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A Case Study of Tactile Language and its Possible Structure: A Tentative Outline to Study Tactile Language Systems among Children with Congenital Deafblindness

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Abstract

Few published research papers concern the study of communication and language development among children with congenital deafblindness. The aim of this study is to explore and discuss linguistic features of what may be considered as tactile languages. By analysing one pilot video observation of a five year old congenital deafblind child communicating with his mother about a slide experience tactile linguistic features of phonology, morphology, semantics and syntax were explored. The linguistic features of tactile language were found to involve a potential unique and complex structure based on direction, speed and acceleration of movements, pressure, and body position. It is discussed how tactile languages, if they exist, can be studied from its unique bodily-tactile nature and not as a modification of visual sign languages.

Keywords: Deafblind; Dual sensory loss; Communication; Sign language development; Social interaction; Tactile sign language

Introduction

Some research papers and practice reports have been published on the tactile adaptation of visual sign languages among deaf sign language users with acquired blindness [1-8]. Many of these people have Usher syndrome which in most cases are characterized by congenital deafness and progressive loss of vision, resulting in functional blindness in early or mid-adulthood [9]. Some of the researched topics have been modified use of sign-space and pointing [10], rules to govern turn-taking by using hand-over-hand (hands-on-signing) [5], and characteristics of adverbial morphemes [1].

Research in tactile sign language among people with acquired deafblindness, however, concern people who already have acquired a visual sign language, and explore how visual sign language perception can be supported by tactile modifications. For a child with congenital deafblindness the situation is different. The congenital deafblind child has to acquire language within the tactile modality, because that is the primarily communicative access to the world.

Current research in communication development among children with congenital deafblindness

The scientific and educational interest in deafblindness and tactile communication dates back to around 1860 with the case story of Helen Keller and her teacher Ann Sullivan [11], which shed light on the uniqueness and challenges of being deafblind. However, Helen Keller was not congenital deafblindness. In most countries, education and support for individuals with congenital deafblindness has throughout history been a sub-discipline of deaf education and teaching. Using the same methods, adapted to the tactile modality, children with congenital deafblindness have been trained in the local audio-oral language or visual sign language. Different behavioral training methods, for instance objects reference systems, were used to support the child's acquisition of a symbolic language [12]. However, since the 1980s this approach has been criticized by researchers and professionals working with children with congenital deafblindness [13]. The approach has not been successful and at best only leads to learning of conditional behavior and not language. As a consequence of the missing outcome, the focus turned to supporting pre-lingual communication development [12]. Inspiration was taken from social interactionist theories of early language development [14,15] stressing that natural social interaction and nonverbal communication between infants and their caregivers are the building blocks for later symbolic language development. In the last 2 to 3 decades it has been explored how the caretaker can sustain and expand the social interaction by responding bodily to the child's expressions of tempo, rhythm, intensity, and emotions within the tactile modality [12,16-18]. Tactile plays (e.g. tactile peek a boo) as well as eating and bathing routines have been suggested to be activities of social interaction that lead to development of early turn-taking and "cause and effect" abilities. Tactile signals for turn-taking may include reaching out with a hand, whereas a signal for turn-giving may be a change of hand position [16,17]. Joint attention using tactile strategies has also been showed to be an important ability to support, for instance responding to the child's attention cues, such as head turning [19]. The outcome of supporting congenital deafblind children's early pre-lingual tactile social interaction has been researched in case-based studies [16,17,20-23], practice reports [24-26], and in studies reviewing the efficiency or quality of intervention methods [21-23,27,28]. Supporting early social interaction by using the tactile modality as a mean for later language development is today the dominating rehabilitation approach in congenital deafblind education in many European and North American countries.

Support to congenital deafblind children's social interaction and communication development has offered many children the first crucial step from social isolation and deprivation. But delay of language development is in general characterized as severe [12,29,30], still few individuals with congenital deafblindness develop a symbolic linguistic system, communication abilities remain at a pre-symbolic/lingual level [19,31]. One typical example is a case study of a 3 year old child with congenital deafblindness in interaction with caretakers presented by Vervloed et al. [18]. The study is a thorough analysis of the social interaction and pre-verbal communication were turn-taking dynamics are used in order to determine the level of communication. It was reported that the child was "in transition between the prelocutory and illocutory stages". The child demonstrated good tactile social interaction and communicative skills, but symbolic communication and language development was only emerging [18].

Summing up, three mistakes have been made in support to congenital deafblind children's language development. 1) Behavioral symbolic language training overlooks the need for support to early stages in language development. 2) Use of visual sign language or audio-oral language as the aim or model for language acquisition, which both can hardly be perceived. 3) A too strong focus on early social interaction and pre-verbal communication which has demonstrated only a little success in supporting the congenital deafblind child in the transition to a symbolic language.

All three mistakes have overlooked what may be the natural language for a congenital deafblind child, that is tactile language. To understand what tactile language may be, inspiration can be taken from research in congenital deaf children's acquisition of sign language.

Visual sign language research

Research in visual sign language acquisition has, since its advent in the 1960s, expanded the understanding of human language [32,33]. Human languages are not fixed to the auditory modality but can develop in the visual modality as well. Stokoe was one of the first to observe the unique linguistic structures in visual sign language [34]. He demonstrated that visual sign language has its own morphology and syntax as well as phonology. He described the phonology of visual sign language and revealed that every sign in sign language is made from three features that are called "primes", those are hand shape, location and movement [34,35]. Following Stokoe's work, many linguistics and psychologists began to study the properties of sign language during the 1970s, and it became prevalent to study congenital deaf children's natural development of visual sign language in natural environments in interaction with deaf peers and deaf signing caregivers [33]. After four decades of research there is a rich research based understanding of the development of visual signed languages among deaf children and sign language studies continues to contribute with important insights of the human language [33].

Visual signed languages have their own rules for phonology, morphology, semantics, and syntax but also follow the same fundamental principles as aural-oral languages [35-38]. The basic building blocks (phonemes) of sign language are movement, location and handshape. By altering those, one can change semantic meaning [39]. The morphology of most sign languages is rich and complex [40]. For example in ASL (American Sign Language) the sign GIVE can be modulated grammatically in the visuo-spatial space to indicate "GIVE TO ONE PERSON", "GIVE TO MANY", and "GIVE REPEATEDLY". The classifier handshape system in signed languages, for instance a flat hand (B-proform) representing a driving car, is an important part of the morphology of signed languages [41]. Another feature of the morphology is the use of facial expression and other non-manual signals. Facial expressions are used as concrete linguistic statements with grammatical functions and one can for example indicate questions or negation with facial expressions [42,43]. The syntax of sign language is expressed in the order of the signs and by the location and movement of the sign [44]. The use of space makes sign language greatly different from spoken languages [33], it is linguistic structure built within a visual-spatial modality.

The deaf child's sign language acquisition follows overall the same steps and is comparable to acquisition of audio-oral language for a child without hearing impairment [45-47]. One of the first steps in language development is babble. Deaf children babble in sign language by repeating hand shaped patterns which are analogous to oral babbling for hearing children [48]. One of the next steps in language acquisition is the use of gestures and then the use of signs and combining gestures and signs [49,50]. Around the same ages as children without hearing impairment, a deaf child develops use of grammatical structure and pragmatic language abilities [49,51,52].

Some congenital deaf children who are not exposed to sign language (e.g. hearing parents who do not use sign language) are able to develop sophisticated gestural systems that assume the functions of language and share some similar features (among others handshapes) with sign languages [49,51,52]. Similarly, has the development of visual sign language among groups of congenital deaf children that have not been exposed to any existing visual sign language been observed. The best known example is the study of a group of Nicaraguan children and the emergence of a sign language among them and its change and development over time and "generations" [53].

A linguistic tactile language turn

Children with congenital deafblindness experience severe sensory barriers for the development of language, but in case of no other severe neurological damages [54], they may have a normal congenital language capacity – a congenital "language acquisition device" [55]. Similar to the natural development of language in the visual modality among deaf children, features of unique tactile languages may also develop naturally among congenital deafblind children. It can be suggested that tactile languages, if they exist, are unique languages shaped by the tactile modality. Similarly to how Stokoe in the 1960s, and colleagues later on, started to investigate the structure of visual sign languages, it may also be possible to understand the structure of tactile languages. To our knowledge no one has investigated congenital deafblind children's tactile behavior and interaction with others as being emerging tactile language.

The aim of this study is to give a first tentative outline of the possibility of the existence of tactile language and the possible structure of tactile sign language (phonetics, morphology, semantics, and syntax) and to discuss how it can be investigated.

Method

Participants

Both new terms and methodology may be needed to explore the potential language structure of tactile language. Analysis of video-observation has been a frequently used methodological approach in

researching congenital deafblind children's social interaction [56,57] and was therefore the best available methodological choice for this study, all though it may meet severe limitation in the ability of measuring tactile behavior.

Selected for this study was a five year old boy with congenital deafblindness without residual hearing or vision and no additional disabilities. The boy was cochlear implanted 6 months before the time of the observation, but no response to the cochlear implant was observed at the time of observation. Caregivers and parents had supported the child from early infancy by using tactile social interaction as described in the introduction section [25,26]. The boy and his parents had throughout his life received continuous guidance and support and gotten monthly visits from experts in deafblindness and tactile communication. The boy and his parents and caregivers were at the time of the observation able to communicate at a symbolic level. The boy is selected because he had been supported in what may be "natural" tactile communication and language as a first language and did communicate at a symbolic level.

For this pilot study one sequence of 1½ minutes of the boy´s typical tactile communication was selected by author 1 and 2. In the selected sequence the boy sat on his mom's lap facing her (Figure 1). The boy and his mom talked about a playground experience earlier the same day where the boy went down a slide.

Procedure

The sequence was coded following a list of behavioral categories of what could be considered as elements of tactile language structure. The list was an explorative list generated by the authors for this pilot study and did not have the ambition to represent a complete list of all possible behavioral elements of tactile language:

Position (Positions of body, body parts, and objects)

Touch (duration and location of all intentional touch of body parts and objects.)

Pressure (soft, medium, or hard pressure on own or other body parts or objects)

Movement (slow, medium, or fast speed and acceleration of body parts or objects)

Muscle tension (weak, medium, or hard tension of body parts)

All codings were made by author 1 and 2 independently and disagreements were discussed until agreement was meet. All codings were made using the software Elan (http://tla.mpi.nl/tools/tla-tools/elan/), which was designed for gesture and sign language analysis.

Results

In the sequence the boy holds his mothers hands and moves the hands in a position above his head, one hand on each side of the head. The hands are held in this position for two seconds with a medium pressure and muscle tension in arms and hands (Figure 1). Then he makes a fast and accelerating movement with his right arm and hand, while still holding his mothers hands, down to a position below his body (Figure 2). He also twists his body and stretches his arm downwards. The mother repeats the same movements accompanied with the oral Danish phrase "yes, sli-i-de down". The boy repeats the same movements with the same intensity and extension as the first time. The mother repeats again and the boy repeats the movement for the third time.

Figure 1: Boy with congenital deafblindness and his mother in tactile communication about a slide experience.

Figure 2: Boy with congenital deafblindness and his mother in tactile communication about a slide experience.

The repeated movement sequence can be analysed in three parts: 1) Holding the hands up, 2) moving them down, and 3) holding them down.

In first part of the sequence the boy holds his and his moms hands in a position above his head and presses her hands. The semantic meaning may be "I was high up here, exiting". The possible phonological and morphological elements were identified to be "position above his head", "no movements in two second", "stretched arm tension" and "pressure of his mother's hands".

In the second part of the sequence the hand is moved from above the boys head to a position where the arm is stretched below his body and the body is twisted. This part may have the semantic meaning "slide fast all way down". Next to "high speed", "high acceleration" and "direction of the movement" and the "position of hands down of the body", the "twisted and stretched body tension"

was all identified as possible phonological and morphological elements.

The third part of the sequence may have the semantic meaning "landed down there" and was analysed to have the following phonological and morphological elements: "holding position down of the body" and "stretched arm tension".

The entire sentence with the tactile language elements in brackets is: "I was high [stretched arm tension] up here [hold position above head], exiting [press hand], slide fast [speed and accelerated of movement] all way down [direction of movement down from position above head to below body] and landed [holding position] down there [stretched arm and twisted body]".

Discussion

The results from this study are tentative and based on only one utterance and one case. However, the results may be a first step towards an outline of what tactile communication and language features might be and how they can be studied.

Analysed from a visual sign language perspective the utterance expressed by the boy could simply be understood as a tactile modified B (flat hand) classifier representing the boy sliding down. But this study indicates that some unique tactile language structure elements may exists, which will not be identified from a mere visual sign language analysis.

Tactile phonology

In visual sign language movement, location and hand shape are the main building blocks. In tactile sign language the building blocks may include speed, acceleration, position relative to other body parts, muscle tension and pressure. Touching gently may have a different meaning than touching with force and muscle tension in shoulder and arm may have different semantic meaning than lack of muscle tension in shoulder and arm.

Tactile morphology

Collins [1] investigated adverbial morphemes in tactile American sign language among adults with acquired deafblindness. A number of unique tactile adaptations were found with regard to the semantic categories Manner/Degree, Tine, Duration, Frequency, Purpose, Place/Position/Direction. For instance adding signs to substitute head movement or facial expressions which could not be observed by the deafblind individual was observed. Singular and pluralism may be indicated by touching one time or many times or making a movement once or many times. Interrogative sentences may for instance be made by adding signs or with specific movements, hand and body positions. [1] Collins identified the unique tactile features to be variations/adaptations of visual sign language, which may be different from tactile language acquired as a first language. [8] Raanes discovered some of the same unique tactile variations in her analysis of dialogues of adults with acquired deafblindness in tactile Norwegian Sign language.

Tactile syntax

In visual sign language positions and the visual-spatial order of signs are used to construct a sentence. In tactile sign language different places of the body and positions in relation to the body may similarly be used to represent grammatical relations. Holding and stretching the hands above the head and then moving them down, to a position down of the body (stretching arms and body downwards), may be the most important elements of the syntax of the boy's tactile phrase. Similar to what is observed in visual sign languages [44], this study demonstrates the congenital deafblind child's use of tactile classifiers with multiple information and multimorphemic tactile units (the whole complex slide experience expressed in one tactile expression).

Tactile sign language "space" of communication

The space for expressing tactile language is the body and physical environment around. In this study, the boy sat on his mother's lap and they were facing each other. This position seems to be an optimal tactile communication position. They are within touch and can not only feel and follow each other's hand and arm movements but also feel body movements, position and muscle tension by having close physical contact. In visual sign language spatial position of signs and facial expressions are part of the language structure. These elements cannot be used in tactile language, instead touch is used and possibly a number of other senses: kinesthetic, balance, temperature and other internal senses. Those senses may also be building blocks of tactile languages or at least important extra-linguistic information in tactile communication.

Limitations of a tactile based language

This study may have identified features of what may be structures of a tactile language. The possibility that some tactile language features can be identified is not equal to the existence of tactile languages and that tactile languages can develop in children with congenital deafblindness. It is well documented that visual sign languages are unique languages which develop among congenital deaf people and are transferred from one generation to the next. This is however not the case for tactile languages and may never be. The use of the same tactile language in a group of children with congenital deafblindness has to our knowledge never been reported. The group of congenital deafblind children may be too small and diverse [58] and because of the dual sensory loss it is very difficult to have natural interactions between congenital deafblind children. The conditions for the emergence of a natural tactile language that will be passed to the next generation are very limited at the best.

Another limitation may be sensory and perceptual. 1) The tactile modality may be too difficult to perceive, the register of discrimination may be to narrow for a full language. 2) Expression and perception of tactile language may be too slow to be processed efficiently in working memory [59] and therefore not a functional modality for language acquisition. 3) A number of important communicative abilities in early language development may be difficult to establish in the tactile modality. It has for example been reported that mutual and joint attention are more difficult to establish in tactile modality [60].

Despite the barriers of acquiring language in tactile modality, children with congenital deafblindness still need to be supported in progressing as far as possible in acquiring language in a modality that they are able to perceive.

Limitations of the study

This study was an explorative case study of the possible structures of tactile language. More research is needed to further investigate the identified features. First of all useful methods for studying language in

a tactile modality need to be developed, video-observation of tactile behaviour (touch, pressure, etc.), which was used in this study, only uncover a visible surface.

This study was a study of one utterance expressed by one child with congenital deafblindness. Even though we find the communication analyzed typical, the tactile behavior observed may be unique for this child and not representative for children with congenital deafblindness in general. Different cases in different communicative situations need to be studied.

Suggestions for future research in tactile language and communication

One way to progress with the understanding of tactile language and communication may be to research haptic communication. Haptic communication is a field of research in relation to both technology [61] and in human communication and interaction [62] for instance sexuality and gestures. Both fields of research may shed light on fundamental perceptual tactile abilities for communication, also among congenital deafblind children.

Haptic communication signals is also used and studied as an extra-linguistic communication approach for supporting people with acquired deafblindness [63]. Haptic signals, for example signed on the back of the deafblind person, can give information about the environment for instance placement of doors and other people and if other people are moving around, laughing, or talking. Lahtinen has studied "haptemer" as being tactile morphemes in haptic communication signals [63]. Haptic communication signas may be another source for understanding tactile language.

Tactile communication strategies has been reported to be frequently used by caretakers in communication and interaction with congenital deaf infants. Deaf mothers of deaf children use tactile signing, placing signs at the infant's body and touch to guide and maintain the deaf child's visual attention during the communication [64,65]. Studies of use of touch in communication with different groups of children with and without disabilities may also be a source that adds to the understanding of tactile language and communication.

Finally, other disciplines than structural linguistic may be useful to address, to add to the understanding of congenital deafblind children's language development. One may be cognitive semiotic analysis [66] of how meaning is negotiated in tactile communication. Others studies of cognitive processes of touch and tactile language [59] and behavioral analysis of tactile social interaction [56].

Water is something different for a fish, duck and cat. A congenital deafblind child perceives the world differently than a typical hearing and seeing child does – and also meets different action possibilities (affordances) [67]. A tree gives the congenital deafblind child a possibility to explore the texture and smell of bark and rotes but not the global visual representation of it. It is important to be aware of these fundamental perceptual differences when exploring what tactile language and communication may be. Slobin warns against looking for a universal human language structure and looking too much for similarities between audio-oral and visual sign languages [68]. Tactile languages may add to the understanding of the variability of human language structures.

Conclusion

Stokoe's well-known paper from 1960, being the advent of linguistic sign language research, started with the following sentence: "The primarily purpose of this paper is to bring within the purview of linguistics a virtually unknown language, the sign language of the American deaf." The same statements cannot be applied to tactile sign language. But after decades of unsuccessful training of children with congenital deafblindness in audio-oral language or tactile modified visual sign language, the study of tactile language and communication features based on its own modality may be important both to offer the best support to people with congenital deafblindness and to investigate the capabilities and limitations of human languages.

When a child is deafblind it is difficult to responds to the child's tactile language capacities. The congenital deafblind child experiences the world though touch, temperature, and other senses which gives a completely different basis for the development of language. How this takes place and might develop into tactile language and communication is relevant to study more.

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