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Sign networks: Nucleated network sign languages and rural homesign in Papua New Guinea

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ABSTRACT

The sociodemographic typology of sign languages classifies them based on the characteristics and configurations of their users. When considering homesign and sign languages in rural areas, this typology needs further refinement. Here, I present new concepts to enable this. The study is based on fieldwork with twelve deaf people in Western Highlands, Papua New Guinea, and review of studies worldwide. Sign language communities can be mapped as *sign networks*. Using this mapping, I propose a new typological category for languages with one central deaf user and many fluent hearing signers: *nucleated network sign language*. I use *sign base analysis* to determine lexical consistency between unconnected deaf signers in Western Highlands. The high level of consistency among largely unconnected deaf people is explained by a *regional sign network* connecting deaf and hearing signers. This research emphasises the role of both deaf and hearing signers in sign language emergence and maintenance. (Sign languages, social networks, sign networks, typology, homesign, rural sign languages, Papua New Guinea)*

INTRODUCTION

The first wave of research on sign languages focused on those of multigenerational deaf communities in the United States and Europe. Since then, researchers have engaged with increasingly diverse signing communities, from single deaf children raised in non-signing households to rural communities with high rates of deafness and resulting local sign languages shared by deaf and hearing people (e.g. Goldin-Meadow 2003; de Vos & Zeshan 2012; Le Guen, Safar, & Coppola 2020). From this work, a sociodemographic typology of sign languages has emerged, in which sign languages are classified according to the configurations of people who use them. This typology provides a valuable corrective to the oft implicit assumption that sign language is exclusively the province of the deaf. Rather, around the world, sign language emerges for communication not only among deaf people, but also between deaf and hearing ones. Sign language routinely occurs within the broad spectrum of human communicative resources.

As new signing communities are described, there is an increasing lack of fit between attested sign languages and existing categories within the sociodemographic typology. This has prompted some to question the value of sorting sign languages into types at all (Safar 2019). But sound taxonomies can be useful, allowing us to identify possible patterns of covariance between sociodemographic characteristics and linguistic features. A more comprehensive mapping of the range of social settings in which sign languages emerge and are used may reveal how different social configurations and cultural beliefs do, or do not, support sign language emergence and maintenance. A better typology can improve our understanding of the wide range of communicative situations that deaf AND hearing people find themselves in, and help us move beyond the view of sign language as an uncommon, arcane type of language.[1]

In this article I aim to improve on the current taxonomy. My argument is based on my field-based study of sign languages in the Nebilyer and Kaugel valleys of Papua New Guinea, and relevant literature from elsewhere in the world. There is a degree of lexical consistency among Nebilyer/Kaugel sign languages, despite there being little-to-no 'deaf sociality' (Friedner 2011). As I show below, this lexical consistency cannot be explained by shared local culture or shared gestural repertoires. My solution to this puzzle encourages researchers to look beyond single sign language types and consider how sign languages are connected.

Before introducing the Nebilyer/Kaugel case, I outline the existing sociodemographic typology of sign languages. Importantly, in the following typology, I do not discuss alternate sign languages. These arise among hearing people due to cultural protocols, lack of a common language, or because speech is not preferred or impossible in certain situations (such as in hunting). Alternate sign languages are used overwhelmingly between hearing people. In contrast, the sign language types in the following section are used overwhelmingly between deaf people, or between deaf and hearing people. For more information about alternate sign languages, see Kendon (1988) and Jepsen, De Clerck, Lutalo-Kiingi, & McGregor (2015).

THE SOCIODEMOGRAPHIC TYPOLOGY OF SIGN LANGUAGES

Deaf community sign languages

Deaf community sign languages are used mainly by deaf people, for communication with other deaf people. Examples of this type are Auslan (Australian Sign Language) and Nicaraguan Sign Language. Deaf community sign languages often arise in the context of deaf education, when unrelated signers come together (Meir, Sandler, Padden, & Aronoff 2010). In communities that use this type of sign language, deafness often constitutes a pillar of personal and community cultural identity (Padden & Humphries 2005). Deaf community sign languages are often *national sign languages*, officially associated with a nation-state. However, other

sign languages may exist within the same nation-state. For example, in Israel, Al-Sayyid Bedouin Sign Language co-exists with a national sign language, Israeli Sign Language. *Original sign language* (Woodward 1991), *urban sign language* (Dolman 1986), and *macro-community sign language* (Fenlon & Wilkinson 2015) are other terms in use. These fundamentally refer to one type of sign language, the primary feature of which is that it is used mainly between deaf people in a deaf community. The sociodemographic features of a deaf community sign language are given in (1).

(1) Sociodemographic features of a deaf community sign language

a. Used primarily by deaf people, for communication with deaf people
b. A network of users who are mostly not related to one another
c. Often associated with education, the nation-state, and urban areas
d. Often associated with a sense of deaf culture, deaf identity, and deaf sociality; deaf people seek each other out for communication and friendship
e. Usually multigenerational

Village sign languages

The canonical 'deaf village' (Branson, Miller, & Marsaja 1996) is a community in which there is a high incidence of hereditary deafness and a resultant *village sign language* shared by deaf and hearing people (Zeshan 2004:43). Examples include the Al-Sayyid community, Israel (Sandler, Meir, Padden, & Aronoff 2005), and Adamorobe, Ghana (Nyst 2007; Kusters 2015). While these communities' isolation has arguably been overstated (Kisch 2008), village sign languages are nevertheless characterised by use within a geographically and socially quite tightly bounded community.

As more rural signing communities are described, it is clear that most do not fit the deaf village profile. For example, Inuit Sign Language is not used in a discrete village, but rather in at least three geographically widely dispersed communities in remote northern Canada (Schuit, Baker, & Pfau 2011). In view of such exceptions, *rural sign language* (de Vos 2011; de Vos & Nyst 2018) and *micro-community sign language* (Fenlon & Wilkinson 2015) are gaining traction as alternate terms. However, both rural and micro-community sign languages are usually described as emerging in communities with high incidences of deafness. It would seem to follow, therefore, that a sign language used in a rural area or a 'micro-community' WITHOUT a high incidence of deafness is not, by the standards of the literature, a rural sign language.

Other terms used in relation to sign languages in rural areas focus less on spatial distribution and more on contexts of use. *Speech/sign community* (Nonaka 2007) and *assimilating community* (Bahan & Poole Nash 1995) describe communities with a high ratio of hearing to deaf signers, and positive and inclusive attitudes to deafness and sign language. Kisch (2008) describes a *shared signing community*, in which sign language fluency is widespread among both deaf and hearing people.

Extending this concept, Nyst (2012) coins the term *shared sign language,* but defines this as a type of sign language used in communities with a high incidence of deafness. Therefore, 'shared sign language' cannot apply to a situation where there is a sign language shared by a SINGLE deaf person and several hearing interlocutors. But such languages exist, as I show below.

Given the wide range of sign languages in rural areas worldwide, I agree with Nyst's (2010:416) judgment that there is a 'large grey area between the conventional and expanded sign languages of large [d]eaf communities on the one hand and the functionally more restricted homesign languages on the other' (described in the section *Homesign* below). What is needed in order to illuminate that grey area is not a further proliferation of variants of the 'village sign language' concept, which emphasise high levels of deafness, but new concepts to place alongside it within a more finely differentiated typology of sign languages.

Within that refined typology, I propose that *village sign language* be retained as a term for canonical deaf village situations such as the Al-Sayyid community and Adamorobe, with the following definitional features.

(2) Sociodemographic features of a village sign language

a. A high incidence of deafness (hereditary or otherwise)
b. A high proportion of hearing to deaf users
c. Often a lack of deaf sociality or deaf identity (but cf. Kusters 2015)
d. A relatively bounded community in a rural area
e. Multigenerational

Family sign languages

Davis & Supalla (1995) and Osugi, Supalla, & Webb (1999) use the term *family sign system* and Haviland (2013) the term *family homesign* to describe languages used by families with multiple deaf members in rural areas. Hou (2016, 2018) offers *family sign language*, and describes San Juan Quiahije Chatino Sign Language (CSL) as a 'constellation' of six family sign languages. This reflects the fact that CSL is not one monolithic language, but at the same time, the family sign languages are not wholly distinct. Classification of a language as a family sign language does not appear to be predicated on the existence of multiple deaf family members; two families with whom Hou worked had only one deaf member. Nevertheless, researchers emphasise the family as the main site of use. The characteristics of a family sign language are listed below in (3).

(3) Sociodemographic features of a family sign language

a. The primary site of use of the language is the family
b. The family usually has multiple deaf members
c. Associated with both children and adults in rural areas

d. Deaf users may or may not be in contact with other deaf people
e. The product of both a deaf person and hearing family members
f. Transmitted intergenerationally

Homesign

The concept of *homesign* has been most famously elaborated by the work of Goldin-Meadow (2003) and colleagues. A homesigner is a deaf person who does not have access to a conventional sign language. This may be the case because they are being raised to lipread and speak rather than sign, or because a conventional sign language does not exist in their community. A homesign system is often considered to be an individual and idiosyncratic invention by the deaf user alone (Frishberg 1987; Senghas, Senghas, & Pyers 2005). Accordingly, homesign is assumed to be one generation old. Complexity inherent in a homesign system is often reported as not being taken up by the deaf person's interlocutors (Goldin-Meadow 2003; Carrigan & Coppola 2017). Homesign as it is canonically understood has the following features.

(4) Features of homesign

a. The product of a single deaf person not in contact with other deaf people
b. Associated with children in nuclear families
c. Chiefly the product of the deaf individual
d. Characterised by frequently unsuccessful attempts at communication by the deaf signer
e. Not transmitted intergenerationally

Most homesign research has been done with deaf children in developed countries. In these cases, child homesigners have the opportunity to eventually join a deaf community and acquire its sign language. However, in the Global South, this is not the case, for reasons of mobility or because a deaf community may not exist. Adult homesign in rural areas has been investigated by Yau (1992) in China and Indigenous Canadian communities; Coppola (2002) and colleagues in Nicaragua; Torigoe & Takei (2002) in Okinawa, Japan; Fuselier-Souza (2006) in Brazil; Nyst, Sylla, & Magassouba (2012) in Mali; and Neveu (2019) in Peruvian Amazonia.

Homesign in rural areas shows a greater diversity of sociodemographic features than the child homesign investigated by Goldin-Meadow (2003). For example, some rural homesigners appear to be quite isolated from the wider community, while others appear well integrated (Yau 1992). After working with some fifty rural deaf signers in Mali, Nyst and colleagues (2012) argued for a differentiation between *rural homesign* and *oralist homesign*. Oralism advocates the exclusive use of lipreading and speech, and active discouragement of signing (Baynton 1996:1–14). The ten deaf children Goldin-Meadow (2003:58–59) worked with were attending oralist programs, and their parents had been advised not to expose them to any sign language. They had not made progress in learning spoken

language and had developed their own oralist homesign systems. While oralist homesign is not shared by a user community and is not transmitted intergenerationally, homesign in rural areas may be. Nyst and colleagues note that in many rural areas, gesture is considered the normal way of communicating with deaf people. This differs from oralist homesign, where hearing parents may avoid gesturing with their deaf children.

There is, therefore, a useful differentiation between oralist homesign and rural homesign. Oralist homesign features are those of homesign outlined above, with the additional features given below in (5).

(5) Features of oralist homesign (in addition to those in (4) above)

a. Associated with urban areas
b. The caregivers of the deaf child are attempting to teach them to lipread and speak; they may avoid gesturing with the deaf child.

This is in contrast to rural homesign features, given below in (6).

(6) Features of rural homesign

a. Associated with both children and adults in rural areas
b. The deaf user may or may not be in contact with other deaf people
c. Often the product of both a deaf person and hearing community members
d. Variability in how fluent communication is
e. May be transmitted intergenerationally
f. There is often a community expectation that the way to communicate with deaf people is to use gesture.

In an alternate subdivision of the category of homesign, Horton (2020) describes an *individual homesign system* (the deaf homesigner has no contact with other deaf people) and a *shared homesign system* (deaf homesigners have contact with one another). Also emphasising deaf-deaf contact, Zeshan (2011) posits the notion of *communal homesign*, where deaf people are in sporadic contact, meeting occasionally at festivals or markets. The concepts of individual homesign, shared homesign, and communal homesign rely on contact among DEAF signers to generate the system, rather than contact between deaf and hearing.

Puzzles in Nyst's (2010) 'grey area'

After reviewing the existing sociodemographic typology, several unaccounted-for linguistic situations emerge. For example, both NATURAL.SIGN in Nepal and CULTURE in Papua New Guinea have the characteristics of rural sign languages but are used in urban areas (respectively, Kathmandu and Port Moresby) (Green 2014; Reed 2020). A further unaccounted-for situation (which I explore in this article) is that in which a rural deaf adult has little-to-no contact with other deaf people, but nevertheless enjoys rich signed interaction with hearing people who are not exclusively family members.

Macleod (1973), Kuschel (1973, 1974), and Jepson (1991) all describe deaf adults who are the sole deaf people in their rural communities; respectively, Billy in Yorkshire (England), Kagobai in Rennell Island (Solomon Islands), and Mohan in Rajasthan (India). All of Billy, Kagobai, and Mohan's signed interaction is with hearing people. Their interaction is not restricted to a family setting; they sign regularly with unrelated community members and friends. Billy and Kagobai are described as enjoying a relatively high degree of acceptance by and interaction with their hearing communities; they are not isolated. Jepson describes Mohan's language as a probable co-creation with his family, rather than his sole invention. This is contrary to the paradigmatic features of homesign outlined in (4) above.

Furthermore, Yau (1992) describes the case of Madame Pettikwi, whose very large sign lexicon stands in contrast to other homesigners Yau worked with. Madame Pettikwi's sign language was used to a high degree of fluency by friends and family members across three generations. Finally, Bakaye is the only deaf person in his community in rural Mali, yet Nyst and colleagues (2012:265) describe his signing skills as 'excellent'. Bakaye visits his deaf cousin regularly in a neighbouring village, but the cousin is reportedly a less fluent signer despite having a deaf father. Nyst and colleagues conclude that it is hearing community members who provide the main language input to a deaf person; it is not contact with other deaf people that is the critical factor in sign language development.

The cases of Billy, Kagobai, Mohan, Bakaye, and Madame Pettikwi are a missing link in our typology of sign languages. These five people are rural deaf adults who use their sign language with people who are not exclusively family members. They also have little-to-no contact with other deaf people. They and their interlocutors appear able to communicate about most things with ease. There is little in common between these cases and oralist homesign. While Nyst and colleagues (2012) took the crucial step of splitting homesign into oralist and rural, there is too much diversity in rural homesign languages to subsume them under one meta-category of 'rural homesign'. We see below how one Nebilyer/Kaugel sign language in particular falls outside the extant typology of sign languages, and has more in common with the languages of Billy, Kagobai, Mohan, Bakaye, and Madame Pettikwi.

Another challenging case for the existing sociodemographic typology of sign languages is that of Imanoli, the sole deaf woman living in rural Enga Province in Papua New Guinea (Kendon 2020). Imanoli's sign language is used by her family members, with varying degrees of fluency. Kendon's field assistant, Ngangane Waipili, has a deaf sister. He had never met Imanoli before and is from some miles away, but could reportedly understand Imanoli's language. Kendon concludes that this shows that the sign language in Imanoli's community is shared more widely in the region. Similarly, Nyst and colleagues (2012) note lexical consistency among rural homesign languages in Mali, despite deaf people having little-to-no contact. Osugi and colleagues (1999) found that on Amami Island,

Japan, even deaf people who reported no contact with other deaf people shared identical signs for ten out of twenty-five concepts.

This lexical consistency between what appear to be unconnected sign languages also poses an explanatory challenge for the existing sociodemographic typology. I explore this further in THE REGIONAL SIGN NETWORK, including the possibility that these signs may be part of a shared gestural repertoire. I now turn to the Nebilyer/Kaugel case.

THE STUDY AREA

My study area lies with the lower Nebilyer and Kaugel Valleys in Western Highlands Province, Papua New Guinea (PNG). These are rural areas west of the provincial capital Mount Hagen. I refer to the study area as 'Nebilyer/Kaugel'. Figure 1 shows the location of Nebilyer/Kaugel within PNG. Figure 2 shows the study area and the home locations of my twelve deaf consultants. The population of Mount Hagen is approximately 30,000. Approximately 10,000 people live within the boundaries of the area (excluding Mount Hagen) shown in Figure 2. The indigenous spoken language of the area is Ku Waru, which is part of a larger dialect continuum with some 250,000 speakers (Merlan & Rumsey 2017; see also Merlan & Rumsey 1991). Most people under sixty are bilingual in Tok Pisin, a mainly English-lexified creole.

Most people in Nebilyer/Kaugel are subsistence farmers. People belong to tribes, which are further segmented into clans. Tribes and clans are associated with areas of land; for example, Kailge is associated with the Kopia tribe. Clans and families live in small hamlets, which are fairly evenly spread out across the area. When women marry, they usually leave their community for that of their husband. A common pattern is marriage of women from the Kaugel Valley to men in the Nebilyer Valley. Movement in the region is relatively fluid; public trucks link communities, usually via Mount Hagen. Prior to the advent of public transport, Nebilyer/Kaugel people regularly walked long distances between communities, including over the mountain range separating the Nebilyer and Kaugel valleys.

METHODOLOGY

My base for this work was Kailge (see Figure 2), about one hour by public truck from Mount Hagen. Alan Rumsey and Francesca Merlan have been doing linguistic anthropological research at Kailge since 1981, and are fluent in both Ku Waru and Tok Pisin. I am a hearing Auslan (Australian Sign Language) signer who has used Auslan since age three (see Reed 2020). Rumsey made recordings of signing at Kailge in 2015 and 2017, after first noticing it in 1997. I began working with these recordings in 2017. In April 2018, Rumsey and I conducted four weeks of fieldwork in the study area, accompanied by Merlan. In November 2018, following

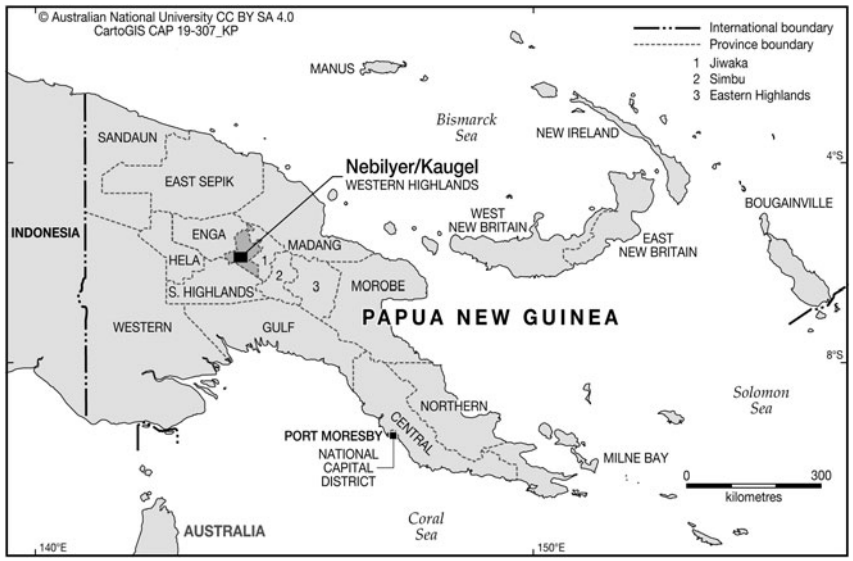

FIGURE 1. The location of Nebilyer/Kaugel within Papua New Guinea.

a four-week fieldtrip to Port Moresby (Reed 2020), I returned to Kailge for two further weeks of fieldwork. I have good command of Tok Pisin, and learned Nebilyer/Kaugel ways of signing during my fieldwork.

I located deaf consultants via a chain-referral method, beginning with six deaf people known to John Onga, Rumsey's main field assistant. John is a competent user of local ways of signing. I found that deaf people often had little knowledge of other deaf people in the local area; I needed to use hearing people as referrers. Over four weeks in April 2018, I connected with twelve deaf signers (seven women, five men). I invited deaf signers to attend with their choice of hearing companion. The research session was attended by the deaf person, their companion/s, one or more local hearing research assistants with competence in signing, Rumsey and/or Merlan, and myself. Rumsey and/or Merlan explained the research goals in Ku Waru to the deaf person's hearing companion; specifically, that we were interested in how deaf people communicate locally. The hearing companion translated these into sign, or if they were unable to, a hearing research assistant with competence in signing did so. As I gained competence in local ways of signing and Tok Pisin, I conveyed the research goals directly to consultants and their companion/s.

The constitution and length of recording sessions differed per consultant. Each consultant completed a sociodemographic interview and a pictorial wordlist elicitation task (see LEXICAL SIMILARITY AMONG NEBILYER/KAUGEL SIGN LANGUAGES). I worked with six of the twelve consultants for single sessions comprising two to

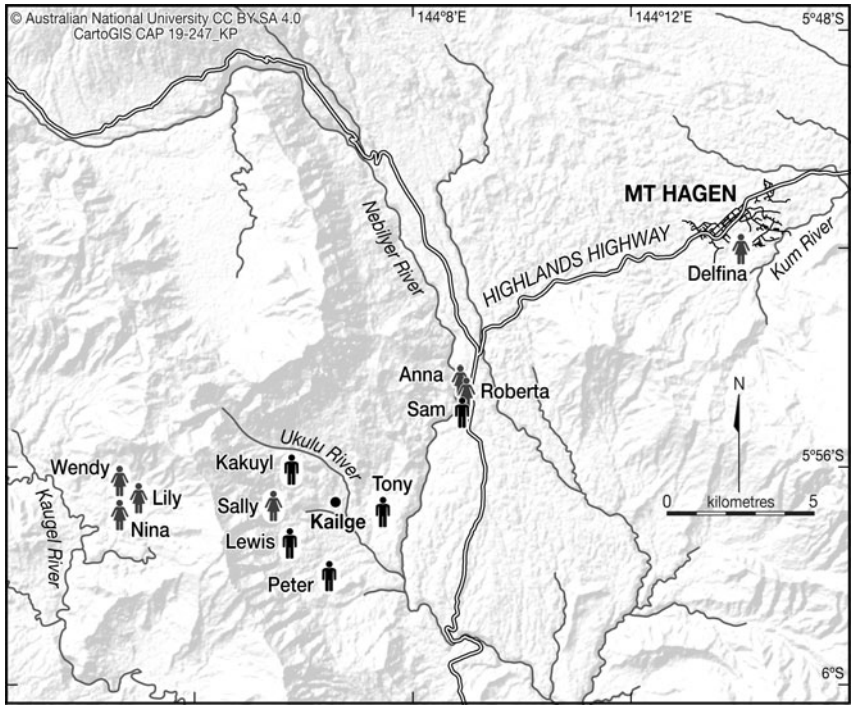

FIGURE 2. The study area and home locations of consultants.

three hours. The interview and elicitation task often inspired conversational digressions between signers, which I encouraged. In the case of five further consultants, I worked with them for several sessions over two or three days. In the case of the final consultant, Kakuyl Kulup, I worked with him for multiple sessions over seventeen days. These additional sessions involved video-recording of free conversation between deaf and hearing signers, usually with me out of the room, and subsequent translation and discussion of these recordings with me. Both deaf and hearing people participated in translation. The translation process was recorded. Consultants were given the opportunity to review footage collected and to give consent for all or part of it to be shown to others or kept private. Participants were paid for their time and travel costs.[2]

SOCIODEMOGRAPHIC PROFILE OF DEAF PEOPLE IN NEBILYER/KAUGEL

I first sought to establish whether certain settlements in Nebilyer/Kaugel had high concentrations of deafness (a definitional feature of village sign languages),

whether deaf people had contact with one another (a definitional feature of shared and communal homesign), and whether families had multiple deaf members (as do most family sign languages). Space restrictions preclude a profile of each signer (see Reed 2019:42–53). My conclusions are given below.

(7)

a. There is no evidence of hereditary deafness nor a high rate of deafness in this area; eleven of twelve deaf consultants have no deaf relatives.
b. There is no deaf sociality or sense of deafness as a tenet of personal and/or cultural identity.
c. While two consultants live in one community and three in another, there is no evidence that they interact more often with one another than with any other unrelated person in either community.
d. Most deaf people are the only ones in their community.
e. Only one deaf person had attended school (a mainstream school).
f. In the one case where a family includes two deaf people, there is no evidence of a family sign language.
g. Each deaf person is at the centre of a network of predominantly hearing signers.
h. Deaf people in a larger network of signers appear to be more fluent signers.

Deaf community sign languages are characterised by deaf sociality, community, and often education. It is clear from (7b) through (7e) that Nebilyer/Kaugel sign languages are not deaf community sign languages. In relation to (7a) and (7d), these sign languages cannot be village, rural, shared, or micro-community sign languages, since the literature stipulates a high incidence of deafness as a defining feature of these types. Where there may have been the possibility of a family sign language in (7f), this has not occurred.

Setting aside deaf community sign languages and village sign languages, the remaining type is homesign. Within this category, all Nebilyer/Kaugel sign languages are rural homesign. However, there is significant diversity in the configurations of users of Nebilyer/Kaugel sign languages. In respect of (7g), while each deaf signer is at the centre of a network of signers, the size and configuration of these networks differ substantially. There is considerable variation in the regularity with which deaf signers have contact with other signers, whether deaf or hearing. Some consultants appear to live somewhat isolated lives; three of the five deaf men in the study live alone, which is very unusual for hearing men in the Highlands.

In respect of (7h), 'fluency' can be measured by the speed of signed interaction; the precision of turn-taking; the existence of and efficacy of requests for repair; and ability to converse about topics on which there is little common ground between signers. There is a relationship between the fluency of a deaf person's signing and the size of their network. Deaf people with large networks of other signers appear to sign more fluently with both their companion and the research team.[3] As in Mali (Nyst et al. 2012), in Nebilyer/Kaugel, the degree of deaf-deaf contact a deaf person has does not correlate with sign language fluency. The critical

factor is the size of the network of signers—or *sign network*—a deaf signer is involved in, whether the signers in that network are deaf or hearing. I now expand on the concept of sign network.

SIGN NETWORKS

In general terms, a *network* is a collection of individual elements that are connected. These elements are known as *nodes*, while the connections between them are *ties*. The type of network we are concerned with here is a *social network*, in which the nodes are people and the ties are some form of social interaction (Milroy 1980). I define a *sign network* as a social network in which the relevant ties between people are signed communication. Inspired by Granovetter (1973), these *sign ties* may be categorised as strong or weak. I define a strong sign tie as one in which individuals: (i) regularly communicate using sign, and (ii) where signed communication is characterised by equivalent levels of sign fluency at both nodes. I define a weak sign tie as one in which individuals do communicate in sign, but where this is infrequent and/or where their sign competencies differ substantially.

NUCLEATED NETWORK SIGN LANGUAGES

Kakuyl Kulup is deaf man around forty-five years old who lives roughly an hour's walk outside of Kailge, in an area populated by other members of his clan (see Figure 2). Kakuyl is married to a hearing woman and has six hearing children. He works as a subsistence farmer and carpenter. Like the five cases presented in *Puzzles in Nyst's (2010) 'grey area'*, Kakuyl is the only deaf person in his community and has limited contact with other deaf people living nearby. Kakuyl is surrounded by a network of fluent hearing signers with whom he communicates regularly. Not all of these are family members: four are his close childhood friends. Kakuyl also signs regularly with other members of his clan and tribe. The high levels of fluency of the hearing signers closest to Kakuyl leads me to believe that Kakuyl's sign language is as much the creation of the hearing signers as it is his.

Kakuyl's sign network is shown in Figure 3. His sign network is characterised by both weak and strong sign ties. Weak sign ties exist between Kakuyl and those in his larger networks of clan and tribe, and also with two nearby deaf men Kakuyl knows but only rarely interacts with. Strong sign ties exist between Kakuyl and his friends and family members. Although Kakuyl's children are still acquiring the sign language, they interact with him daily. I make allowance for their young age and characterise them as having strong sign ties to him. I record strong sign ties between Kakuyl and three deceased people, on the basis of Kakuyl's report that they were excellent signers.

There are other social ties within this network, such as the family ties between Kakuyl's siblings. However, there are no sign ties linking hearing nodes. Hearing people in the network do not sign together unless Kakuyl is present, and therefore

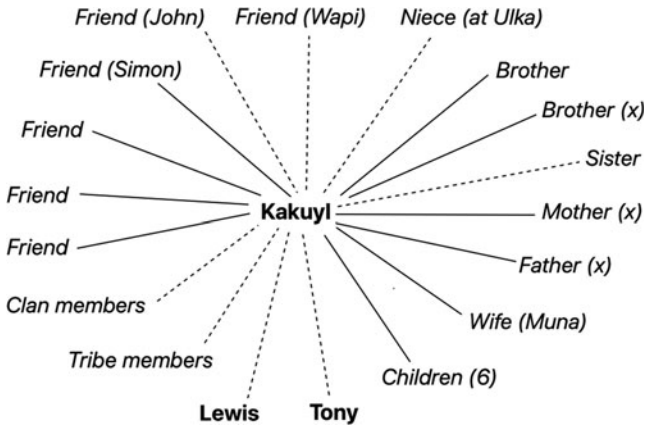

FIGURE 3. Kakuyl's sign network (bold denotes deaf; italics denote hearing; (x) denotes deceased; solid line denotes strong sign tie; dotted line denotes weak sign tie).

he functions as the 'bridge' between them, even in moments of conversation. Hearing-hearing signing without Kakuyl present only exists in very rare instances, such as to prevent overhearing by nearby hearing non-signers. Kakuyl is therefore the central node of his sign network.

I now consider the sign network of an oralist homesigner, David (Goldin-Meadow 2003). David communicated regularly with his mother and his sister in sign. While David's language had internal consistency and systematicity, this systematicity and complexity was not taken up by his mother or sister. Therefore, while David may have been a fluent signer, his interactants were not fluent. Accordingly, David's sign network is characterised by only weak sign ties (Figure 4).

Not all deaf people in Nebilyer/Kaugel have the same rich sign network as Kakuyl. 'Lewis' is a deaf man around forty years old; he is originally from a community in the Nebilyer Valley. He now lives alone in Mount Hagen where

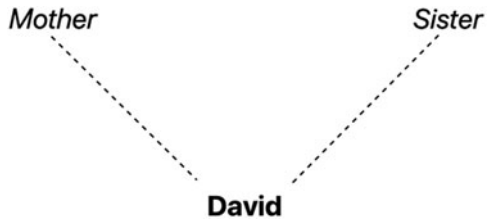

FIGURE 4. David's sign network (bold denotes deaf; italics denote hearing; dotted line denotes weak sign tie).

he works in a shop, and previously ran his own market stall. Working with Lewis over several sessions, I did not meet any hearing signer who could communicate with him fluently in a way that those in Kakuyl's sign network could communicate with Kakuyl. While Rumsey did record Lewis and Kakuyl having what appeared to be fluent signed conversation, Lewis and Kakuyl see each other only rarely. Lewis and John consider each other friends; they see each other fairly regularly and sign together. However, after several sessions with Lewis and John, I believe that their communication is not fluent, in that it is characterised by regular misunderstandings and a need to stick to a limited range of conversational topics. Thus, on the evidence so far, Lewis' sign network has no strong ties, as he has no sign interlocutors with whom he communicates both regularly and fluently.

In terms of the sociodemographic typology, David's language is oralist homesign, while Lewis's language is rural homesign. However, rural homesign as a category does not adequately capture Kakuyl's large sign network and the regular, fluent interaction he enjoys. Nor does 'rural homesign' adequately capture the experiences of Madame Pettikwi, Bakaye, Mohan, Kagobai, and Billy. Based on these cases, I propose a new taxonomic class: a *nucleated network sign language*.

(8) Nucleated network sign languages

a. A nucleated network sign language is characterised by one deaf person who is not in regular contact with other deaf people, but who is at the nucleus of a network of fluent, prototypically hearing signers.
b. The deaf person's sign network includes both related and unrelated individuals.
c. The nucleated sign network includes both strong and weak sign ties; it has a large amount of strong sign ties.
d. Communication is both regular and fluent between the deaf person and hearing signers in the network.
e. The nucleated network sign language type is associated with deaf adults in rural areas.
f. If the deaf user has children, the sign language is likely to be transmitted intergenerationally.

A rural homesign language may have strong sign ties. Rural homesigners have been described as having one or more 'privileged interlocutors' who share the sign language (Fuselier-Souza 2006; Neveu 2019). A differentiating factor between a nucleated network sign language and rural homesign is the comparative abundance of strong sign ties in the former. Given that 'abundance' is a gradient notion, a continuum exists, therefore, between rural homesign and nucleated network sign languages.

Nucleated network sign languages differ from family and village sign languages as the former have only one central deaf node, whereas the latter have several. Consider Adamorobe, Ghana, where some 1.2% to 2.6% of the population is deaf and where deaf people meet and communicate with one another regularly, as well as

with many fluent hearing signers in the village (Kusters 2015). The sign networks of deaf Adamorobe Sign Language signers are heavily interlinked. They would not exhibit the simple radiality of a nucleated network sign language.

Family sign languages prototypically have multiple deaf members. For example, the family who use Zinacantec Family Homesign ('Z') includes three deaf members (Haviland 2013); as such, the Z sign network does not have one central deaf node, but rather three. It does not exhibit the nucleated characteristic of a nucleated network sign language. As mentioned in *Family sign languages*, some family sign languages arise in families with only one deaf member (Hou 2016). Arguably, then, these languages could be described as nucleated network sign languages in a family setting.

In both family sign languages and nucleated network sign languages, signed interaction is frequent and the ties are maintained over time (recall the strong sign ties between Kakuyl and his four close childhood friends). What differentiates a prototypical nucleated network sign language from a prototypical family sign language is the existence of a single central deaf user in the former vs. several deaf users in the latter. Hitherto, sign language development has been largely attributed to deaf-deaf contact. However, this downplays the contribution that hearing people can make to sign language emergence. Nucleated network sign languages explicitly bring these contributions into the picture.

I now turn to the other puzzle presented earlier; to explain the degree of lexical similarity between Nebilyer/Kaugel sign languages, despite their deaf users having little-to-no contact.

LEXICAL SIMILARITY AMONG NEBILYER/KAUGEL SIGN LANGUAGES

In order to determine the degree of lexical similarity among Nebilyer/Kaugel sign languages, I created a pictorial elicitation task featuring 131 images of local phenomena including people, animals, and foodstuffs (see Reed 2019:56–57). A common approach to determining similarity vs. difference between sign languages is to compare sublexical phonological parameters of signs; namely, handshape, location, movement, and orientation (e.g. Guerra Currie, Meier, & Walters 2002). In Nebilyer/Kaugel, the elicitation task showed that there is a high degree of intra-signer variation in form. This variation is not always conditioned by assimilation with the preceding sign or gesture. Figures 5 and 6 show two productions of MALE by 'Wendy', where the finger selection varies in between signs, and is in fact inversely conditioned by the finger selection of the preceding sign or gesture.

This variation contrasts with that in another young sign language, Kenyan Sign Language (KSL). In KSL, there is inter-signer variation in form; for example, signers may articulate GUAVA variously at different locations on or near the mouth (Morgan 2017:44–45). However, in KSL, there is no intra-signer variation in

form; signers are consistent within their own idiolects (Morgan 2017:45, 92–96). In contrast, Nebilyer/Kaugel signers are not internally consistent.

Because sublexical contrastive parameters in Nebilyer/Kaugel sign languages differ in even the same signer's tokens of the same sign, I use *sign base comparison* to determine sign similarity vs. difference (Mandel 1977; Kendon 2020). A sign's base is 'the object or action that the production of the sign is derived from' (Kendon 2020:39). Sign base is essentially Richie, Fanghella, & Coppola's (2012) *conceptual component* and Mudd, Lutzenberger, de Vos, Fikkert, Crasborn, & de Boer's (2020) *underlying iconic motivation and mapping*. Sign base has been used by Konrad (2013), Hou (2016, 2018), Hartzell, Ergin, Kürşat, & Jackendoff (2019), Neveu (2019), and Horton (2020).

All of the signs that I recorded for this task and which form the dataset for the subsequent analysis are iconic; that is, a sign's form has a locally understood resemblance to some real-world property of its referent. During later conversation with signers, I recorded other signs that are not included in this analysis. All other signs I recorded were either iconic or could be traced to a common local gesture (e.g. a negating gesture). Given that every Nebilyer/Kaugel sign in the dataset is iconic, sign base is a robust comparative feature in this case.

Consider Figures 7–11 in response to the picture stimulus 'hospital'. Figures 7, 8, and 9 have the same base: being injected. Using sign base comparison, they are the same sign. This is despite differences in the sublexical parameter of location; the tokens in Figures 7 and 8 contact the upper arm, while the token in Figure 9 is directed towards the flank. Figure 10 has a different base (body pain) and is therefore a different sign. Figure 11 has a different base (feverishness) and is therefore a different sign again.

I chose the responses to sixty-six of the 131 stimuli for analysis. The stimuli I excluded either failed to get a consistent response because the picture was unclear, or consistently elicited descriptive paraphrases, leading me to assume there was no standalone lexical sign for that concept across several lexica. Next, I chose signers who responded to at least half of the sixty-six stimuli (five signers in total). I contrasted the results from these signers with results from two signers living in the capital, Port Moresby, who did the same task. One of these signers, Johnny Hasu, hails from coastal Gulf Province, and the other, Rodney Sidion, from Southern Highlands Province (see Figure 1).

Table 1 shows the percentages of common bases between pairs of signers relative to the number of stimuli to which they both responded. Despite the fact that many of them have never met, Nebilyer/Kaugel signers exhibit base consistency rates of between 61% and 79%. The two Port Moresby signers exhibit 36% to 52% consistency with any given Nebilyer/Kaugel signer. Using a permutation test, I established that the rate of consistency among Nebilyer/Kaugel signers is statistically significant, at the level of .048 (Reed 2019:76–79). That finding is visualised in Figure 12, which shows the results of a neighbour-joining analysis

FIGURE 5. Image a: Attention-getting gesture [full hand]; Images b and c: male [index finger and thumb selected].

FIGURE 6. Image a: Point [index finger]; Image b: MALE [full hand].

(using SplitsTree4) of the data in Table 1, indicating the relative degrees of lexical difference among the sign languages.

If all seven sign languages considered here were the products of independent invention, then we might expect to see roughly identical levels of similarity or difference among all them. Instead, we see that the Nebilyer/Kaugel sign languages cluster together in terms of similarity, while the two sign languages from outside the area are more dissimilar. Why should this be the case, given that there is very little interaction between deaf people in Nebilyer/Kaugel?

There are multiple aspects of a referent which could be selected as a sign's base. It could be that the shared local culture of signers in Nebilyer/Kaugel has led to independent selection of the same bases, given that within their culture, particular aspects of a referent are the most salient. For example, in the Highlands, pigs are farmed and have a rope attached permanently to their foreleg in order to lead and tether them. Perhaps as a result, all Nebilyer/Kaugel signers take this tethering

FIGURE 7. Kakuyl Kulup, HOSPITAL.

method as the base for PIG (Figures 13–15; incidentally, note here the differing orientation parameter of the wrist and grasping hand). In contrast, Johnny's PIG takes as its base the aggressive charging of a pig, which is unsurprising given that in his home province, pigs are hunted, not farmed (Figure 16). However, although Rodney hails from the same Highlands pig-tethering zone as Nebilyer/Kaugel, Rodney's PIG is based on the pig's ears and snout, not tethering (Figure 17).

In all Nebilyer/Kaugel sign languages, WHITE-PERSON takes as its base white people's typically smooth hair (Figures 18–21). However, Rodney's WHITE-PERSON takes as its base white people's skin (Figure 22). Why should one characteristic of white people be selected in Nebilyer/Kaugel, and another in nearby Southern Highlands? Unlike the contrast between signs for 'pig' in coastal vs. Highlands areas, there is no easy cultural explanation for why one feature would be selected in one locale, and another feature in another. An alternate hypothesis is that the sign which takes smooth hair as its base is widespread in Nebilyer/Kaugel due to a process of dissemination between its signers. I return to this in the next section.

Another possibility driving the higher level of similarity among Nebilyer/Kaugel sign languages is that co-speech gestures have fed into these languages and led to their lexical consistency. This is reported for sign languages in rural Mexico (Le Guen 2012; Hou 2018; Safar 2019) and for deaf community sign

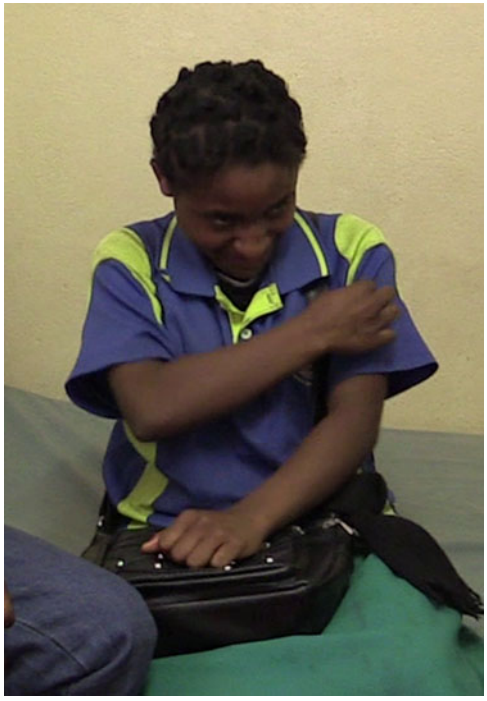

FIGURE 8. 'Roberta', HOSPITAL.

FIGURE 9. 'Tony', HOSPITAL.

FIGURE 10. 'Lewis', HOSPITAL.

languages including Jordanian Sign Language (Hendriks 2007). Some co-speech gestures in Nebilyer/Kaugel have indeed entered local sign languages. Figure 23 (recorded by Rumsey in 2011) shows a hearing Ku Waru speaker using a negating gesture, timed with his production of Ku Waru *naa* (NEG). The same gesture/sign, NEG, is widespread in Nebilyer/Kaugel sign languages. Figure 24 (recorded by Rumsey in 2011)

FIGURE 11. Rodney Sidion, HOSPITAL.

TABLE 1. *Lexical similarity of sign languages by sign base comparison (N/K denotes Nebilyer/Kaugel). Raw numbers are shown in brackets.*

	KAKUYL (N/K)	TONY (N/K)	Lewis (N/K)	WENDY (N/K)	ROBERTA (N/K)	JOHNNY (GULF)
Tony (N/K)	79% (49/62)					
Lewis (N/K)	67% (44/66)	76% (47/62)				
Wendy (N/K)	65% (36/55)	66% (35/53)	65% (36/55)			
Roberta (N/K)	61% (38/62)	71% (42/59)	66% (41/62)	57% (30/53)		
Johnny (Gulf)	36% (21/58)	45% (25/56)	52% (30/58)	41% (20/49)	45% (25/56)	
Rodney (S Highlands)	39% (23/59)	40% (23/57)	47% (28/59)	38% (19/50)	36% (20/56)	59% (33/56)

shows Wapi and John Onga using a gesture that is timed with Wapi's production of Ku Waru *pora* ('finish'). A similar gesture in which the hands are flipped from palm-down to palm-up is used in Nebilyer/Kaugel sign languages as FINISH.

Additionally, all Nebilyer/Kaugel sign languages recruit a local finger-counting method; Figure 25 shows 'Sam' signing EIGHT. Finally, Figure 26 shows Muna (Kakuyl's wife) signing SYMPATHY. This sign is performed by 'chucking' one's own chin, moving the second, third, and fourth (or alternately, third and fourth) fingers horizontally across the underside of the chin. This sign is derived from a local gesture that expresses affection or sympathy, but the gestural version is articulated not on the producer's own chin, but on the chin of their interlocutor.

In 2018, I ran an experiment in which I translated some fifty signs in the nucleated network sign language at Kailge into Ku Waru and Tok Pisin. I presented these spoken stimuli to several hearing people at Kailge, some of whom have strong sign ties to Kakuyl, and some of whom have either weak ties to him or never interact with him at all. I asked for responses in *aksen*, a Tok Pisin term which refers to signing, gesturing, and other forms of action such as dancing or waving one's hands during worship. People with weak or no sign ties with Kakuyl said they did not know any *aksen* for most of the words. It would seem, then, that most of the signs in use at Kailge are exclusive to the sign language, rather than being widely shared gestures for the concepts in question.[5]

In summary, neither gesture nor convergent invention within a shared local culture can completely account for the high degree of lexical consistency between Nebilyer/Kaugel sign languages. In SOCIODEMOGRAPHIC PROFILE OF DEAF PEOPLE IN NEBILYER/KAUGEL, I also eliminated deaf-deaf contact as a driver for sign consistency. As a way to account for this consistency, I now introduce the concept of a *regional sign network*.

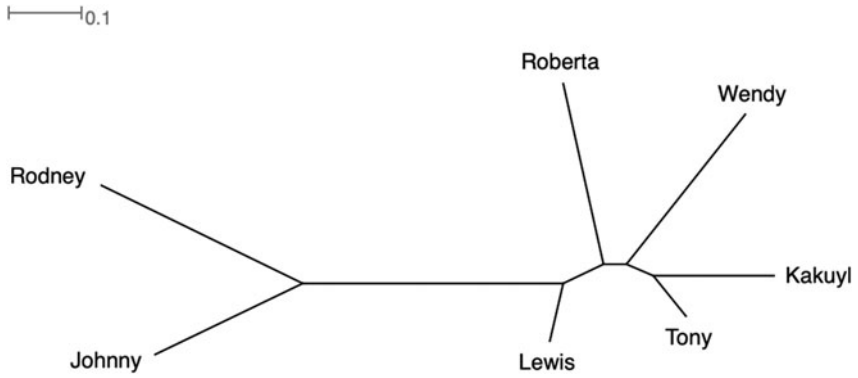

FIGURE 12. Neighbour-joining analysis of data in Table 1. Distance between nodes indicates degree of lexical dissimilarity between the sign languages according to the scale shown.[4]

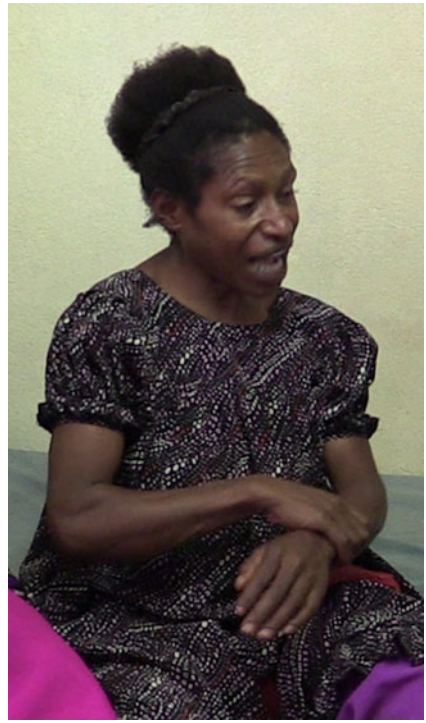

FIGURE 13. 'Anna', PIG.

FIGURE 14. 'Nina', PIG.

THE REGIONAL SIGN NETWORK

Lexical consistency across Nebilyer/Kaugel sign languages can be explained by the concept of a *regional sign network*. As in sign networks more generally, the nodes of a regional sign network are individual signers, and the regional sign network has sign ties which can be graded as weak or strong. What is characteristic of a regional sign network is a preponderance of WEAK ties between signers. That is, it is characterised by signed communication between signers which is irregular and/or non-fluent.

In Figure 27, I present a diagram of what is currently known of the Nebilyer/Kaugel regional sign network. There are many other hearing people with strong sign ties to Kakuyl (see Figure 1). It is likely that there are sign ties between these people and signers in other networks in the region, but due to limited data, these are currently unknown. It may also seem that hearing and deaf signers in this regional sign network are fairly well balanced. This impression is an artefact of my decision to focus on interviewing deaf signers about whom they signed with. If I had interviewed hearing signers, I may have uncovered many more weak sign ties linking them and deaf people they sign with irregularly.

FIGURE 15. 'Wendy', PIG.

John is a hearing signer who signs regularly but not fluently with both Kakuyl and Lewis; hence, he is weakly tied to both. Kakuyl and Lewis do see one another and sign together, but only once a year or so at community gatherings. John is the strongest weak tie, as it were, joining both of these deaf men. Kakuyl and Lewis can share signs via John, a hearing person, as a mediator participating in both of their sign networks.

Recall that Lewis works in Mount Hagen. As Lewis signs rather than speaks, he must have weak sign ties with his landlord, boss, and customers. Lewis shares signs with John, and then likely uses those signs with hearing people in Mount Hagen (and vice versa). It is conceivable that Lewis' hearing interactants gain some active command of signing via association with him. When these hearing people need to communicate with another deaf person in the region, they will then likely use the same signs they learned from Lewis. We see, therefore, how sharing of signs can occur across this regional area through hearing intermediaries.

FIGURE 16. Johnny Hasu, PIG.

Furthermore, both Kakuyl and Roberta are weakly tied to deaf men living in Ulka tribal country, whom they have never met. Roberta's hearing father, Joseph, is an Ulka man, and recalls being exposed to sign growing up by interacting with deaf men there (Reed 2019:84–88). When Joseph's daughter was born deaf, Joseph likely drew on this latent sign knowledge to sign with his daughter. Joseph returns to Ulka country regularly to carry out family obligations, and sees

FIGURE 17. Rodney Sidion, PIG.

FIGURE 18. Simon Kaiya, WHITE-PERSON.

FIGURE 19. 'Tony', white-person.

FIGURE 20. Peter Kerua, WHITE-PERSON.

these deaf men there (Reed 2019:109–10). As such, Roberta is linked to the Ulka deaf men, despite never having met them. Kakuyl is also weakly tied to the Ulka deaf men, by virtue of the fact that Kakuyl's hearing niece has married into the Ulka tribe. Kakuyl visits his niece a few times per year to do farm work, and reports signing with her. If Kakuyl's niece interacts with the deaf men in her community, she would likely use the signs she has acquired from Kakuyl. Here, we see how deaf and hearing people in the region are part of overlapping social networks, which provide conduits for sign diffusion.

I propose that most sign sharing in Nebilyer/Kaugel has occurred through a process of diffusion via these weak sign ties. Weak ties are the most likely pathways for diffusion because weak ties between individuals are more numerous than strong,

FIGURE 21. Kakuyl Kulup, WHITE-PERSON.

FIGURE 22. Rodney Sidion, WHITE-PERSON.

and therefore many more individuals can be reached via weak ties than strong ties (Granovetter 1973; Milroy & Milroy 1985). It is via weak ties that information is most widely diffused throughout a network (Milroy & Milroy 1985:364–65). The regional sign network is a natural extension of Zeshan's (2011:228) concept of communal homesign, where sign sharing is driven by 'sporadic, unsystematic contact' between deaf signers. However, in a regional sign network, sign sharing is driven by sporadic, unsystematic contact (or in other words, weak ties) between not only DEAF signers but hearing ones as well.

The regional sign network concept may prove useful for other analysts. For example, Schuit and colleagues (2011) and Schuit (2012, 2015) describe Inuit Sign Language (IUR) as one entity, despite its being used in geographically disparate communities in remote northern Canada. Schuit (2015) describes a gestural origin for some—but not all—IUR signs. In the past, there was extensive contact between Inuit from different regions. Now that life is no longer nomadic and communities are only linked via plane transport, contact between deaf IUR signers is now rare (Schuit et al. 2011:16; Schuit 2012:389–90). I suggest that the sharing of signs in IUR occurred in the past via a regional sign network linking not only deaf, but deaf and hearing signers across the region.

Returning to Kendon (2020), it may be that the deaf woman, Imanoli, and Kendon's assistant, Ngangane Waipili, were members of another regional sign network where signs were shared as a result of the sporadic interaction of deaf and hearing signers. Similarly, Osugi and colleagues (1999:102) note that signs are shared by deaf people across Amami Island, despite them having no contact with one another. Given that their focus is on deaf-deaf contact, Osugi and colleagues state that unravelling this conundrum presents 'quite an enormous

FIGURE 23. Thomas Wai, gesture co-occuring with Ku Waru *naa* (NEG).

FIGURE 24. Wapi Onga and John Onga, gesture co-occurring with Ku Waru *pora.*

task'. This task could be productively undertaken by investigating a possible regional sign network on Amami Island linking deaf AND hearing signers.

The regional sign network does not exist in a vacuum. It is interlocked with other social networks and communities of practice (Milroy 1980; Lave & Wenger 1991) in the region, including family ties, marriage-based networks, occupation, and

FIGURE 25. 'Sam', EIGHT.

FIGURE 26. Muna, SYMPATHY.

church membership. For example, Kakuyl and Lewis occasionally interacted as children, when Lewis came to visit Kakuyl's clan area. Their interaction as children was not motivated by their deafness, but rather by the fact that Lewis's mother is from Kakuyl's clan. Indeed, these men's interaction now occurs mainly in the context of events such as funerals where clans and tribes come together. Roberta

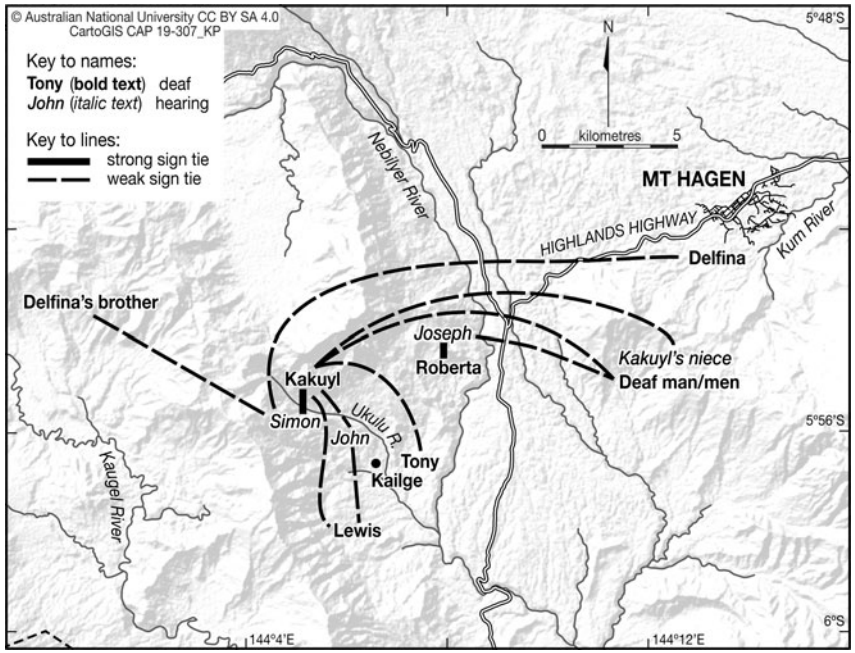

FIGURE 27. A partial map of the Nebilyer/Kaugel regional sign network.

occasionally interacted with another deaf girl, but this was not motivated by their deafness, but rather by the fact that they were both members of the same church. In order to describe a regional sign network, it is critical not to consider it in isolation, but to consider how it interweaves with other social networks and communities of practice.

CONCLUSION

In this article, I have presented new concepts to populate the 'grey area' of scholarship lying between deaf community sign languages and homesign (Nyst 2010). Firstly, the concepts of sign network and strong and weak sign ties allow us to explicitly consider signed communication in mapping social networks. Considering both rural homesign studies and new data from Nebilyer/Kaugel, I find that some sign languages have a particular sign network shape, characterised by a single deaf signer and a relative abundance of strong sign ties to hearing signers. I argue for a new taxonomic category to capture this type of language: a nucleated network sign language.

Using sign base comparison, I find that Nebilyer/Kaugel sign languages have a greater degree of lexical similarity than would be expected if they were all independent inventions. The likely route for sign diffusion across the region is

not deaf-deaf contact, but rather sporadic contact between both deaf AND hearing signers via regional weak sign ties. Regional sign networks are influenced by other social networks, such as family, clan, and tribal obligations. In addition, a society's cultural beliefs about commitments to connection and communication with kin and social partners influences sign language emergence and maintenance.[6]

To close, I note that oralist homesign has hitherto been considered the canonical exemplar of homesign. As rural homesign studies increase, it is time to consider whether oralist homesign is in fact quite rare worldwide, and as such, is not the best candidate for canonicity.[7] Given that true village sign languages are rare, it may be that rural homesign is the most common type of sign language in the Global South. Further research into rural homesign will continue to elucidate the social and linguistic features of this understudied but comparatively common sign language type.

NOTES

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[1]I thank an anonymous reviewer for this point.

[2]Human Research Ethics Committee of the Australian National University protocol #2018/084.

[3]For an example of what I define as sign fluency, I exhort readers to watch an example of the nucleated network sign language at Kailge at https://vimeo.com/344214883.

[4]I thank Alan Rumsey for suggesting this analysis, and Siva Kalyan for generating it.

[5]An anonymous reviewer suggests that this task could be reversed, in that a set of signs could be presented to a hearing non-signer and they could be asked to identify which sign matches a given referent. It may be that hearing non-signers have lower productive but higher receptive skills. I hope to undertake this in the future.

[6]Thanks to an anonymous reviewer for this point.

[7]I thank an anonymous reviewer for this point.

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