General Article

Sustaining Digital Language Resources and Sign Language

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Abstract

This paper discusses the need of a multi-modal and multilingual sign language resource by providing insights from the experiences based on the development of digital based sign language resources which are the North East Sign Languages SignBank (A variety of the Indian Sign Language) in a web-based format and the Meghalaya SignBank (A variety of the ISL), a mobile application. It raises the challenges and concerns of sustaining such language resource and its use, drawing upon the cross modal perspectives of archiving human languages, issues in education and the cultural and linguistic diversity of the deaf community in India and particularly the North East region.

Keywords: Sign Language, Indian Sign Language, Digital Language Resources, Sustainability, Mobile Application, Web-based

Introduction

Sign language, a natural human language used predominantly by the deaf communities of the world, has linguistic properties similar to any spoken language. The idea that just hand movements and facial expressions can form the basis of an entire language, a unique culture and a different understanding of the world is mind-boggling. The arbitrariness of signs and their permutations and combinations are no different from the arbitrariness of the sounds of spoken language and their meanings, and yet, they both evolved and continue to evolve naturally through our universal need to connect and communicate. Embroiled in world of confusions and misconceptions, miscommunications and misunderstandings, it is easy to understand why a soundless language of a minority population of the people who cannot understand the spoken word would be conveniently overlooked and typecast as a disability.

Thus, the field of Sign Linguistics emerged with the ground-breaking work of William Stokoe (1960) on Sign Language Structure: An outline of the Visual Communication System of the American Deaf, which engendered more studies that investigated the influence of modality of communication on its language structure (see Brentari, 2002). Thus, research studies mostly circled around the role of gestures in a language (see Messing and Campbell, 1999; Liddell 2003). Research into the mechanics of sign language use, with its intricate coordination of hand movements and facial expression as the modes of production, offers interesting opportunities to investigate and gain

insights into human language. Hence, Stokoe's first ever linguistic description of sign language (see Stokoe 1960; Battison 1974; Brentari 1998) generated a whole new perspective in our understanding of human languages. This has given rise to other studies that investigate how sign language relates to cognition and how it is processed in the human brain (see Namir & Schlesinger 1978; Klima & Bellugi 1979 and several others studies).

Consequently, documentation of sign language and its compilation into a dictionary is vital for the analysis and description of the linguistic configurations of sign language. In the context of deafness and the deaf community, a dictionary can also serve as a means of developing an unknown language that has emerged out of a human need to connect with one another, thereby inherently identifying them as a community having their own unique culture. A sign language dictionary also serves the purpose of propagation of the language (see Lucas, 2003), where a corpus based analysis of sign language usually results in various printed dictionaries (see Brien, 1992; Johnston, 1989, and several others). In India, sign language dictionaries in printed form started in the 1970's in the four major cities of India (see Vasishta, Woodward, & Wilson (1978); Vasishta, Woodward, De Santis, 1980; Vasishta, Woodward, De Santis & Sharma, 1985; and 1987).

With technological advancements and the race towards a digital global world, it became much more feasible and viable to document visual language such as sign language in multi-media modes which have greatly improved in recent times. There are numerous digital based sign language resources, but only a few are mentioned in this paper. An online resource such as the British-Sign.co.uk (https://www.british-sign.co.uk/) is a website which is available online where one can learn British Sign Language (BSL), fingerspellings and even online courses. It also provides free resources regarding BSL and contains many links for beginners. Signing Savvy (https://www.signingsavvy.com/) is another online dictionary of American Sign Language (ASL) displaying thousands of fingerspellings and signs common to both Canada and America. It consists of tutorials and courses on how to use Sign language for the users. Auslan Signbank (http://www.auslan.org.au/) an interactive dictionary of Australian Sign Language (AUSLAN) is also available online. Links include the AUSLAN archive and corpus, etc. Users can interact online by providing feedback and reporting missing signs.

Further, many apps for translation have been developed around the world with the objective of breaking communication barriers for the deaf community around the world and improving the services dedicated towards D (The term 'Deaf' is used with a capital 'D' referring to a group of deaf people whose first language is sign language having their own specific and unique culture and a community of their own, which is the contemporary trend in linguistic research. In this paper, the same convention is also followed.)/ deaf individuals in various public spaces. Hand Talk (www.handtalk.me), a virtual interpreter led by a by a 3D character known as 'Hugo', offers digital

translation to Brazilian Sign Language, a language used by the deaf community in Brazil. It automatically translates text and audio to Libras on smartphones and tablets. It can be used by individuals on their phones or by companies to translate website content that contain information which may not be readable. Motion Savvy's (https://techcrunch.com/2014/06/06/motionsavvy-is-a-tablet-app-that-understands-sign-language/) new sign language app is a real time translation technology that is able to track both hands and 10 fingers, and convert sign language to grammatically correct spoken language. This comes in a device (UNI) which captures the voice of the speaker and displays it in text format so that the deaf can read.

In India, however, very few sign language resources are available, these include an online course on ISL which was developed in web and mobile based applications such as the "Talking Hands (https://www.talkinghands.co.in/)" (Deaf Enabled Foundation, Bengaluru initiated in 2013). Since 2000, the Ramakrishna Mission in Coimbatore (2001) has documented sign language according to different semantic categories derived from a project in collaboration with CBM international. Wallang (2015) has also attempted to document the language used by the deaf community in the form of a Multi-media dictionary of Shillong Sign language (ShSL) and in printed form that contains phonological description of each sign (Wallang, 2014). Currently, the Indian Sign Language Research Training Centre, (ISLRTC (under the Ministry of Social Justice and Empowerment, Govt. of India)) has recently launched an ISL dictionary encompassing the varieties of sign languages operating in the country, with an entry of 3000 words (Wallang, 2019). Recently a DEF-ISL app (https://play.google.com/store/apps/details?id=in.eightfolds.deafenabled&hl=en_IN) was launched in India on the month of April 2019, with a view to bridge communication barriers and enhances English language skills. It was developed in collaboration with Larsen & Tubro (L&T) and the Deaf Enable Foundation and it can be used in phones using both Android and IOS. It comprises of 5000 + easy phrases and sentences in sign language. The app is categorised into semantic groups where users can use the search button to look for a particular sign citation.

Background of the Digital Sign Language Resources

The NESL SignBank: The NESL SignBank (See Wallang, 2019) comprises of a variety of sign languages commonly used by the deaf community across the North Eastern (NE) states in India. This was developed at the North East Regional Institute of Education (a unit of NCERT in Shillong) to promote and strengthen teacher education in regular and inclusive classrooms where D/deaf students are available. Hence, the database consists of lexical items of more than 5000 signs citation which are commonly used in the field of education. Signs included in this Web-App cover several areas which have been classified into different semantic categories i.e. basic words, question words, kinship terms, colour terms, food items, locations, professions,

educational terms (of various subject areas), etc. Besides the lexical items, fingerspellings, both single-handed and double-handed, along with numerals have also been included. This web-based format also extends more information about the demographics of deafness in the region, and provides insights into the linguistic properties of the language. Hence, it offers more understanding into the grammatical and organisational principles of the language in general, which supports the user while communicating in sign language. It is not simply listing of words, but it also takes into account the lexical variation that exists across the region by incorporating all variants. This was done to ensure that smaller deaf communities that exist in the region are not eliminated or dominated by major communities. The end product of the NESL-SignBank was prepared to be hosted in the institutes' website whereby users can simply access information through online mode and send questions and give feedback.

The Meghalaya SignBank App: Meghalaya SignBank (Meg SignBank) app was launched during the observation of International Day of PWDs on the 3rd of December, 2018. The app already contains a list of approximately 3000 words. Meghalaya Sign Language which is a variety of the ISL is commonly shared across the deaf communities in the state of Meghalaya. The development of this app symbolizes their strength as a linguistic entity and gives recognition and empowerment to the language and its users. It was developed to take precedence in the field of education and public institutions by ensuring communication access to all hearing or deaf and particularly for the deaf community where they can exercise equal opportunities in all spheres of their lives. Every educational institution can adapt this app in its teaching and learning process to show respect for and adhere to the language of such communities.

It was designed in a user-friendly manner, where English, Khasi and Garo languages (the official languages of the state) can be used to access sign language and it is portable since users can install it in their phones with minimal space requirements. The user can simply type a word in any of these languages and the corresponding sign will be displayed in a video format. A series of data collection through video recordings of each sign was carried out and collected from Deaf native signers across the state following linguistic methods. Each word in the Meg SignBank has been translated from sign language to English, Khasi and Garo. Further, if there are two variants of a single word, both variants are included. In other words, if there happens to be two to three ways of signing a single word having a similar meaning in the three spoken languages, these variants are incorporated to ensure that the deaf communities in different parts of the state understand each other. Words have been semantically cagtegorised and 17 categories have been identified so that users can simply click on the semantic category they want and then find a list of words relevant to that category. These are Agricultural terms, Animals & Insects, Apparels & Clothing, Calender, Colour terms,

Games & Sports, Greetings and Simple Phrases, Health and Medical terms, Legal and Government terms, Places and Institutions, Relgious terms, Socio-cultural terms, Local Places, Electoral terms and Tools. There are two types of fingerspellings–the single-handed and the double handed spellings, which are simply the manual representation of the English alphabets. They are kept in two windows under the Meg SL option which consist of hand images for each alphabet. The Home window also consists of information about the developmental process of the app, the team involved, and instructions for using the settings of the app. Users can simply click on any of these category to access a sign. Regarding access and availability, this MegSignBank (A variety of Indian Sign Language) was developed with a team of engineers (NIC, Meghalaya), and it is currently available for android phones or tablets at Google Playstore for free.

Sustainability of Sign Language Resources

This section discusses a few challenges experienced in the development of NESL SignBank and the Meg SignBank (both of which are varieties of ISL), and highlights the need to build a more comprehensive resource in terms of sustaining the relevance of such language archives, dictionaries, etc. With the advent of computer applications and mobile apps, it is possible to store language resources for one's own information. However, such digital resources are liable to become obsolete due to the on-going requirements of updating information in the emerging computer formats. Further, besides the information update that is required from time to time, they also need conscious effort in different areas to gain wider acceptance in most hearing communities. It is yet to attain the vibrancy in education needed for its sustainability, and this is particularly the case in rural areas than in urban mainstream India. Simons and Birds (2008) pointed out that "A language resource is any physical or digital item that is a product of language documentation, description, or development or is a tool that specifically supports the creation and use of such products" (p.88). According to Simons and Bird (2008) language resources in discussing the 'Open Language Archives Community' and the dangers of extinction of knowledge, there are necessary and sufficient conditions for sustaining use of language. The Sustainability model they pointed out has the following characteristic features–the Extant, Discoverable, Available, Interpretable, Portable and Relevant. They also discussed the roles of the creators, the archives (institutions that create long term language resources), the aggregators (institutions that gather data from multiple resources) and the users in sustaining these virtual language libraries. What is pertinent in their argument is the role of aggregators in providing technical infrastructure in sustaining language use which is responsible for accessibility, the ability to adapt in varied formats and availability.

In the context of sign language, the viability of the sign language dictionaries needs to be taken into consideration. Can Signbanks or apps really support

communication and classroom teaching and learning? They are commonly used to learn individual signs, which is the equivalent of looking up a particular word of a spoken language in a dictionary. However, simply listing signs in a dictionary format with no linguistic description does not offer much to the users. It doesn't help in opening one's mind and ability to understand the role of spatial grammar and its implications on pedagogy and language learning. In other words, when one looks at a spoken language dictionary, one not only sees the meaning of words, but also learns how to pronounce the word according to the sounds pattern of that particular language. Similarly, in a visual –manual language, apart from learning the meaning of a sign, one would also gain more information of how it is supposed to be produced. A user is simultaneously introduced into the phonological features involved in the production of each sign, for instance, which handshape, movement, location etc. are associated with it. Rather than continuing to present sign language pictures and videos, this requires one to visually learn movement of hands and facial expressions.

A user should be able to decipher the importance of the phonological features of a sign which is integral to its production and its grammatical structure. However, it is usually the case that users utilise such resources in classroom situations by signing a single sign or make use of fingerspellings within an English structure while communicating. Hence, it becomes a word-by-word translation of a spoken form, which is usually inaccurate, since not every word has a sign correspondent and most of the grammatical features such as plural forms, pronouns, verb forms, tense, etc. of spoken forms are simultaneously expressed in the manner of movement of the hands, and spatial modification.

This kind of signing muddles up with the sign language grammar, making it impossible for the deaf signer - who has no access to English language - to understand what is being signed. Further, sign languages have a more spatial syntactic structure which gets disfigured due to use of the word-by-word translations.

When one simply incorporates sign language in their speech, the discourse that follows in the classroom is mostly lacking in meaning and content to the deaf listeners. This was observed (based on a study) much more closely when a teacher was teaching mathematics, and formulae and rules of calculation were simply fingerspelled. Even if interpreters were present, they invariably have no clue as to the subject of teaching and would misunderstand the lesson, especially since there is no proper coordination between the interpreter and the teacher prior to the lesson.

So, how relevant are dictionaries and apps? However advanced we may think our educational institutions are we cannot ignore the reality that D/deaf children are still expected to learn English language or any other spoken language in many schools. Teachers and instructors need technical support in terms of sign language training with special focus on the intricacies of spatial grammar. Although the NESL SignBank does provide information on the

grammatical features, it needs to extend to being able to provide naturalistic data that will support meaningful classroom instructions. Hence, a multi-modal corpus on sign language needs to be considered so as to be able to render a natural discourse that will be more relevant to such classroom situations and thus, contribute to sustaining such languages.

Sign Language Corpus as a Language Resource

Several attempts have been made to build language corpora that thrive on collecting natural language data through rigorous recordings of actual language use in real world such as the Brown Corpus by Kureća and Francis, in the 1960's and several others developed on the same lines such as the Lancaster-Oslo/Bergen Corpus (see Beale, 1985). These corpora have been collected from native speakers and have often been used to extract information related to word frequency; structural rules, phonological aspects of that language etc. and they have been instrumental in the creation of comprehensive grammar books. Hence, corpus linguistics as a method for linguistic analysis is relevant for any discussion on the need for developing a multi-modal sign language corpus. In the context of sign language, a visual-manual mode of communication, the absence of a form of writing, the lack of consensus for a standardised notation system of transcription and the struggle for recognition of most sign languages, particularly in India, developing a corpus is more crucial than a dictionary, simply because the data and information in a corpus is more comprehensive. A corpus contains both spoken and written forms of language taken from real situations and stored in a machine-readable format. Modern digital corpora however, are more flexible and more competent to store all forms of text in multi-media mode with suitable notation software and glossing. As Johnston and Schembri (2013) points out till 2008, sign language 'corpus' remains simply a list of video recordings with no linguistic descriptions with the exception of some which contain written forms of transcription. Studies on ISL and its variety have been initiated since the year 2000 (see Zeshan, 2000, 2001, 2002, 2003a, 2003b; Sinha, 2017, Wallang, 2014, 2015), and these are based on data collected from a selected group of informants, and not based on a larger corpora considering the cultural diversity in the country.

A multi-modal corpus that draws natural language data from various sources is needed. As stated above, in India attempts have been made to incorporate sign varieties operating across India (Indian Sign Language Research & Training (http://www.islrtc.nic.in/.) and yet this is only a dictionary which is accessible online. The online dictionary contains a variety of semantic categories which includes legal, medical, technical terms, English idioms, names of places, numerals, etc. Nevertheless, these are all attempts that contribute towards understanding of sign language in India and thus manoeuvre more academic resources which support the deaf community and promote equity in education. Johnston and Schembri (2006) working on AUSLAN, points out the difficulty in archiving sign

languages. He highlighted the issues in sustaining data which for the most part, involves time-consuming series of video recordings, and necessary annotation for linguistic analysis. Today, creation of multi-modal sign language corpora is possible with the advent of multimedia software for example, the ELAN software (see Crasborn & Sloetjes, 2008) that can automatically annotate multimodal forms of language; and iLex (see Hanke & Storke, 2008) a database tool to transcribe sign languages. In India, the urgent need is to create an open source multi-modal sign language resource that could be productive for those sectors dealing with the deaf community and render better services that would contribute to its sustainability.

Sign Language in Education amidst Diversity

As pointed out above, a multi-modal based corpus on sign language is needed for larger understanding of its structure, the implications on language acquisition and the integration of pedagogy in classrooms. In education, attempts (NCERT on Barkha series, North East Regional Institute of Education on 'Reading cards', Folktales, Children stories, the NESL SignBank, and several others) have been made to integrate sign language in school education by ensuring pedagogical materials are translated and represented in sign language. However, the status of sign language in language policy is yet to gain momentum particularly in the field of academics. By legislation, several provisions have been made to ensure sign language should be made accessible as per the Rights of Person with Disability Act (2016). Although the United Nations Convention on Rights of Person with Disability advocate for formal recognition of sign languages (see Batterbury, 2012) yet in the RPWD Act, (2016) sign language is still being reflected under the 'augmentative and alternative communication' in the context of 'disability', hence, it is not treated at par like any other spoken language which by constitutional rights (Article 29, (1&2)) can be promoted like any other minor tribal languages. Its status as a natural language with a diverse group of deaf community members is yet to be understood. Thus a major corpus for linguistic archiving of sign languages drawn from multiple resources is necessary. Although sign language may have minimal functions in the larger society as compared to the dominant languages in the country, its place in education right from school education needs much more than simple archiving of the language or integrating it in ICT classroom materials for instance, by providing simultaneous translation of classroom instructions and materials. It is often the case that such translations cater to inclusive classrooms, but the sign language used in these materials may be of a variety that is different from the students or teachers who may not have the knowledge of other varieties of sign language used in different parts of the country. Consequently, there may be possibilities of lexical and structural differences, or even the risk of losing the indigenous forms of sign language varieties by incorporating more borrowed forms from dominant sign languages. A multi-modal corpus in ISL that takes consideration of

the varieties that exists in a cultural and diverse country will no doubt have extensive vocabulary with more intriguing structural features, which can contribute to the study of human languages.

Sign language in the context of inclusive education remains a setback. Although, attempts have been made to integrate inclusive education in both pre-service and in-service teacher education, yet sign language within the concept of 'total communication' loses its stance as a natural language. In pre-service education, sign language does not appear to be incorporated seriously in most teacher education programmes, in the NE region. Although diploma courses and short term trainings are available (Rehabilitation Council of India based institutions) and with the commencement of ISLRTC most courses on ISL are regulated by the ISLRTC, which need to work collectively with teacher training centres. In mainstream education, in-service teacher training programmes and teaching learning materials in sign language are quite rare. D/deaf children are not commonly found in mainstream schools since most of them prefer to study in deaf schools where they can communicate with each other and even reside there. Hence, rather than a sign language training of teachers, it is more viable to have awareness programmes on the basics of sign language and integrate it into the regular training programmes.

Although NCERT has been providing exclusive trainings in this area in the NE region, the state educational functionaries have initiated similar trainings as well, particularly in Meghalaya, Nagaland and Mizoram. Based on these short term trainings, it has been observed that most teachers often learn the language quickly, but its actual utilisation in schools remains unknown and probably unused because of a lack of clear-cut guidelines and resources. Even with the Meg SignBank, an initiative taken by the state government of Meghalaya from the department on disability (rather than from the mainstream educational functionaries) failed to make a definitive impact as the app was not mandated as a resource for teaching and learning and perhaps, it is yet to build itself extensively for the purpose of education. However, the NESL SignBank does contain information that can support teacher education even if it still requires incorporating more data and instructional materials. To ensure sustainability of such digital language resources, one needs to extend and ensure that the data is relevant for the users. Therefore, relevance of a larger corpus is needed in order to develop and improve teaching-learning materials.

The present scenario reveals that sign language is yet to make its way into the existing special schools in the NE states, let alone 'mainstream education'. Different schools have their own preferences for the kind of curriculum, method of teaching and the type of sign language used. One school may advocate for the use of ISL while another may rely on whatever sign language resources and/or training are available for the children's benefit. Thus, there are many disagreements amongst schools, and more often than not, teachers would prefer to use

what is easily available and/or under the expertise of people from outside the region, while disregarding the deaf community's perspective.

The onus falls on the creators of these programmes and applications to address these issues. Based on the development of the Meg SignBank, one has to take into account the need of the users, for example, the need to use the app in public institutions such as in hospitals, in legal matters, electoral duties (as part of the campaign on inclusive election), and so on. Thus, simply listing signs may be productive to cater to short term trainings, but to sustain the app, it needs to incorporate more instances of natural language use in actual contexts and at the same time ensure that these are translated to the local languages as well so as to include those users (hearing) who may not understand English.

Additionally, one of the critical concerns in today's world is the decreasing rate of linguistic diversity due to the rapid speed in information and technology and economic advancements. Some may not agree to the link between economic advancements and language development and preservation, and perhaps it may be true in reference to spoken languages only. However, the NE states with its linguistic diversity, rich traditions, cultures, folklores and numerous oral history of distinct folktales present an interesting area to derive insights into deafness and the disconnect that the deaf community faces from the hearing world's traditional knowledge and culture (this is not dealt in this paper). Due to this varied nature, one expects diversity even within deaf communities existing in this region.

However, deaf communities are not defined by geographical boundaries- they exist in places where deaf people congregate and often live together such as residential schools, deaf clubs and associations, or in small villages where families having hereditary deafness are present. Schools are usually located in urban areas of the region and they mostly form the platform where most sign languages develop by virtue of having deaf students with the basic human need to communicate. Homesigns (the signs used at home) are the initial forms of communication that children carry to such schools. In the context of deafness and sign language, it was observed that smaller deaf communities (while working on the database of both NESL SignBank and Meg SignBank) tend to move towards mainstream languages which are considered to be more beneficial and more advanced as they meet the communication requirements particularly in academic and occupational spaces.

In the context of the NE region, sign language variations at the lexical level and structural level across the region were observed particularly while documenting the NESL SignBank. Striking differences can be seen particularly in the state of Nagaland, where the structural features of the sign language use in the deaf schools in Nagaland is similar to the ASL. Further, while compiling signs for the Meg SignBank, disagreements as to what is considered the correct or standard form of single sign for a particular word emerged from those residing in urban

areas and rural interior parts of the state. However, the groups representing the urban areas predominate in most instances, as they are more exposed to ISL and ASL due to contact with different NGOs and other national and international organisations that often relate to their programmes or in other social platforms. Similarly, when these groups meet native signers from other states, they tend to borrow signs which result in loan signs, and often replace their own indigenous signs for many reasons.

In view of the inherent nature of cultural diversity in India and particularly in the NE States, sign language dictionaries, archives, SignBanks, and so on so forth ought to contain national and regional dialects. Hence, the requirement of a multi-modal and multilingual corpus becomes indispensable particularly in the NE region. This is possible with the support of the institutions and functionaries and their active role in mainstream education (or as Simons and Bird uses the terms 'archives' and 'aggregates') for the sustainability of the sign language corpus and for it to be treated at par with the corpora of spoken languages. Bearing in mind that such resource should have open access may not only be seen as language resources, but can also help one to understand the underlying structures of such languages in order to able to use and integrate in their daily lives, particularly in an academic environment.

To sum up, the sustaining model as pointed out by Simons and Bird (2008) requires much more in building a digitally based sign language corpus than our efforts till date, and this is yet to be achieved. It is not enough to create resources in sign languages in the form of apps or dictionaries as a corollary of technological advancement in aiding data collection, storage, automatic annotation (transcription), accessibility (in multi-media or in print), availability, and relevance. Sign language faces a great many challenges such as the dearth of materials, its status which is still not recognised as a natural language in our country, and its place in the curriculum at all levels of education. To truly sustain the growth of sign language resources, educational institutions can be the mechanism to provide a platform for building and updating such corpora for extensive research with long-term financial support and at the same time to ensure their continuity and relevance.
students on the post-test. The graph shows that experimental group scores were better than traditional group scores. It is indicated that the computer assisted instruction better than traditional method of teaching.

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