The Acquisition of Spatial Language: A Prelude

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ภาษามือ หรือภาษาใบ้ (Sign Language) มีที่มาและวิวัฒนาการที่น่าสนใจยิ่ง ภาษามือมีความเหมือนหรือต่างจากภาษาพูดที่มนุษย์ทั่วไปใช้กันในชีวิตประจำวันอย่างไร ระยะเวลาการเรียนรู้ภาษามือของเด็กที่เกิดมาหูหนวก กับระยะเวลาการเรียนรู้ภาษาพูดของเด็กปกติทั่วไป ทั้งทางด้านคำ (Morphology) และประโยค (Syntax) เหมือนหรือต่างกันมากน้อยแค่ไหน ภาษามือที่คิดค้นขึ้นเอง (Home Sign) แตกต่างกันมากน้อยแค่ไหนในแต่ละครอบครัว และท้ายสุดสมองกับการเรียนรู้ภาษามีความสัมพันธ์กันอย่างไร บทความนี้จะตอบคำถามดังกล่าว

1. Introduction

The acquisition of spatial language is comparable to the acquisition of

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sign language, because 'space,' compared to 'sound' in spoken languages, seems to be the most significant factor in conveying meaning in sign language. Research into sign language is very new. It really only began in the late seventies or early eighties (Bellugi 1988). This is the reason why it is interesting to find out what we actually thought about sign language in the past: Did we consider sign language a language?

Jackendoff, in one of his influential books *Patterns in the Mind* (1994), stated clearly that:

> "the most important thing I want to stress is that American Sign Language (ASL) is a language. It seems completely different from familiar languages such as English, Russian, and Japanese...the peripheral system is different, but the inner workings are exactly the same." (Jackendoff 1994: 31)

Obviously, there are many things that need to be learned and understood about sign language, for example its common characteristics, and its grammar and structure compared to spoken languages. In order to grasp a basic understanding of sign language, I would therefore like to address in this paper (i) background knowledge of sign language, (ii) timeline and major milestones of deaf children compared to hearing children, (iii) space and its unique roles in sign language, (iv) the acquisition of morphology and syntax of deaf children and hearing children, (v) home sign, and (vi) language development and the brain.

2. Background knowledge of sign language

It is worthwhile to take a look at some previous literature on sign language and see how researchers in the past thought about its existence. It was assumed once that sign language was just a collection of vague and loosely defined pictorial gestures, had no grammar: was derived from English: was a pidgin form of English on the hands with no structure of its own: was much too concrete and too broken in pieces (Bellugi 1988: 158). These opinions seem to be in conflict with the idea of the biological foundations of language which believe that human beings are genetically born equipped with some capacities that enable us to learn and understand all kinds of human languages. Traditionally, however, the concept of biological foundations was restricted only to spoken languages. It was believed human beings were evolved for speech, even the major language meditation areas of the brain were intimately connected with the vocal-auditory channel (Lennenberg 1967), and that spoken languages had been found to manifest certain basic structural principles assumed to result from the fact that language was normally spoken and heard (Liberman 1982).

However, recent studies (Loew 1984: Bellugi 1988: Orlansky & Bonvillian 1988: Meier & Newport 1990: Jackendoff 1994) have found that sign language is an autonomous language with its own mechanism for relating visual forms with meanings. Sign language has evolved linguistic devices that are not derived from those of English or any other spoken languages. Also, human capacity for

language is not limited to the vocal auditory modality. And just like spoken languages, there are also different sign languages.

3. Timeline and major milestones of deaf children and hearing children

The research shows that deaf children acquire the language in a similar manner to hearing children. That is, from birth to the age of six months (crying to early babbling), all the sounds produced by both deaf and hearing children are determined by biological factors. The environment has no effect in this period. However, in the late babbling period the environment begins to affect the utterances of children, that is, deaf children's babbling is not the same as hearing children's babbling. Deaf children begin to acquire the first recognizable sign (FRS), whereas hearing children begin to acquire the first recognizable word (FRW). The time in which both acquire each major milestone—FRS VS. FRW, 10-sign VS. 10-word, combined 2 or more signs VS. combined 2 or more words—is very similar. However, the research indicates that deaf children acquire each step a bit earlier. The reason why FRS is acquired before FRW is related to physical capability. While hearing children have to wait until their vocal tracts and the process of myelination are properly grown, deaf children can simply use their hands to make gestures to communicate. The reason that two-sign combinations tend to appear earlier and do not equate with two-word combinations is because in spoken languages we do not consider one pointing gesture together with one spoken word as two-word utterances, but they do in sign language

(Orlansky & Bonvillian 1988). Apparently, this is the most striking reason that everyone should bear in mind when understanding timelines.

4. Space and its unique role in sign language

Perhaps the most significant distinguishing aspect of sign language, and one that is crucial for understanding its acquisition, is the unique role of space. Spatial contrasts and spatial manipulations figure structurally at all levels (Bellugi 1998). In terms of lexicon, ASL uses locations to differentiate lexical signs. ASL uses dimensions of patterning to signal morphological use–e.g., different geometric contours (lines, arcs, circles) and directions of movement. In terms of syntax, ASL employs space to signal pronominal reference, verb agreement, and anaphoric reference.

4.1 The acquisition of morphology

It is amazing how similar deaf children and hearing children are when comparing inflectional and derivational morphology. They follow the same steps and go through the same stages.

4.1.1 An inflectional distinction

Regarding the acquisition of inflectional morphemes, deaf children go through three stages of acquisition.

I. In the first stage of two to three signs, around the age

of two, signing children do not make use of the inflectional apparatus of ASL. Even when these children imitate, their imitations do not copy parental inflected utterances; instead, they use the uninflected form of the sign. This might be similar to hearing children learning irregular verbs. Although they first begin to use both present and past forms, they treat them as a distinct unit. Therefore, they use both 'go' and 'went' not knowing these two verbs are morphologically related.

II. At the next stage, between the age of 3 and 3.6, deaf children begin to produce inflected forms of verbs. However, they always overgeneralize the rule in the same way as hearing children. For example, instead of using just two fingers of the right hand to make a plural form of the word 'two ducks,' deaf children at this stage tend to use two fingers of both hands to signal the plural form of the word 'two ducks.' This also happens with hearing children when they try to add the '-ed' form to the verb 'go' to make it a past event. Children at this stage begin to understand the rule of the language but unfortunately they fail to comprehend its exception.

III. It takes about five years to master the usage of inflectional morphemes.

4.1.2 A derivational distinction

In ASL there is a consistent formal relationship between verbs and their formally related deverbal nouns (e.g. CUT &

SCISSORS: DRIVE & CAR). The forms of such pairs share hand shape, place of articulation and movement shape, but the noun form is regularly differentiated from the verb form by frequency and manner of movement: whereas the verbs show a variety of movement characteristics, the related nouns are always repeated, in a small and restrained manner.

In the acquisition of derivational morphemes, deaf children go through similar stages to hearing children.

I. In children under the age of two, no formal marking whatever appears: therefore, verbs and their deverbal nouns are being signed identically.

II. Between the ages of two and three, children sporadically mark nouns and verbs with appropriate features but do not do so systematically. It means that some verbs and nouns are marked while the others are left unmarked.

III. Between the ages of three and five, children begin to mark systematically the full morphological distinctions between verbs and their related deverbal nouns: they even make overextensions, that is, they extent the morphological markers to nonexistent ASL forms. For example, they try to sign the nonexistent verb 'to picnic' from the existent noun 'picnic.' This can be a good example to show that children do not learn language by imitation. Rather, they learn the rule and make their judgement from the language presented to them.

4.2 The acquisition of syntax

As mentioned earlier, the most striking and distinctive use of space in ASL is its role in syntax and discourse, especially in nominal assignment, pronominal reference, verb agreement, anaphoric reference and the referential framework for discourse. Since the acquisition of anaphora is an interesting process of hearing children, it therefore should be beneficial to compare this to deaf children.

4.2.1 Anaphora

Anaphora is both a syntactic and semantic issue since it concerns the semantic reference of pronouns and the syntactic structures in which pronouns appear (Foster 1990). In sign language, the signer must not only determine which points in space to select (the same locus point cannot be used for different nominals) but must monitor their spatial positions throughout the discourse for the purpose of subsequent reference. Loew (1982; 1984), in her study of the acquisition of anaphoric reference in the laboratory, finds the following stages.

I. At age 3.1, deaf children's formal mechanisms for conveying anaphoric reference beyond present contexts are minimal. Verbs are rarely indexed for non-present reference, they are just consistently and correctly indexed for present reference. This can be compared to the Minimal Distance Principle proposed by Carol Chomsky in the acquisition of anaphora of hearing

children (Chomsky 1969, in Foster 1990). That is, children will take the subjects that are closest to the verbs as a performer of the action.

II. At age 3.6, deaf children begin to use anaphoric reference beyond present contexts. However, they tend to use one locus for several references, stacking them up at one point, thus leaving the reference unclear and ambiguous.

III. At age 4.4, deaf children use several different loci in a single story but still do not establish identities for each locus.

IV. By 4.9, deaf children use loci correctly and consistently. However, they still fail to consistently maintain the identity of the previously established loci across stretches of discourse until around ages 7 to 10 when the fully mature system can be integrated and mastered across sentences and discourse.

5. Home sign

Generally, 90% of deaf children are born to hearing parents who, quite naturally, tend to expose their children to speech (Hoffmeister & Wilbur 1980, in Goldin-Meadow & Mylander 1990). Consequently, deaf children have to create their own language to communicate with a person in their family, this is known as home sign, as it differs from family to family. However, it has been suggested that home sign is also a systematic language. Goldin-Meadow and Mylander (1990) suggested that, first and foremost,

there was clearly an attempt at communication. The children did not just stand around gesturing, they made a point of establishing eye contact with an addressee before performing the signs. Second, their gestures were not performed on objects. For instance, the gesture signifying the opening of a jar would be made in the air, not on a jar. Third, the gestures came in separated strings. Fourth, it was possible to read a meaning into the gestures and to guess consistently what the child had in mind. This shows that children can produce a language although they are not exposed to the language of the environment. As stated by Jackendoff:

> "Children can't get rules of mental grammar from the environment--the most they can get is examples of utterances, from which they construct their own mental grammar...the structuring of these gestures in rule-governed fashion can't come from anywhere but the children themselves." (Jackendoff 1994: 36)

So far we have seen that sign language is a systematic one. It can be acquired in a similar manner to spoken languages. It also shows that human capacity for language, due to biological foundations, is not limited only to spoken languages. We, as human beings, are ready to learn all kinds of languages. Human beings are capable of constructing a language to communicate by themselves by using mental grammar if languages are not presented to them, as in the case of home sign.

Another area in sign language that remains to be answered is related to spatial cognition, especially the brain. How does the brain of deaf children process information when it comes to language production? Is it similar or different from that of hearing children? Do the left and right hemispheres in deaf children work the same way as those in hearing children? These are the questions that need to be solved.

6. Language development and the brain

While the studies on sign language are relatively new, the ones on brain and language can be traced back hundreds of years. During those years, however, they have not been fully developed. Many issues are still left unsolved and are a mystery. Research into sign language, on the contrary, can fully develop within thirty years or so.

What researchers have found out about the brain and language is extremely astounding. We can answer some questions about how the brain processes information while we are using language, and what happens if our brains are damaged.

Concerning the brain and language, two major parts responsible for this are the left and right hemispheres. The two main areas within these two hemispheres are Broca and Wernicke's areas. It has been suggested that Broca's area is an area that controls the use of syntax. Therefore, those whose Broca's areas were damaged would produce halting strings of words without

grammatical markers (e.g. inflections on verbs) or function words, such as articles and prepositions (Heny 1985). Broca's aphasia seemed to understand language, whereas the Wernicke's area noted severe comprehension problems.

Although we cannot make a clear cut distinction between what the left and right hemispheres do, the approximate duty of each side of the brain can be summarized as follows:

Left brain	**Right brain**
Analytic processing	Holistic processing (dealing with overall patterns or 'gestalt' forms)
Temporal relations	Spatial relations
Speech sounds	Non-speech sounds
Mathematical	Musical
Intellectual	Emotional

According to the critical period hypothesis, however, the right hemisphere can take over many linguistic responsibilities for the left hemisphere if it gets an early enough start. Once lateralization patterns (the specialization of the hemispheres for certain functions which creates a dichotomy) are established, as young as the age of 12, some say 5, the right hemisphere is limited in its formal linguistic capacity (Heny 1985). It is impossible to make a clear-cut distinction between the right and left hemispheres, for both halves have to work together in order to produce and understand the language.

The research shows that the brain processes the production of sign language and spoken language in a similar manner. That is, the left hemisphere is dominant for sign language. The right hemisphere, however, is responsible for visual-spatial, non-language functions. The research also suggests that signers whose left hemispheres were damaged have been found to produce strikingly similar aphasia types in ASL as well as in oral languages.

7. Conclusion

These are the major findings of the brain related to sign language. Obviously, we do not have much detail of the actual process but we have some general ideas. This might be related to the fact that neuroscience is a very complex and complicated subject which is difficult to study in depth.

Many issues about the brain and its relationship to sign language are still left unsolved and are a mystery. As modern technology develops, we all hope that one day we can tackle this mystery and find out what, exactly, it is in our brains that enables us to speak and understand human languages.

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