marking in a new sign language

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Abstract

While there has been no recognized sign language in Vanuatu and no record of intergenerational transmission of language between deaf people, a cohort of deaf children have been attending a school in Port Vila. Previous reports of the gathering together of deaf people, specifically deaf children, have documented the emergence of new sign languages. Studies of emerging sign languages show that linguistic devices for marking argument structure, including word order and grammatical use of space, emerge over time through intergenerational transmission. We examine longitudinal emergence of these devices in the first cohort of a new sign language in Vanuatu. Participants include six deaf children from Vanuatu (ages 8-14, mean 11.6), four of whom had 5-14 months of exposure to Fiji Sign Language. Spontaneous descriptions of sixteen transitive events were elicited using a communicative task. Data were collected 1.5 years after the establishment of the signing community in Vanuatu, and then again one year later. We measured a variety of argument marking strategies: word order, split events, constructed action, assigning characters to present individuals, use of space in marking arguments, spatial modulation of verb, and use of semantic classifiers. Comparing time one and time two rates of argument differentiation strategies in the deaf children, we found a decrease in constructed action and an increase in the use of spatial marking of arguments, classifiers, and spatial modulation of verbs, with few changes in word order. Comparison of these argument marking strategies with those used by thirteen children in Fiji Sign Language, suggests that the change in argument marking is not due to language contact but is arising from sustained community use.

Summary in Bislama

Long Vanuatu i no gat wan nasonel saen lanwis, minim se ol pipol we oli def long Vanuatu oli stap yusum sam saen blong olgeta nomo blong toktok long famili blong olgeta. Be long Port Vila naoia i gat wan grup blong sam def pikinini we oli stap skul tugeta. Long fulap difren kantri long wol ol lingwist i bin luksave se taem we ol def pikinini i stap tugeta long wan ples nomo, oli save mekem wan niu saen lanwis i kamaot long hem. Atikol ia bae i lukluk long fasin blong ol def pikinini long skul ia long Port Vila we oli stap wokem saen lanwis blong olgeta. Blong faenemaot se saen blong olgeta i stap jenis olsem wanem, mifala i mekem sam

eksperiment wetem ol pikinini ia afta oli bin stap tugeta blong 1.5 yia, mo afta long wan yia bakagen.

Atikol i luk espeseli long hao nao ol pikinini oli soemaot se huia i mekem wanem long wanem. Long lingwistiks, toktok blong wan aksen hemi wan veb, huia we i mekem wan aksen hemi subjekt blong veb, mo wanem we veb i mekem aksen long hem hemi objekt. Atikol ia bae i lukluk long oda blong subjekt, veb mo objekt long toktok blong ol pikinini ia. Mo tu hemi lukluk long sam defren stael blong makem subjekt, veb mo objekt we i save stap long ol saen lanwis nomo, olsem yusum difren spes blong soemaot subjekt o objekt, yusum bodi blong soemaot aksen, o talem se ol man we i stap oli olsem subjekt mo objekt blong veb. Mo tu i gat wan rod blong soemaot aksen long fulap defren saen lanwis long wol we ol lingwist ol singaotem olsem klasifaea. Hemi minim se man i yusum defren sep blong han blong olgeta blong soemaot defren kaen samting, olsem yusum tu finga we i stap daon olsem leg blong wan man blong soemaot ol pipol, o han we i flat nomo blong soemaot wan trak. Afta man i save muvum han blong hem blong soemaot fulap infomesen blong aksen, olsem ol daereksen, fos mo spid blong aksen ia.

Blong faenemaot ol difren stael we oli pikinini i stap yusum, oli bin mekem wan pleplei wetem ol pija, we oli mas eksplenem gud wanem i hapen long wanwan pija mo fren blong olgeta i mas soemaot se oli diskraebem wanem pija. Wan risol blong ol eksperiment ia hemi se afta long wan yia bakagen, ol pikinini i no yusum ful bodi blong olgeta tumas olsem fastaem, be oli stap yusum difren spes nomo blong soemaot subjekt mo objekt. Sam blong ol pikinini ia oli bin go long Fiji blong hamas manis blong stap long wan skul we oli stap yusum nasonel saen lanwis blong Fiji we oli singaotem Fiji Saen Lanwis (FJSL). I mekem se wan kwesten bakagen hemi se saen lanwis we ol pikinini i stap yusum i kam klosap olsem FJSL o hemi defren bakagen long wan stael blong Vanuatu nomo? Ol risol blong eksperiment ia i soemaot se ol pikinini blong Vanuatu oli mekem wan niufala stael blong olgeta nomo, we oli no folem stael blong Fiji nomo. Ol risol blong stadi ia i intresting tumas from i no gat tumas risej olsem we i stap wetem ol pikinini long taem we oli jas stap tugeta. Long sam narafala risej long defren ples long wol, oli bin faenem se hemi mas gat wan ful jeneresen blong mekem grama blong wan niufala saen lanwis, be yumi luk se ol pikinini i stap mekem sam rul blong grama blong olgeta long wan yia nomo.

Keywords

argument marking, emerging sign language, language contact, language acquisition

1 Introduction

The gathering together of deaf people, specifically deaf children, has historically led to the emergence of many of the national sign languages in use around the world today (Braithwaite, 2018; Power & Meier, 2022; Senghas & Coppola, 2001). Many studies of young sign languages report how language emerges by comparing subsequent generations or cohorts of adult signers who had as language input the signing of the previous generation or cohort. This allows linguists to follow the emergence of grammatical devices over generations of language users. Child language development has been argued to be the impetus for grammaticalization and language change in both creoles and emerging sign languages (Bickerton, 2016; Senghas et al., 2004, but see also Raviv et al., 2025). However, out of necessity, most studies make these claims based upon on the language of adults. Rather than focusing on adult language users, the current study examines how children develop argument marking strategies in the

context of a young sign language. We report on the longitudinal change within a group of ni-Vanuatu deaf children who are the primary members of a signing community which is around 5 years old. The children in the current study experience a high degree of variation in their language input, which is primarily through peer-to-peer contact. Our study design enables us to investigate how these particular circumstances of language development impact the argument structures children use and whether that development can explain the grammaticalization in young sign languages as previously claimed. We specifically examine the strategies used by this first cohort of signers in a newly formed signing community to indicate who did what to whom in an elicited production task in a two-year longitudinal design.

1.1. Argument marking devices in sign languages

Before reporting on the types of argument marking devices in use by the children in Vanuatu, we provide a brief overview of argument marking devices that have been described for other sign languages. Both grammatical use of space and syntactic word order are used in sign languages to indicate who did what to whom (see Kimmelman, 2022, for a recent review of argument marking in sign languages).

We describe here three types of grammatical use of space that have been documented as occurring in both young and old sign languages: morphological marking on verbs, classifier systems, and role shift or constructed action. To illustrate these argument marking strategies, we provide examples from the current data that were gathered from children's signing in Vanuatu and Fiji. In order to protect the privacy of the child participants, we have not included pictures of their signing. Instead, we offer examples in a format that is common in sign language linguistics. Glosses of each sign produced are given using an English word of equivalent meaning in SMALL CAPS. Subscripts are used along with these glosses to indicate if the sign is produced in a non-neutral location. Subscripts of $_1$ or $_2$ refer the signer (first person) or interlocutor (second person) respectively. Subscripts of other letters, such as $_A$ or $_B$ refer to arbitrary locations in the signing space. The gloss IX is used for indexical (pointing) signs along with a subscript to show the direction of the index. For classifier constructions the gloss CL IS followed by a letter to indicate the handshape used. Below each gloss, we include a description in italics of the sign including relevant spatial or nonmanual features when relevant, especially for those less familiar with glossing notation. Finally, each example includes a free translation of the meaning of the description.

The first type of grammatical use of space that is often used in sign languages to disambiguate who did what to whom is morphological marking of verbal agreement in the class of verbs known as agreeing or indicating verbs (Padden, 1988). Signers can track referents by assigning spatial loci to the event participants. In morphological marking of arguments on agreement verbs, the movement or palm orientation of the verb is modified using this referent tracking to move from the location of the subject to the location of the object or vice versa in 'backwards' verbs. Because the arguments of the verb can be distinguished from verbal morphology, greater flexibility in word order is allowed with this class of verbs (Fischer, 1975; Krebs et al., 2021). The full grammatical system entails both associating a location with each argument and modulating the verb to or from those locations for coreferential agreement. Note, there is debate among linguists as to whether 'agreement' in these verbs is analogous to agreement systems in spoken languages (Mathur & Rathmann, 2010) in part because corpus studies have shown that this marking is not obligatory in languages such as BSL (Fenlon et al., 2018), and cues from semantic and pragmatic properties of verbs may be more relevant than exact use of spatial loci in ASL (Frederiksen & Mayberry, 2022). Our description here does not argue for any particular syntactic interpretation of the construction, but instead we employ

the widely used terminology of agreement in order to report how the construction is present in the community of study.

A fourteen-year-old girl in Vanuatu produced (1) in response to Figure 1, in which both the verb and the object argument are modified with grammatical use of space. After signing the lexical sign for train, she articulated the verb 'pull' beginning to the far left and slightly behind her body. The non-spatially modified form of the verb 'pull' begins at a location slightly in front of the signer and moves toward the signer's body. Thus the verb movement is modified by a change in its starting location. Finally, the object of the sentence, tree, is articulated in the same locus to the left-back of the signer. In this way, the signer makes clear that tree is the object being pulled. The modification of the verb and the object are co-referential by both using this spatial locus.

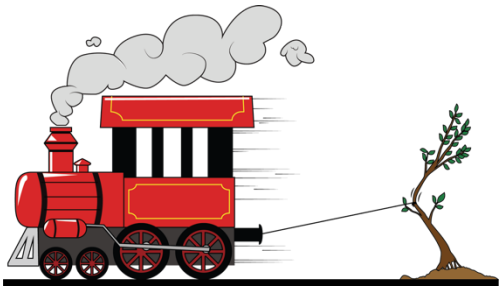

Figure 1. Stimulus for elicitation task - drawing of a train pulling a tree

(1)	TRAIN	$_{A}$PULL	TREE$_{A}$
		Beginning location of the verb is displaced to the left-back of the signer	*The lexical sign for tree is articulated at the left-back of the signer, not in neutral location*

'The train pulled the tree'

Secondly, many sign languages have complex classifier systems which include size and shape (SASS) classifiers, entity or semantic classifiers, and handling classifiers (Aronoff et al., 2005). For argument marking, semantic classifiers can be used to indicate the class to which the argument belongs (e.g. person, animal, vehicle). These classifiers can then be moved to iconically show the manner and path of the action taking place or the relationship between two entities (Loos et al., 2022). A nine-year-old boy in Vanuatu produced (2) which uses entity classifier with V handshape to indicate a person and the handshape of B to indicate a vehicle in response to Figure 2. In this example, the participants in the event, one person and one vehicle, are indicated by the handshapes used in the classifiers. The final sign in the sequence in which he uses the vehicle classifier handshape to run into the person classifier handshape clearly shows who did what to whom.

Figure 2. Stimulus for elicitation task - drawing of a train running into a man

(2) TRAIN CL-V CL-B RUN-INTO-CL2-CLB
Right hand in V handshape pointed down as in a person standing *Left hand flat with palm facing down* *Left hand moves toward and hits the right hand near the fingertips*
'The train hits the standing man'

Finally, signers can use grammatical space for distinguishing who did what to whom through role shift or constructed action. In both of these devices, the signer uses body position and/or facial expression to indicate the referent who is performing the action (Kocab et al., 2015; Stamp & Sandler, 2021). These devices are particularly salient in narrative discourse for not only marking referents, but also marking shifts in referents. The signer can identify their own body as one of the event participants through role shift or constructed action, then, when they perform an action, they are indicating that the action was performed by that event participant.

Sign languages additionally mark arguments through the use of syntactic word order. For the class of plain verbs (Padden, 1988), which are not able to be modified with agreement morphological marking described above, word order is the primary method of marking arguments. Generally, sign languages, like the vast majority of spoken languages, are classified as having basic word order of either SVO or SOV (Napoli & Sutton-Spence, 2014). In these cases, arguments are disambiguated by their sequential order of occurrence in the sentence. In absence of grammatical use of space, signers of these languages rely on basic word order for argument marking. Even in languages which rely on word order to mark arguments, conditioned variation in word order is influenced by factors such as information structure, context, and animacy (Levshina et al., 2023).

1.2. Argument marking in emerging sign languages

Studies of young sign languages are useful to answer a variety of research questions across fields. Within linguistics, many aspects of communicative interactions and the grammar of emerging sign languages have been studied. Here we review studies of argument marking devices, the focus of the current study. Intergenerational transmission has been claimed as obligatory for argument marking grammatical structures to emerge and become regularized across the signing community. Most of the studies examining the emergence of argument marking in young sign languages use a retrospective paradigm to study language emergence. That is, data is collected from adults, who are assumed to have a fixed signing system that corresponds to the age of the sign language age when they were acquiring it. This is because

younger signers are more likely to use innovations or new grammatical structures (Senghas & Coppola, 2001). After childhood, when the signers are exposed to new grammatical features, they are less likely to adopt them. In contrast, our study examines a sign language while the first cohort is still acquiring their language. To predict what the signing of this cohort may be when they are adults, we review reports of the signing of the first cohort of adult signers in other studies.

First, it has been widely argued that a full use of agreement morphology does not develop until the third cohort or generation of signers (De Vos, 2012; Ergin et al., 2018; Meir, 2010; Padden et al., 2010); however in a report on ditransitive verbs of transfer, verbal agreement is reported as being used by some of the signers of Yucatec Maya Sign Language (Le Guen, 2022). As stated above, the full system of verbal agreement requires both the arguments to be associated with abstract spatial loci and the verb to be modulated to agree with those loci. It is possible that the parts of this complex system emerge separately, so we focus on each of the subparts of the system.

First, we ask whether first cohort signers in young sign languages are reported to modulate the motion of the verb. First cohort signers of Lengua de Señas Nicaragüense (LSN) have been reported to produce verbs with spatial modulation; however these verbs did not correspond to systematic spatial or referent marking (Senghas, 2003; Senghas et al., 2004). First generation signers of Al-Sayyid Bedouin Sign Language (ABSL) and Israeli Sign Language (ISL) have been reported to modulate verbs only along the front-back axis and not along the diagonal or side-to-side axis (Padden et al., 2010). From these studies we can expect the first cohort of signers in our study to produce verbs with modulation of movement.

Second, in previous studies of emerging sign languages, first cohort signers are reported to establish arguments in grammatical space. One method of establishing referents using concrete space is to assign an event participant to the signer or the interlocutor. This has been reported to be utilized at high rates by LSN cohort one signers and cohort one signers of ISL (Kocab, et al., 2023; Meir, 2010; Padden et al., 2010) but rarely by cohort one signers of Central Taurus Sign Language (CTSL) or ABSL (Ergin et al., 2018; Meir, 2010). For LSN, cohort one signers have been reported to use grammatical space by assigning arguments to space for 67-80% of arguments (Flaherty, 2014; Kocab et al., 2015). They establish arguments in space even though they do not also modify the verbal movement to begin or end in those same loci. These studies categorize grammatical use of space to include strategies of body shift, indexical point to space, spatially modulated lexical label, index character assignment to present individuals, and the use of classifiers (Flaherty, 2014; Kocab et al., 2015; Kocab, Carter, et al., 2023). This work predicts that the first cohort of signers in a new sign language will use various spatial devices to assign arguments to space. In sum, we expect that the first cohort of signers will modulate verbal movement and will assign arguments to space using a variety of strategies; however, we do not expect these systems to converge into grammatical coreferential verbal agreement.

Turning then to word order, previous studies of emerging sign languages have reported that the first cohort of signers do not converge on a basic word order (Ergin et al., 2018; Flaherty, 2014; Meir, 2010; Senghas et al., 1997). Some have argued that the first cohort of signers have a tendency to produce single argument structures in which transitive reversible events are produced with split event or successive one-argument structures (Meir, 2010; Senghas et al., 1997). In split event or successive one-argument structures, two verbs are produced for a single event, one which corresponds to the action of the agent and one which corresponds to the action of the patient. The second cohort of these sign languages has been reported to have an even higher rate of these split event structures (Ergin et al., 2018; Senghas

et al., 1997). Also, first cohort signers have been reported to show sensitivity to animacy in word order by producing different orders depending on whether the object is animate or inanimate (Ergin et al., 2018; Flaherty, 2014; Senghas et al., 1997).

Taken together, these studies suggest that signers from the first cohort or generation of an emerging sign language will have signed descriptions characterized by the following:

- Will produce spatially modulated verbs that will not form part of a complete coreferential system of verb agreement.
- Will produce a variety of strategies for establishing arguments in space including assigning characters to present individuals, role shift or constructed action, classifiers, and perhaps assigning arguments to abstract spatial loci.
- Will not converge on a basic word order.
- Will have variable word orders depending on animacy of the object.

All of these previous studies have examined the signing of participants when they are adults. It remains to be seen how the first cohort of signers develop their language over time as children to arrive at this endpoint.

1.3. Background of the signing community

More detail on the language ecology of current participants is needed to contextualize the argument marking results. Studies of signing practices of deaf people often compare the impact of sociocultural factors such as community size and demographics, language transmission patterns, and geographic location (de Vos & Pfau, 2015; Hou & Vos, 2022) on linguistic structure, and name the languages typologically according to those factors (Braithwaite, 2020; Moriarty & Hou, 2023). Such typological questions are beyond the scope of the current study. Rather than employing any of these naming conventions, we describe the relevant sociocultural situation of the community before turning in detail to the current study.

Beginning in 2021, a cohort of deaf children have been attending a school in Port Vila. In 2021, there were a total of seven deaf children enrolled in the school, but this number has increased each year. As of 2025, there are 20 deaf children enrolled. Beginning in 2025, the school opened a deaf dorm for students and is planning on expanding its programming for deaf students to two other islands in Vanuatu. Therefore, it is possible that the language at use at the school will continue past the current group of children. The data from the current study capture a key moment when the dormitory was not yet established and the children attended school during the day, going to their own homes each evening. There has been no recognized sign language in Vanuatu and no record of intergenerational transmission of language between deaf people (Blyth & Brown, 2018; Iseli, 2018; Jenkin et al., 2019). Other studies of the situation for deaf adults in Vanuatu have not reported families or villages with high incidence of deafness or extended social networks of hearing friends or family that link several deaf people (Iseli & McKee, 2025, see companion issue; Eldads Vira et al., 2025, see companion issue) such as those which have been reported for Papua New Guinea (Reed, 2022). Thus, the children in this study were not acquiring a sign language that had been used more broadly among deaf people in Vanuatu.

The children in the current study are genetically unrelated to each other and from different provinces in Vanuatu and do not live in the same neighborhoods within Port Vila. Thus, the signers in the current study do not share a high-context sociocultural setting (Meir et al., 2012). Rather, they come from various backgrounds and geographic areas, similar to what has been described for the beginnings of national named sign languages (Braithwaite, 2018; Power &

Meier, 2022). The school of more than 1,000 students, was founded on the principles of inclusive education. The deaf children of the current study attend classes sometimes with their hearing peers and sometimes with small groups that include both deaf children and children with other disabilities. The language of instruction for the school is English and the school staff try to support the deaf students through sign language in small groups during independent work times. The signing community in Vanuatu is small and consists of deaf and hearing members of the school community. Finally, the current signing community is not creating their language completely *de novo*. Some members of the community experienced language contact with Fiji Sign Language. One school staff member, a head teacher, has two years of experience working in a deaf institute in Fiji, where she learned Fiji Sign Language. The other school staff have learned some signing from this head teacher and from the students. Four of the deaf students also had up to two school years of exposure to Fiji Sign Language at the same school in Suva, Fiji (academic years were incomplete due to temporary closure of the school during the COVID-19 pandemic). These four children did not have ongoing contact with anyone from the school in Fiji since returning to Vanuatu for the 2021 school year. We turn now to the topic of the current study: the development of argument marking devices in this community. Thus the longitudinal study in the children in Vanuatu examines how argument marking devices develop within the first cohort of a signing community.

1.4. Current study

The current study examines argument marking strategies previously described for emerging sign languages in a longitudinal design. Using a picture description task, we examine change in argument marking strategies after one additional year of communication in the signing community. In addition, we compare the argument marking strategies of the children in Vanuatu with children in Fiji to determine if the observed strategies are due to language contact. From previous studies of emerging sign languages, we expect that the children in Vanuatu will not converge on a word order, nor display full coreferential verbal agreement, and will set up arguments using grammatical space. However, it is unclear at what time point in the children's signed interactions these predictions will hold. Our study focuses on two research questions. First, will argument marking strategies change from time one (T1) to time two (T2) in the signing of the children in Vanuatu? Secondly, are the argument marking strategies in Vanuatu borrowed via language contact with Fiji Sign Language?

2 Method

2.1 Participants

Participants from Vanuatu include six deaf children who are enrolled in the same school in Port Vila and have regular interaction with each other as described in Section 1. All of the deaf children report being the only deaf member of their family and learning to sign upon entering the school setting. The school began admitting deaf students in 2021, and four deaf students had some language contact with Fiji Sign Language in 2019 and 2020, when they left Vanuatu to attend school in Fiji. All ni-Vanuatu participants completed the elicitation task in 2022 (T1) and then again one year later in 2023 (T2). Due to the language contact with Fiji Sign Language, a second group of thirteen child participants were recruited from Suva, Fiji. The children in Suva all attend Gospel School for the Deaf. They come from various parts of Fiji and reside in the deaf hostel during the school term. At the hostel and at the school, they regularly interact with deaf adults who are also signers of Fiji Sign Language. Many of the participants in Fiji were personally known to the four ni-Vanautu deaf children who had

previously been enrolled at the same deaf school. Participant attributes for both groups can be seen in Table 1.

Table 1. Participants' background characteristics

	Vanuatu: T1	Vanuatu: T2	Fiji
Number (male)	6 (4)	6 (4)	13 (7)
Age in years (mean)	7-14 (10.5)	8-15 (11.6)	8-16 (12.4)
Age of exposure to signing (mean)	6-13 (8.9)	6-13 (8.9)	5-10 (6.6)

2.2 Task

Data was collected during trips of the first author to Vanuatu and Fiji. Each visit was of a duration of approximately three weeks. The present study includes data from two trips to Vanuatu and one trip to Fiji. The author has since made additional trips to both countries and has ongoing contact with the signing communities. In Vanuatu, consent was obtained in Bislama through interaction between the first author, school personnel and the families of the participants. Before each video session, we also obtained assent from the children. During the first visit of the first author, the primary teacher of the deaf children interpreted the assent and task instructions. By the second visit of the first author, the author communicated directly with the children using their signs. In Fiji, consent was obtained in English or Fijian through interaction between school personnel and the families because the children were staying at the hostel and there was no opportunity for the families to meet the first author in person. A member of the Fiji Association of the Deaf assisted with the research, obtained assent from child participants and gave all task instructions during the data collection. Research methods were approved by the University of California San Diego IRB.

We elicited descriptions of simple transitive sentences using a picture description task. Each signer chose a communication partner from among the other signers present at the school. The signer viewed a drawing of a simple transitive event and signed their description to the communication partner. The partner was then shown an array of four pictures, which included the target picture and three distractors. One of the distractors reversed the roles of subject and object, where possible. For example, if the target picture was a boy pulling a girl, the comprehension array would include the target picture and a picture of the girl pulling the boy. The other two distractor pictures were randomly selected from the complete set of pictures. If the event was not reversible, for example a woman lifting a box, one distractor would include the subject acting upon a different object (woman lifting a balloon) and one distractor would include the subject and object with a different verb (woman hitting a box) and the last distractor would include a different subject (boy lifting a box). A complete list of stimuli images is given in Table 5. The comprehension arrays were visible to the signer before they began signing. The goal of this elicitation paradigm was to elicit full informative sentences so that we could analyze how the signers were marking who did what to whom. The same procedure was repeated for each of the sixteen target pictures. The order of presentation was randomized between signers.

Animacy, specifically of the grammatical object, has been shown to influence word order in sign languages (Meir et al., 2017; Napoli & Sutton-Spence, 2014). For this reason, our stimuli, developed by Dr. Rabia Ergin, were balanced for animacy of subject and object. The sixteen stimuli contained 8 with animate subjects (4 of which had animate objects and 4 which had inanimate objects) as well as 8 with inanimate subjects (4 of which had animate objects

and 4 of which had inanimate objects). This balancing of animacy across stimuli allows the examination not only of what argument marking strategies are in use in the community, but also the degree to which those strategies are conditioned by animacy.

2.3 Coding

All transcription and coding was completed in ELAN software (2021). For analysis, the first signed description of the picture was included whether or not the communication was successful. Each description was coded for a wide number of argument marking strategies. Word order between the subject, object and verb was coded. Subject and object were determined based on the stimulus picture and not extrapolated from the signing because the rules of syntax in the language are not described or developed in such a way to make extrapolation possible.

Recall that in emerging sign languages, and in established sign languages, signers will at times describe the event from both the agent and patient perspective with a separate action attributed to each of the event participants. According to our coding schema for word order this would result in SVOV or SVVO or OVSV or OVVS word orders. However, in these cases the primary way that the participants were disambiguating who did what to whom was by assigning an action to each event participant. These were therefore coded as 'split event' production.

Another way sign languages can mark arguments is through constructed action, where the signer uses their own body as one of the event participants rather than using abstract space. Each description was coded for whether this strategy was used for 0, 1, or 2 arguments.

In some emerging sign languages, some signers assign event participants to present individuals. For example, an eight-year-old child in Fiji produced (3) in response Figure 3. She first assigned the role of object (girl) to her partner. She then assigned the role of subject (boy) to herself. Finally, she produced the verb push modulated so that the palm orientation and movement were toward her partner. The action or verb was performed with her own body as subject acting upon the body of the participant who was assigned the role of object. We called this strategy 'indexed character assignment' and each description was coded for whether this strategy was used for 0, 1, or 2 arguments.

Figure 3. Stimulus for elicitation task - drawing of a man pushing a woman

(3)	IX_2	GIRL	IX_1	BOY	$_1PUSH_2$
	Point at interlocutor seated to the right of the signer		*Point to signer's chest*		*Palms facing interlocutor to the right of signer, sign moves from location close to signer's chest toward the interlocutor's location*

'You are the girl, I am the boy, I push you'

Next, we looked at whether arguments were assigned abstract locations in grammatical space. Loci could be assigned either through signing a lexical sign displaced to the abstract location or using an indexing sign to assign the location. Lexical assignment to space and indexical assignment to space were each coded separately for being used for 0, 1, or 2 arguments. Any spatial modulation of the verb was also coded. We coded for the presence of spatial modulation (0/1) as well as for what that spatial modulation agreed with based on coreference. Some modulations of the verb represented the real-life size, shape, or location of an argument. For example, a verb push when referring to a man pushing a box which was on the floor was modulated so that the ending location of the push was lower than the neutral space. We label this type of modulation as 'spatial/real world' because the modulation is not associated with an argument that was established in space, but with the real-life characteristics of the event. If the beginning or ending location of the verb was modulated to be in the same beginning or ending location that was established as the loci for any arguments (coreference), the verb was coded as agreeing with those arguments. Verbs with modulation could then be coded as agreeing spatially, with the object, subject or both. Finally, some signers used semantic classifiers to mark arguments and show the action of the event. Each description was coded as using classifiers for 0, 1, or 2 arguments. In all, the coding procedure measured presence of a variety of argument marking devices and was able to account for descriptions which employed more than one argument marking strategy.

3 Results

3.1 Rates of argument marking strategies

Participants employed many argument marking devices in their descriptions of transitive events. The rates of argument marking devices reported here are a reflection of the presence of the device in a single description, not of whether the device was used to mark only one or both arguments. Furthermore, a single description could use multiple devices. Our research questions were twofold. First, after one additional year of interaction, will there be change in

argument marking devices in the children in Vanuatu? Results for rates of strategy use and t-test are shown in Table 2. Comparing T1 and T2 data from Vanuatu, we see significant changes in strategies for almost every observed strategy. Notably, we saw a drop in constructed action, from 21.79% to only 8.53% and an increase in rates of both spatial arguments (7.59% to 21.95%) and classifiers (6.33% to 15.85%).

Table 2. Comparison of argument marking strategies for time one (T1) and time two (T2) in Vanuatu. Rate (sd) of argument marking strategies by participant group and t test results.

	Vanuatu: T1	Vanuatu: T2	t statistic (df = 159)	p-value
Split event	13.92 (10.4)	15.85 (17.1)	0.8613	0.3904
Constructed action	21.79 (15.2)	8.53 (6.8)	7.1888	<0.0001
Index character	0 (0)	1.22 (2.8)	3.8723	0.0002
Spatial arguments	7.59 (13.4)	21.95 (15.2)	6.3497	<0.0001
Classifier	6.33 (10.8)	15.85 (16.1)	4.3894	<0.0001
Spatial modulation verb	22.78 (14.9)	31.71 (4.9)	5.14656	<0.0001

Second, we ask if argument marking strategies are due to language contact with Fiji. To answer this question, we compare the rate of argument marking strategies used in Fiji to those used in Vanuatu at T1, which is closer chronologically to language contact. We found significant differences in argument marking strategies as seen in Table 3. For example, indexing characters to present individuals was used in 18.23% of descriptions in Fiji but not at all in Vanuatu T1 data. Furthermore, spatial arguments were used in 29.69% of descriptions in Fiji, but only in 7.59% of descriptions in Vanuatu. Similarly, classifiers were used in 37.5% of descriptions in Fiji but only 6.33% of descriptions in Vanuatu.

Table 3. Comparison of argument marking strategies for Fiji and Vanuatu T1. Rate (sd) of argument marking strategies by participant group and t test results.

	Fiji	Vanuatu: T1	t statistic (df = 269)	p-value
Split event	23.96 (13.3)	13.92 (10.4)	5.9954	<0.0001
Constructed action	16.15 (12.3)	21.79 (15.2)	3.195	0.0016
Index character	18.23 (26.6)	0 (0)	6.0848	<0.0001
Spatial arguments	29.69 (23.9)	7.59 (13.4)	7.7287	<0.0001
Classifier	37.5 (18.1)	6.33 (10.8)	14.286	<0.0001
Spatial modulation verb	25.52 (11.1)	22.78 (14.9)	1.6635	0.0974

All groups used spatial modulation of verbs in their descriptions of transitive events, so we further coded the verbal modulation to examine for possible grammatical verb agreement. Recall that the movement and orientation of a verb can be modified to indicate agreement in a spatial location with an established argument. For verbs that were modulated in any way, we show the rates of agreement, or coreference with subject and object, object only, or concrete, real-world information (see Table 4). For all data groups, the highest percentage of spatial modulation was in this last category of providing information about the real-world space. For example, in response to a picture of a man pushing a box which was located on the floor, the signer would modulate their sign push so that the ending location of the sign was not in neutral space, but lower toward the floor. Next, we look at spatial coreference. In Fiji Sign Language,

the older sign language, we see instances of verbal coreference with spatially established arguments in a total of 36.7% of all spatially modulated verbs. However, Vanuatu T1, which was chronologically closer to language contact, had a total rate of verbal coreference with established arguments of only 5.5%. This once again shows that the devices used in Fiji Sign Language were not all in use in the Vanuatu context. Finally, comparing Vanuatu T1 and T2, we see an increase in verbal coreference specifically in the area of object only agreement (from 0% to 15.4%) after one additional year of language interaction.

Table 4. Verbal agreement distribution (%) by group

	Fiji	Vanuatu: T1	Vanuatu: T2
Subject and object	26.5	5.5	3.8
Object only	10.2	0	15.4
Spatial/real world	63.3	83.3	69.2

Thus far, our results show that the rate of argument marking strategies clearly change in the course of just one year of continued interaction between the children in the first cohort of children in Vanuatu. However, these devices developed by the Vanuatu children are not simply borrowed from language contact with Fiji Sign Language.

Another argument marking device available to participants is using consistent word order. Previous research in sign languages has shown that use of semantic classifiers and spatial arguments affects and licenses alternative word orders (Krebs et al., 2021). Therefore, examining word order in responses which do not contain semantic classifiers or spatial arguments should eliminate systematic variation and reveal any present basic word order patterns. This is what we report in Figure 4. No group used any word order in even half of their descriptions. Instead, we see that all groups used SVO, SOV, and split event constructions often, with a high level of variation across stimuli.

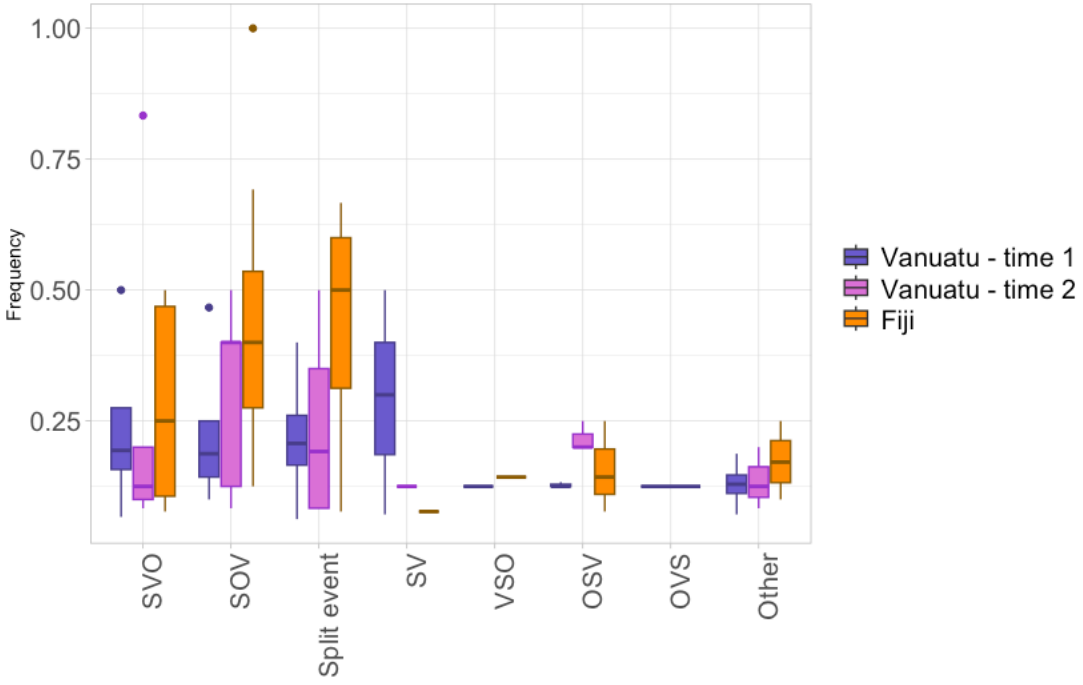

Figure 4. Word order in descriptions excluding classifiers and spatial arguments

Looking, then, at comparison between groups, we see that T1 to T2 change in word order use in Vanuatu only in a decrease of SV word orders, with other variation remaining stable. At T1, some members of the signing community had been signing for less than a year, and produced more single argument descriptions. However, by T2, with an additional year of experience in the community, all participants produced a majority of two argument descriptions. Comparing the Fiji Sign Language rates of word order to Vanuatu T1, we see no significant differences despite trends of higher SOV and split event orders in Fiji.

3.2 Animacy conditions

Our stimuli were balanced for animacy of the subject and object (Table 5), allowing us to further analyze the effects of animacy on the use of argument marking devices. Across language communities, variation in the rate of use of argument marking devices including word order is expected. This variation is often conditioned by information structure, context, and user preference (Levshina et al., 2023). Our stimuli and elicitation method were carefully controlled in order to examine the effects of animacy on variation in the use of these argument devices. Of particular interest is if there is an interaction between the effects of animacy and any of the devices either in longitudinal change or between the productions of children from Vanuatu and children from Fiji.

Table 5. Stimuli and animacy conditions. Agent refers to the person or thing who performed the action. Patient refers to the person or thing acted upon.

Condition	Agent	Verb	Patient
Animate-Animate	Man	Lift	Woman
	Girl	Hit	Boy
	Man	Push	Woman
	Boy	Pull	Girl
Animate-Inanimate	Woman	Lift	Box
	Boy	Hit	Box
	Woman	Push	Tree
	Girl	Pull	Tree
Inanimate-Animate	Balloons	Lift	Boy
	Balloons	Hit	Girl
	Train	Push	Man
	Train	Pull	Boy
Inanimate-Inanimate	Train	Push	Box
	Balloons	Hit	Tree
	Balloons	Lift	Box
	Train	Pull	Tree

In order to examine which factors were driving the variation in word order and argument marking devices, we used linear mixed effect models. We calculated these linear mixed effect models using R programming language and the lme4 package (Bates et al., 2015). We ran individual models with each argument marking device as the outcome variable. For word order, the rate of SVO, SOV, and Split event was each used in turn as outcome variables and models were fit using the Satterthwaite's method. For all other argument marking devices, binomial data with the device present (1) or absent (0) was used in turn as the outcome variable. Our full

models included interaction of country and animacy condition as well as covariates of participant age and age of exposure to the signing community. An example of the full model specification with classifier use as the outcome is Classifier ~ Country * Condition + Age + AoE + (1 | Participant) + (1 | Stimulus), family = binomial. In this example, the model measures how much each of the covariates and interaction contribute to the variation in whether or not a participant used classifiers.

We report first on the models examining rate of the three most common word order devices: SOV, SVO, and Split event (see Appendix A, Table 1A for full results). For word order rate of SVO, no main effects or interactions were significant. The interpretation of this result is that the variation in word order rate of SVO is not primarily conditioned by any of the covariates in the model. For rate of SOV word order, no main effects were significant; however, there was a significant interaction of Vanuatu and the condition with an animate subject and inanimate object ($\beta = 0.115457$, $p = 0.00886$). In this condition, with animate subjects and inanimate objects, signers in Vanuatu increased their rate of SOV use; however, in Fiji, the condition did not lead to a similar increase in frequency of SOV order. This shows that signers in Vanuatu were more sensitive to the influence of animacy than were the signers in Fiji. Figure 5 demonstrates this result. For both T1 and T2 in Vanuatu, the frequency of use of SOV is much higher for the condition with an animate subject and inanimate object (AI). In fact, at T2, the frequency of SOV use for ni-Vanuatu children is very low for the other conditions (AA, IA, and II), but close to ceiling for the AI condition. However, for Fiji, the frequency of SOV word order use did not differ significantly for the different conditions.

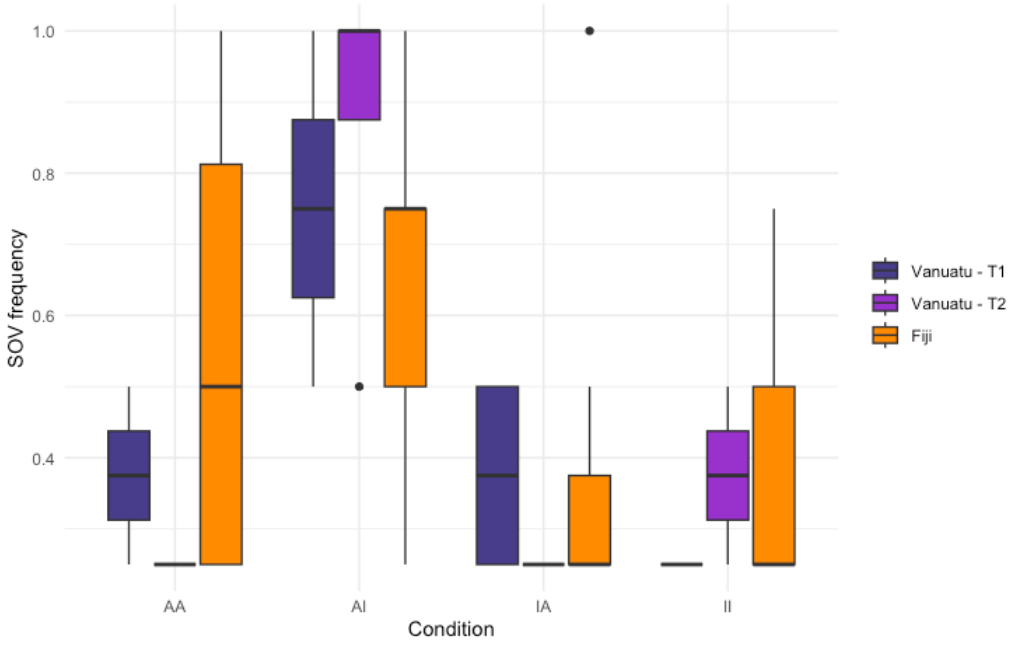

Figure 5. Frequency of SOV word order use by country and animacy condition

For split event, there was a main effect of the condition with an inanimate subject and an animate object ($\beta = -0.090278$, $p = 0.00133$) and the condition with an inanimate subject and an inanimate object ($\beta = -0.072116$, $p = 0.03743$). Across signers, the highest rate of split event constructions was used for the condition where both subject and object were animate. Animate subjects were more likely to elicit split events than inanimate subjects. The covariate of country was not significant. This result shows that some variation in word order, specifically in the use

of split event word order, is conditioned in both countries by the animacy of the arguments. In Figure 6, the frequency of split event word order is much higher in the AA condition for both countries and both sampling times.

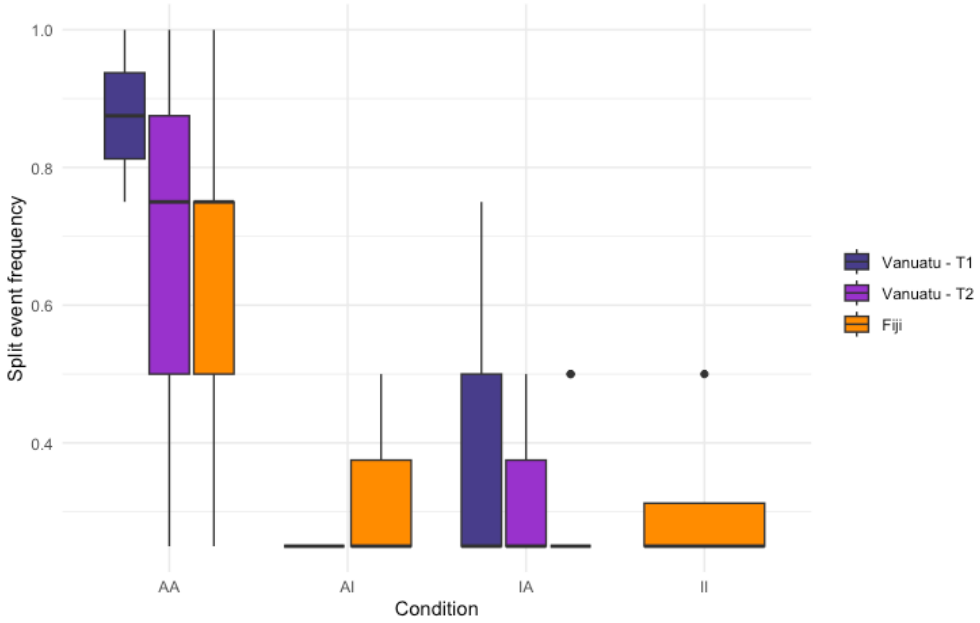

Figure 6. Frequency of split event word order use by country and animacy condition

In concordance with the earlier reported word order results, there is no significant change in word order variation from T1 to T2 in Vanuatu even with the models which account for variation conditioned by animacy. Our second research question regarded the relationship between the signing in Vanuatu and that of Fiji. Using linear mixed effect models, the results show that the signers in Vanuatu differ from those in Fiji in their sensitivity to animacy conditions for SOV.

We now report the results of the statistical models for the other argument devices. For some argument marking strategies, the full statistical model failed to converge. In these cases, we ran nested model comparison by adding single variables one at a time and using an ANOVA to determine if the model with the added variable was significantly better than the model without it. Our base model included participant variables and random effects: Outcome ~ Age + AoE + (1 | Participant) + (1 | Stimulus). We report here on the nested model analysis and the final models which included any variables that significantly improved the base models.

For all of the strategies where the full model failed to converge, the only final models from nested comparisons which included country as a predictor were classifier use and spatial arguments. This is relevant to our second research question which compares the signing of the children in Vanuatu with that of the children in Fiji. The interpretation of this result is that for classifier use and spatial arguments, which country the participants were from may predict the variation in whether or not the strategy was used. Recall that t-tests for these strategies looking at Fiji compared to Vanuatu T1, and Vanuatu T1 compared to T2, showed significant differences in rate of use (see Tables 2 and 3). To determine whether these factors significantly contributed to the variation of classifier use and spatial arguments differently across animacy conditions, we calculated the linear mixed effects model (see Appendix A, Table 2A for full results). For classifier use, nested model comparisons revealed that addition of both country and condition significantly improved the base model ($\chi^2 = 4.2333$, $p = 0.03964$; $\chi^2 = 85.614$

p<0.001, respectively). The final model included both country and animacy condition as main effects. The main effect of country was approaching significance (β = -1.6975, p=0.055). There were significant main effects of Condition IA (β = 3.2995, p<0.001) and II (β = 3.6277, p<0.001) as well as age (β = 0.3131, p = 0.02163) such that classifiers were used at a higher rate in events with inanimate subjects and by older children. Figure 7 shows the frequency of classifier use by country and animacy condition.

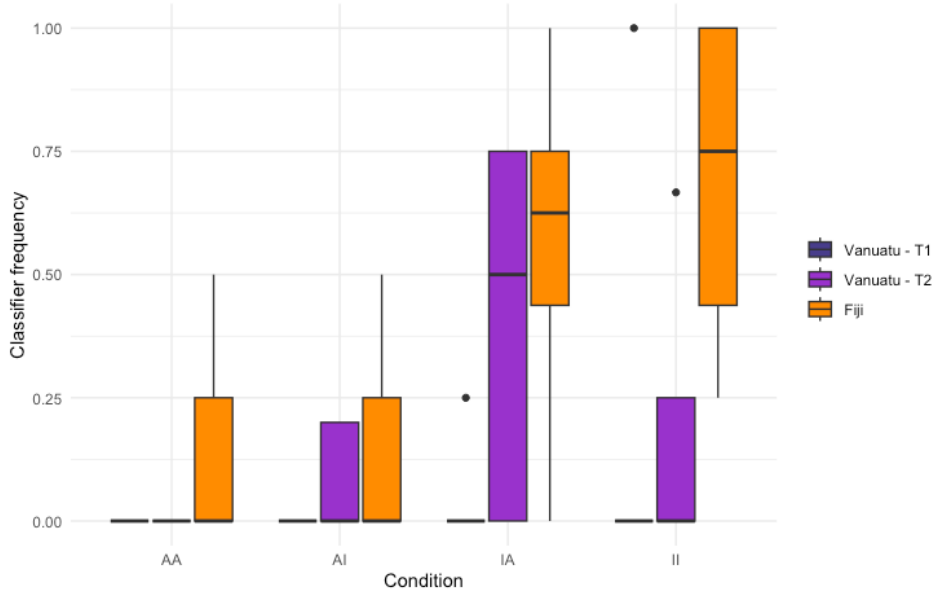

Figure 7. Frequency of classifier use by country and animacy condition

For spatial arguments, nested model comparisons revealed that addition of country was a marginal improvement (χ^2 = 4.9108, p = 0.08583) and addition of animacy condition was a significant improvement over the base model (χ^2 = 11.633; p = 0.0203). The final model included both country and animacy condition as main effects. The main effect of country was approaching significance (β = -1.2846, p = 0.0543). There was a significant main effect of Condition II (β = 1.1105, p = 0.0105) such that spatial arguments were more likely to be used with two inanimate event participants.

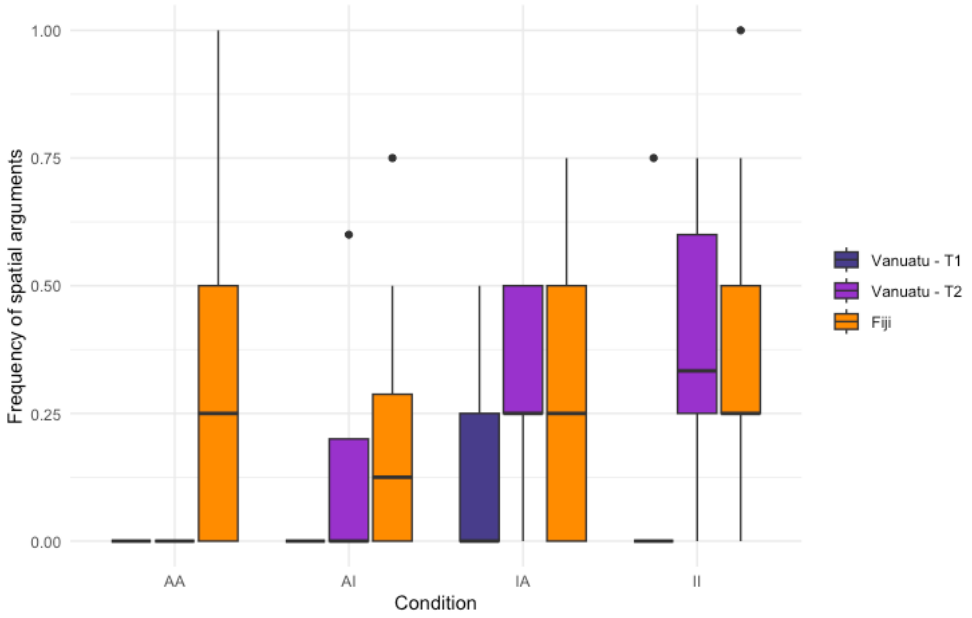

Figure 8. Frequency of spatial arguments by country and animacy condition

The full models for indexing character assignment and constructed action failed to converge and nested model comparisons produced models without country as a covariate, but with animacy condition. Therefore, we ran the linear mixed effect models to examine the effect of animacy on the use of these strategies without country as a covariate. Results of the linear mixed effect models with these strategies as outcome variables can be seen in Appendix A, Table 3A. For both of these models, there were significant effects of animacy conditions on the use of the argument marking device. The paired t-tests reported Section 3.1 showed significant change in rates of some of these strategies from T1 to T2 in Vanuatu (see Table 2) as well as significant differences between Fiji and Vanuatu T1 (see Table 3) when all animacy conditions were considered together. While t-tests showed overall significant differences in group comparisons, the mixed effect model results provide an important observation. Namely, they show that argument marking strategies are highly influenced by animacy conditions of the stimuli. For example, indexing character assignments to present individuals was far more likely when a stimulus had two animate event participants. On the other hand, use of constructed action was more likely when there was one animate and one inanimate event participant, regardless of which one was the subject or object, and less likely if there were no animate event participants. This is important to keep in mind when comparing our present results to other studies or making conclusions about the prevalence of certain types of argument marking strategies in any group, because certain animacy conditions of stimuli may be amplifying or suppressing not only certain word orders, but also the use of other strategies.

4 Discussion

Our study set out to determine how the deaf children in a signing community centered in a school in Vanuatu were developing ways to mark arguments. We answered this through an elicited production task in a longitudinal design. This study captures a unique moment in the young sign language by examining the language use of the children who are first encountering peer-to-peer contact within the first five years of that contact. From reports of the argument

marking strategies of first cohort of signers in other young sign languages we expected to see these characteristics in the signing of the ni-Vanuatu children:

- Will produce spatially modulated verbs that will not from part of a complete coreferential system of verb agreement.
- Will produce a variety of strategies for establishing arguments in space including assigning characters to present individuals, role shift or constructed action, classifiers, and perhaps assigning arguments to abstract spatial loci.
- Will not converge on a basic word order.
- Will have variable word orders depending on animacy of the object.

Our T1 data was collected in 2022, approximately one and half years after the establishment of the signing community in Vanuatu. At the time of data collection, signers had 0.7-3.5 years of signing experience, with four of the signers having previous language contact in Fiji. At that time, we did see signers produce spatially modulated verbs without a full agreement system, not converge on a basic word order, and show sensitivity to animacy in their word orders. While we did see the signers use some other argument marking devices, particularly constructed action, we did not see a high number of the devices used that grammatically mark arguments in space. This was contrary to what has been described for adult signers from the first cohort of other young sign languages. However, one year later in our T2 data, these are exactly the devices that we saw being used at higher rates. In addition, rates of constructed action were significantly lower in T2 as compared to T1. After a year of additional signing experience in the community, the children used whole body constructed action less and were more likely to use other argument marking strategies. This result can begin to reveal the effect of sustained community interaction on argument marking strategies. Interestingly, the changes from T1 to T2 do not reflect a mere boosting of the most common argument marking strategies. The children are not simply taking the most common strategy in the signing community and reproducing it at higher and higher rates, but instead some strategies are becoming more prevalent as others are becoming less so.

Recall that in many previously described emerging sign language communities, the sign language is formed *de novo* from the gesture systems or homesigns of the deaf children. Several studies have compared adult homesigners with various cohorts of signers in LSN to examine the origins of linguistic structures (Brentari et al., 2024; Flaherty, 2014; Kocab, Senghas, et al., 2023; Rissman et al., 2020). The comparison between homesigners and the first cohort of signers can reveal what specific aspects of language develop in part due to community interaction. Our study contributes to this discussion by showing "in real time" the development of these linguistic devices. The result of longitudinal change in the use of grammatical space in our participants in Vanuatu suggests that the added pressure of community interaction with other deaf signers may facilitate the development of grammatical use of space.

A second question in our research was whether the language contact with Fiji Sign Language would account for the argument devices being using in Vanuatu. While previous studies have focused on *de novo* language creation, some of the participants in Vanuatu had language experience with Fiji Sign Language. This means the children in our study may have had access to additional linguistic resources compared to the participants of studies of other young sign languages. Our results show that the T1 Vanuatu argument marking devices were significantly different from those in Fiji Sign Language used by similarly aged children. This was mainly driven by the low rate of argument marking devices used by the children in Vanuatu at T1. Because the time of language contact was short (5-14 months) we suggest that the ni-

Vanuatu children acquired much of the lexicon of Fiji Sign Language, but not the grammatical devices used to mark arguments. Rather than adopting the linguistic devices from the signing in Fiji, the data show that these devices are arising independently in Vanuatu through sustained community use.

The specific linguistic devices emerging in the Vanuatu community are similar to those found in other sign languages of the world, confirming that these grammatical structures arise from deaf communities communicating in the visual modality. For example, while all groups in our study used spatial modulation of verbs, we saw a change from T1 to T2 in the emergence of spatial coreference. As shown in Table 4, at T1 spatially modulated verbs were only coreferential with arguments at a rate of 5.5 percent. One year later, the coreference rate had risen to 19.2 percent. This growth was driven by verbs being modulated to be coreferential with the object argument. One hypothesis of evolutionary trajectory of agreement marking in sign languages is that verbal agreement would first emerge by verbs agreeing with the object of the sentence before the emergence of dual agreement (Le Guen, 2022; Meir et al., 2017). The beginnings of emergence of agreement seen in the one year longitudinal data in the current study follow that evolutionary hypothesis.

While we see growth in the use of space, classifiers, and verbal agreement from T1 to T2, we found little change in the rates of variation of word order over the one-year period. Even in languages with established word orders, some variation is expected depending on animacy conditions (Levshina et al., 2023; Meir et al., 2017; Napoli & Sutton-Spence, 2014). Specifically, events with an animate agent and inanimate patient are more likely to elicit SOV word order. In our study, we found an interaction between country and animacy condition for SOV word order. The children in Vanuatu were more sensitive to these semantic pressures of animacy than the children of similar ages in Fiji who are acquiring an older sign language. One of our hypotheses was that the children in Vanuatu would have different word order frequency depending on the animacy of the object. The results of the linear mixed effect model reveal that the children in Vanuatu produce a higher rate of SOV particularly with an animate subject and inanimate object, but not with all inanimate objects. While it has been argued that through intergenerational transmission word order may emerge before full verbal agreement systems (Sandler et al., 2005), our results show that the opposite may be true within a single generation. Communicative pressure and continued interaction in the community of children in Vanuatu is producing an increased rate of establishing arguments in space and beginning to produce verbal modulations that are coreferential with those arguments, but not yet convergence on word order.

The current report is focused specifically on linguistic structures surrounding argument marking devices, which we acknowledge form only a part of the language practices of the deaf children in Vanuatu and Fiji. Deaf peoples' languaging practices are much more broad and varied than can be described using the current methods (Moriarty & Hou, 2023). Our study adds to the many which look at linguistic structure of signing practices rather than interactional processes (Hou & Vos, 2022). Our elicitation method does provide data on the accuracy of the attempted communication and the participants did, at times, attempt to repair miscommunications. Future studies will examine this more interactional data. Additionally, future studies comparing the signing practices in Fiji and Vanuatu could shed light on the impact of community size and language age on signing practices in other areas of linguistic analysis, but typological comparison is beyond the scope of the current study.

In sum, our study shows that the argument marking strategies in Vanuatu are arising independently through sustained community use, rather than being borrowed from Fiji. The brief period of language contact led to lexical similarities, but not use of the same argument

marking strategies. Furthermore, it is not the case that children are simply boosting the most frequent argument marking strategies from the period of language contact or from the argument marking devices presently in use in the community. The longitudinal change in argument marking from T1 to T2 shows that deaf children in Vanuatu are creating devices to communicate who did what to whom. These devices take advantage of the visual-spatial nature of their language. This provides evidence that such devices can emerge in peer-to-peer contact among children. If intergenerational transmission of their language occurs, the argument marking devices reported here will form part of the linguistic input for the next cohort of language users.

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Appendix

Table A1. Results of linear mixed-effects predicting use of word order. Fiji and animate-animate condition represent the intercept. Significant p values shown in bold type.

Word order	Predictor	β	Std error	p-value
SVO				
	Vanuatu	0.024808	0.057889	0.6743
	ConditionAI	-0.037294	0.055377	0.5093
	ConditionIA	-0.078141	0.044925	0.0979
	ConditionII	-0.063867	0.065494	0.3416
	Age	0.004121	0.009838	0.6800
	AoE	0.006277	0.012550	0.6245
	Vanuatu:AI	-0.011190	0.072714	0.8794
	Vanuatu:II	0.067154	0.084513	0.4371
SOV				
	Vanuatu	-0.058858	0.042937	0.17864
	ConditionAI	0.025799	0.027230	0.34950
	ConditionIA	-0.041574	0.027439	0.13818
	ConditionII	-0.023996	0.029438	0.42020
	Age	-0.001201	0.004782	0.80465
	AoE	-0.001440	0.006639	0.83088
	Vanuatu:AI	**0.115457**	**0.041829**	**0.00886**
	Vanuatu:IA	0.052489	0.039950	0.19715
	Vanuatu:II	0.031247	0.043877	0.48069
Split event				
	Vanuatu	-0.006119	0.036255	0.86759
	ConditionAI	-0.071197	0.036108	0.06165
	ConditionIA	**-0.090278**	**0.023976**	**0.00133**
	ConditionII	**-0.072116**	**0.032741**	**0.03743**
	Age	0.002466	0.004623	0.60212
	AoE	0.007497	0.006763	0.28468
	Vanuatu:AI	-0.073208	0.068104	0.29353
	Vanuatu:IA	-0.009647	0.040208	0.81242

Table A2. Results of mixed-effects logistic regression predicting use of classifiers. Fiji and animate-animate condition represent the intercept. Significant p values shown in bold type.

Argument Marking Strategy	Predictor	β	Std error	p-value
Classifier				
	Vanuatu	-1.6975	0.8866	0.05555
	ConditionAI	0.5616	0.6578	0.39326
	ConditionIA	**3.2995**	**0.6199**	**<0.0001**
	ConditionII	**3.6277**	**0.6272**	**<0.0001**
	Age	**0.3131**	**0.1367**	**0.02198**
	AoE	-0.2963	0.1986	0.13567
Spatial argument				
	Vanuatu	-1.2846	0.6675	0.0543
	ConditionAI	-0.1549	0.4672	0.7403
	ConditionIA	0.7192	0.4414	0.1033
	ConditionII	**1.1105**	**0.4342**	**0.0105**
	Age	0.1676	0.1171	0.1524
	AoE	0.09345	0.16482	0.5707

Table A3. Results of mixed-effects logistic regression predicting use of argument marking devices. Fiji and animate-animate condition represent the intercept. Significant p values shown in bold type.

Argument Marking Strategy	Predictor	β	Std error	p-value
Index character assignment				
	ConditionAI	**-2.119567**	**0.836326**	**0.011265**
	ConditionIA	**-2.772391**	**0.940934**	**0.003215**
	ConditionII	**-4.994834**	**1.409747**	**0.000395**
	Age	0.006487	0.395251	0.986905
	AoE	-0.860265	0.552044	0.119156
Constructed action				
	ConditionAI	**1.02760**	**0.43880**	**0.01919**
	ConditionIA	**1.28778**	**0.43522**	**0.00309**
	ConditionII	**-2.32553**	**1.05667**	**0.02775**
	Age	-0.07106	0.10181	0.48520
	AoE	0.02028	0.10677	0.84937