Proceedings of the 20th North American Conference on Chinese Linguistics (NACCL-20). 2008. Volume 1.
Edited by Marjorie K.M. Chan and Hana Kang. Columbus, Ohio: The Ohio State University. Pages 21-40.

The Nature of Chinese Grammar: Perspectives from Sign Language*

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Chinese grammar exhibits typological features shared by sign languages and young creole languages. Furthermore, like sign languages, Chinese, as much as possible, contextualizes the knowledge of the world, thereby simplifying the syntactic structure and allowing relatively free word order and argument selection. The structural similarities between sign languages and young creole languages can be accounted for by the fact that both types of languages are young languages with an acquisition ambience of mixed language inputs in contact situations. Yet, while young creoles lack inflectional morphology, sign languages have enriched, simultaneous inflectional morphology due to the visual-gestural modality effects. If inflectional morphology in spoken language is a property of old languages, as proposed by Aronoff, Meir, and Sandler (2005), then why didn't Chinese, during the course of its long history, develop a rich morphology, as with European languages? A reasonable explanation is that Chinese has opted to utilize functional mappings rather than inflections for making distinctions among different word classes. This strategy is in line with Nisbett's (2003) contention that Chinese cognition focuses on relations rather than on attributes of individuals. Furthermore, given the the cirucmstances whereby both sign language and Chinese optimize world knowledge to simplify syntactic structures, the "Simpler Syntax" hypothesis recently advanced by Culicover and Jackendoff (2005) can be made even simpler.

0. Introduction

The past four decades of research on sign languages—started by William Stokoe and his associates (Stokoe 1960; Stokoe, Casterline, and Croneberg 1965) and later advanced by Klima and Bellugi (1979), Liddell (1980, 2003), Fischer and Siple (1990), Siple and Fischer (1991), Emmorey (2002), Meier, Cormier, and Quinto-Pozos (2002), and Sandler and Lillo-Martin (2006)—have clearly demonstrated that human language can be produced in two modalities, the visual-gestural modality of signed languages and

*This paper is based on the plenary lecture that I delivered at NACCL-20 held at The Ohio State University, April 25-27, 2008. I am very grateful to Marjorie Chan for inviting me to celebrate the 20th anniversary of NACCL and for editing the paper. I have also benefited from comments and discussions from the participants. Needless to say, I am solely responsible for any errors or infelicities herein.

the auditory-vocal modality of spoken languages. Sign languages are produced and perceived through the gestural-visual modality, and yet with all necessary properties which distinguish human language from animal communication systems. As with spoken language, sign language is a rule-governed system. Thus, like spoken language, sign language has elaborate systems of phonology, morphology, syntax, semantics, and pragmatics.[1] Neurolinguistic findings in the past two decades also suggest that the brain's left hemisphere is dominant for signed language, just as it is for spoken language (Emmory 2002). It is now well-established that sign languages are natural languages.

The discovery and demonstration that language can be expressed not only through the vehicle of speech, but also through the vehicle of sign, has profound implications for linguistics, psychology, anthropology and other disciplines under the umbrella of cognitive science. This should be taken as one of the most crucial research findings in the study of language. No longer can we equate language with speech alone. Nor can we discuss design features of human language based solely on the data from spoken languages (Hockett 1960, Tai 2005). Language universals as well as language disparities should now be drawn from both signed and spoken languages(Sandler and Lillo-Martin 2006). Language universals can be approached from the set of properties shared between signed and spoken languages—in other words, the non-effects of modality—while the differences between signed and spoken languages are, for the most part, due to modality effects. We will briefly discuss *modality non-effects* and *modality effects* in section 1 and section 2 respectively. Section 3 outlines the typological similarities between sign languages and young creole languages and their similarities in acquisition environments. In section 4, we propose that Chinese began as a creole language that, during the course of its long history, had adopted functional mappings in lieu of inflectional morphology. In section 5, we use word order and argument selection to show that Chinese grammar maximizes pragmatic inferences to simplify syntactic structures. Section 6 concludes the paper.

1. Modality Non-Effects

The non-effects of modality as identified in Meier (2002) are: (1) conventionality of pairing between form and meaning; (2) duality of patterning by means of which meaningful units are built of meaningless sublexical units; (3) productivity of new vocabulary through derivational morphology, compounding, and borrowing; (4) syntactic structure building on syntactic categories such as nouns and verbs and embedded clauses such as relative and complement clauses; (5) similar timetables for acquisition; and (6) lateralization in the left hemisphere.

It appears, however, that these non-effects are only first approximations. Under further scrutiny, these non-effects are likely to exhibit still more detailed differences between

[1] Phonology in sign language refers to the system of basic contrastive parameters such as different handshapes, locations, movements, and orientations and the rules of composition of these parameters. The term 'cherology' was used in the early studies of sign languages, but the term has since been replaced by 'phonology' to stress the parallelism between signed and spoken languages.

the two modalities. Let me briefly comment on each of the six aforementioned non-effects. First, although conventionality of pairing between form and meaning holds true for both modalities, at both lexical and syntactic levels, iconic motivations are much more pervasive in signed languages. In contrast, arbitrary association is the general rule for spoken languages, although iconicity in syntax (Haiman 1980, 1985) and onomatopoeia and sound symbolism in phonology (Hinton, Nichols & Ohala 1994) have been documented for spoken languages.

Second, duality of patterning, one of the most important design features of human language, holds true for signed languages as well as for spoken languages. As with spoken languages, signed languages use a small limited set of basic elements, i.e., basic handshapes, in conjunction with other parameters such as location of articulation, hand movement, and palm orientation, to form the basic vocabulary items in the lexicon. However, there is also a difference here. While the phonemic units in spoken languages are themselves non-meaning-bearing units, the basic handshapes in signed languages are often meaningful by themselves. It is only when they serve as sublexical units that their iconic motivations are submerged. It appears that the preservation of iconic motivation for the whole lexical units forces the sublexical handshapes to function as meaningless units. For instance, in TSL the basic handshape /HAND/ by itself stands for hands, but it can be used to form lexical items such as HOUSE and NOW, in both of which cases it becomes a meaningless sublexical unit. This difference between the two modalities may have some important implications for the emergence of duality of patterning in the course of the evolution of human language (Tai 2005).[2]

Third, as with spoken languages, signed languages create new vocabulary through derivational morphology, compounding, and borrowing. However, derivational morphology appears to be more limited in signed languages than in spoken languages. This may be attributed to the youth of signed languages rather than to modality effects (Aronoff, Meir & Sandler 2005). In contrast, compounding seems to be the most important mechanism in creating new vocabulary in signed languages, but this is not necessarily the case in spoken languages. As for the mechanism of borrowing, while borrowed words in spoken languages are subject to phonological regulations of the recipient language, whole signs can be borrowed from one sign language to another sign language without much alternation. Thus, the same sign HOUSE is used Chinese Sign Language, Japanese Sign Language, and Taiwan Sign Language.[3] Furthermore, since all these three sign languages also make use of Chinese characters, character spelling is not uncommon in these languages. As Chinese characters and signs both involve visual perception, they are more compatible with one another than is the case with speech perception. In communities where the spoken language of the hearing is written down in an alphabetic or syllabic script, the deaf use

[2] Following the convention, signs are in upper-case letters throughout the paper.

[3] In terms of language families, Taiwan Sign Language and Japanese Sign Language belong to the same family, but not Chinese Sign Language.

fingerspelling instead. Both character-signing and fingerspelling can be borrowed into sign languages, often creating some variations (Battison 1978, 蘇秀芬 2004).

Fourth, the statement that all sign languages have the same parts of speech as in spoken languages needs to be qualified. It seems that prepositions are absent in all sign languages. It is no accident that in their most recent book on sign language and linguistic universals (Sandler & Lillo-Martin 2006), there is no mention of prepositions at all. This may have to do with the circumstance whereby spatial relations—as expressed in English prepositions 'in', 'on', 'at', 'from' and 'to'—can, in signed languages, be expressed visually and iconically without explicit morphemes.[4] The category of auxiliaries is in general absent in sign languages. Smith (1989) first found three auxiliaries in TSL and claimed that TSL may be the only sign language with auxiliaries. It should be noted that each of these three auxiliaries plays the role of agreement, which is very different in nature from the auxiliaries in spoken languages. Later, Fischer (1996) showed that something akin to AUXI in TSL exists in Japanese Sign Language (JSL), Sign Language of Netherlands (SLN), and Danish Sign Language (DSL). As Fischer (1996:117) concludes, this AUXI-like sign appears to have the fundamental function of agreement. In sign languages, it is often the case that many nouns are signed using actions associated with those nouns. In ASL and other sign languages, these semantically-related nouns and verbs are signed by producing the nouns with smaller, restrained, and repeated movement (Supalla & Newport 1978). However, this is not the case in TSL. The distinction in TSL can be made only in syntactic or discourse contexts. Furthermore, embedding in relative and complement clauses in sign languages is often expressed by non-manual, facial expressions. One of the most difficult tasks in sign language analysis is to identify such expressions and their structural relationship to manual expressions. As to the trade-offs between word order and verb agreement, all the sign languages reported so far have the class of agreement verbs. In addition, all known sign languages use the topic-comment structure. With agreement verbs and topic-comment structure, sign languages appear to have relatively freer word order than do most spoken languages.

Fifth, regarding similar timetable for language acquisition, deaf children acquiring sign language also go through the "babbling" stage when they practice, with their hands, different locations, movements, and handshapes (Lillo-Martin 1999). As a matter of fact, deaf children produce their first words as early as 5-month old, about six to seven months earlier than hearing children, who normally produce their first words in spoken language around one-year old (Newport and Meier 1985). Furthermore, according to Siedlecki and Bonvillian (1993), deaf children seem to master locations first, and then movement, and

[4] In TSL and ASL, there is a sign with downward movement of the cup-shape hand which indicates the existence of an object at a certain location. This sign functions like the locative verb 'zai' in Chinese rather than preposition 'at' in English. See 鄒雅靜 (2004) for a detailed discussion of static spatial relations in TSL.

finally handshapes. Thus, the order of phonological acquisition is different from that of spoken languages. It is safe to assume that further studies on the order of acquisition will reveal more differences between these two modalities with respect to the order of acquisition.

Sixth, neurolinguistic findings in the past two decades suggest that the left hemisphere of the brain is dominant for spoken languages as well as signed languages. The left brain has been known to be more important for language and the right is more important for vision and spatial activities. Evidence from brain-damaged deaf people, however, suggests differences between signs using syntactic space and signs using topographic space (to be discussed in the following section). Syntactic space involves the left hemisphere, whereas the topographic space involves the right hemisphere.

In sign languages, nouns denoting objects can be represented either by shape features or part features of the objects, or by actions associated with the objects, as we have mentioned earlier. Using fMRI technigue, Chiu et al. (2005) have found that the neural substrates mediating the representation took different dynamically distributed forms. Modality effects certainly deserve further and deeper study when we have developed more sophisticated neurolinguistic techniques.

In sum, the six general statements on the modality non-effects made by Meier (2002) need to be further qualified with minor but non-trivial modality effects as we know more about sign languages from different linguistic analyses, facts of language acquisition, and psycholinguistic and neurolinguistic evidence.

2. Modality Effects

There are also modality effects responsible for the structural differences between signed and spoken languages in the lexicon, morphology, syntax, and semantics. Two most important effects are iconic representation of objects and actions and indexic/ostensive identification of referents in signed languages (Meier 2002). Furthermore, as pointed out by Liddell (2003), signed languages also utilize general non-linguistic spatio-cognitive principles to construct meanings. In the discussion below, we will focus on these modality effects on the syntax of sign languages, showing how it contributes to the relative syntactic uniformity of sign languages, in contrast to relative syntactic diversity of spoken languages.

2.1. Three Classes of Verbs

One very important contributing factor to the relative uniformity of sign languages is that all natural sign languages reported so far contain three classes of verbs: plain verbs, agreement verbs, and spatial verbs. For example, American Sign Language (Padden 1983) and Taiwan Sign Language (Smith 1989; Chang, Su and Tai 2005) are not genetically related, but both signed languages have these three classes of verbs; moreover, each class of verbs exhibits similar syntactic behavior in the two languages. This situation holds despite the fact that the same concept may be expressed in one language as plain verb and in the other language as agreement verb, and vice versa. For instance, LOVE in TSL is an agreement verb, while it is a plain verb in English; LIKE in TSL is a plain verb, while it is

an agreement verb in English. The distinction between plain verbs and agreement verbs is not entirely based on the semantics of the verbs as Aronoff, Meir and Sandler (2005:322) would like to believe. Rather, the distinction is made whether the signs for the verbs are body-anchored or not. Plain verbs are body-anchored and allow only small local movements of the hand, while agreement verbs are not body-anchored and allow the hand to move from one direction to another in signing space. Thus, the sign LIKE is body-anchored in TSL but not in ASL. Conversely, the sign LOVE is body-anchored but is not in TSL. Such contrastive examples aside, most agreement verbs identified in TSL are also agreement verbs in ASL (戴浩一、蘇秀芬 2006). Presumably, membership of spatial verbs does not vary from one sign language to another. And all spatial verbs in all sign languages exhibit classifier predicates regardless of whether they express static spatial relations or dynamic spatial relations that involve change of location. What varies from one sign language to another is the use of different classifier handshapes in classifier predicates involving spatial verbs (Emmorey 2003).

Both agreement verbs and spatial verbs move the hand from one direction to another, but the hand movements in these two kinds of verbs are of a very different nature. While agreement verbs use **syntactic space**, spatial verbs use **topographic space**. Topographic space is used to present a schematized layout of the entities and events as they exist in the visual world. For example, to sign "The book is on the table," the topographic space is used to show the spatial relationship "on" between the book and the table. The sign for BOOK must be placed above, or on top of, the sign for TABLE in the signing space. For another example, to sign "The car bumped along past the tree," the topographic space is used to show the path trajectory of the moving of the sign for CAR toward, and then past the sign for TREE. Thus, in representing both static and dynamic spatial relationship in sign language, topographic space is able to create a spatial layout that reflects the spatial relationship between the entities involved in the real world.

Spatial verbs in sign language use topographic space. They are thus able to give visual information about path, trajectory, speed, and even manner and aspect of the movement of action by the verb. They are also able to give information about the location of the action as in signing "The dog is running around in the house." In contrast, syntactic space is used to express abstract concepts and relationships in signing space. Thus, different handshapes can be placed in different areas of the signing space to represent various concepts. For example, in ASL, the sign for CANDY is placed on the chin, the sign for SUMMER moving before the forehead, and sign for TRAIN moving before the dorso (see Klima & Bellugi 1979:42). In TSL, the sign for YESTERDAY is placed above the shoulder, the sign for NOW moving before the stomach, and the sign for DAYS OF THE WEEK moving from the armpit. In all these examples, the location of the sign does not reflect location of entities in the visual world, nor does the moving represent a trajectory in the real world. Syntactic space can also be used to show the contrast between two groups of different people or two different abstract concepts. Thus, in describing people belonging to two opposing political parties, the signer might place a sign referring to one

group on the left of his/her signing space, and the other group on the right side. It is also not uncommon for a signer to place the concept of HEALTH in one area of the signing space, and WEALTH in another area to show the relative merits of the two. Furthermore, syntactic space allows the moving in signing space between two defined points to express grammatical relations, as in "I sent a book to my friend in Japan." Here, the location of "my friend" in the signing space is not the location in the real world, but rather, where the book is directed. In short, plain verbs and agreement verbs in sign languages use mostly syntactic spaces.

Although not all linguists find the distinction between syntactic space and topographic space significant (Liddell 1990, Johnston 1991), we find it is very useful for characterizing three types of verbs in sign languages, including TSL. Furthermore, there is evidence from brain-damaged deaf people and experiments on healthy signers that supports the distinction. As noted earlier, although sign languages are visual languages, they are primarily located in the left hemisphere of the brain. However, the evidence shows that while the use of topographic space in sign languages also engages the right hemisphere of the brain, the use of syntactic space is restricted to the left hemisphere (Poizner, Klima & Bellugi 1987; Emmorey, Corina & Bellugi 1995).

2.2 Iconicity and Simultaneous Morphology

The iconicity in the use of topographic space is highly relevant to the theory of signs proposed by Peirce (1932:2.247, 277-82) in which a crucial distinction is made between "imagic" and "diagrammatic" iconicity. In imagic iconicity, a sign resembles its referent with respect to some visual or conceptual characteristics. In diagrammatic iconicity, none of the signs necessarily resembles its referent, but their relationships to each other mirror the relationships of their referents in the visual or conceptual world. Thus, photographs and statues involve imagic iconicity, but maps and technical diagrams involve diagrammatic iconicity.

The visual-gestural modality allows for an abundance of simultaneous morphology for sign languages in both lexicon and syntax. Even Monomorphic signs have a simultaneous appearance. The pioneering phonemic analysis of ASL monomorphic signs by Stokoe (1960) consists of three phonetic parameters (hand configuration, location, and movement) to be simultaneously initiated. Although later Liddell and Johnson (1986) demonstrated the existence of sequential phonology in terms of LML (location-movement-location) in a sign syllable, the same hand configuration spans over the whole LML sequence, yielding an appearance of simultaneity. Signs in sign language tend to be monosyllabic and often preserve iconic motivations, and thus are iconic images. Simultaneous compounds are also abundant in sign languages. For instance, many TSL verbs incorporate the /MAN/ handshape on the weak hand to express actions such as TELL, LOVE, HELP, LEAD, and KILL. Bringing the /MAN/ handshape and the /WOMEN/ handshape together means MARRY, while moving the two handshapes apart means DIVORCE. Possible

examples of simultaneous affixation also exist in TSL, and the clearest case involves both prefix-like and suffix-like negation markers (Tsay, Myers, Tai & Lee 2008).

Topographic spatial relationships in sign languages necessarily preserve spatial arrangement of the entities in the real world. They are expressed in sign languages with diagrammatic iconicity which involves simultaneous initiation of two or more monomorphic signs. This kind of diagrammatic iconicity holds true in the representation of both static and dynamic spatial relationships in sign languages, as illustrated by the two examples above, "The book is on the table" and "The car bumped along past the tree." In the second example, in TSL as well as in ASL, not only is the manner of a car moving along iconic to the "bumping" in the visual world, but the trajectory of the car moving past the tree is also iconic to the visual world. The iconicity of the manner of moving cannot be properly classified either as "imagic iconicity" or "diagrammatic iconicity". Nor can the trajectory of moving properly be so characterized. They are visually iconic, but are neither "iconic images" nor "iconic diagrams" as in Peirce's original taxonomy of signs. They are expressed with simultaneous morphology in the classifier predicate, where the classifier hand configuration representing the entity in question, the movement of the entity, and the manner and the path of the movement all cluster together along the temporal dimension. In essence, by simultaneous morphology, the classifier predicate represents the static spatial relationship in the three-dimensional world and the dynamic spatial relationship in the four-dimensional world; that is, three-dimensional entities move along the temporal dimension.

In addition to verb agreement and classifier predicates, all sign languages use simultaneous morphology to indicate various kinds of verbal aspects, such as continuative, frequentative, intensive, iterative, and resultative. These aspectual modulations are expressed through the different manners of moving the same hand configuration. These manners consist of different combinations of iconic features, such as reduplicated, even, tense, fast, elongated and end-marked (Klima & Bellugi 1979). These iconic features simultaneously accompany the movement of the hand configuration of signs to indicate verbal aspects.[5]

2.3. Word Order Freedom

Word order is relatively freer in sign languages than in spoken languages, despite the fact that sign languages vary in their preferred word order as do spoken languages. Three factors seem to contribute to the relatively freer word order in sign languages. The first factor has to do with the fact that all known sign languages have agreement verbs. One of the most important functions of word order is to indicate the subject-object relationship. However, this relationship can also be expressed by verb agreement in both signed languages and spoken languages. Thus, there are trade-offs between fixed word order and verb agreement for indicating the subject-object relationship.

[5] See 劉曉梅 (2005) for a study of aspectual modulations in TSL.

The second factor is that sign languages in general are topic-comment languages. Li and Thompson (1976) have proposed a typological distinction between topic-oriented languages like Chinese and subject-oriented languages like English. Sign languages have been described as topic-comment languages like Chinese. For instance, ASL has been described as a topic-comment language since Fischer (1978). TSL is also a topic-comment language. In both signed and spoken languages, the topic sets up the spatial, temporal, or nominal framework for the predication. Sutton-Spence and Woll (1999) characterize topic in BSL as: (1) it comes first, (2) it is followed by a pause, (3) the eyes are widened during the topic, followed by a pause, (4) it can be accompanied by a head nod, and (5) it may be signed with one hand while producing the comment with the other hand. Based on our limited study, topic in TSL also possesses these syntactic characteristics. In TSL as in BSL, both nouns and verbs can be marked as the topic, resulting in SVO, OSV, and VOS orders. Topic structures as well as verb agreement allows null arguments (Lillo-Martin 1999). While this typological feature also holds true to spoken languages, the prevalence of this feature in sign languages can be attributed to modality effects.

The third factor is that real world knowledge allows signed languages to have more flexible word order than spoken languages. Thus, in both BSL and TSL, either MAN NEWSPAPER READ or NEWSPAPER MAN READ, in addition to MAN READ NEWSPAPER are possible. It is because our knowledge of the real world tells us that man can read the newspaper but not vice versa. It is only when the real world allows both possibilities that we have to resort to SVO order or to agreement in sign languages. While this kind of word order flexibility also exists in spoken languages, such as Mandarin, this phenomenon is very common in sign languages.

2.4 Grammaticalized Facial Expressions

Facial expressions are used universally to indicate the emotional states of surprise, anger, happiness, fear, sadness, and disgust (Ekman & Frisen 1975). In sign languages, however, facial expressions are grammaticalized to distinguish sentences types, namely, declaratives, yes-no questions, wh-questions, conditionals. Furthermore, in addition to the marking of topic as mentioned earlier, embedding structures, such as restrictive relative clauses, are also marked by facial expressions, as in ASL (Liddell 1980). Facial expressions are also used to express agreement in TSL（戴浩一、蘇秀芬 2006). These nonmanual signals in sign languages are based on brow-raising, head-tilting, lip-raising, and forward or backward movement of the head and the body. As they are grammaticalized, their assignment of linguistic functions may vary from one language to another (Kegl, Senghas & Coppola 1999). They present formidable challenges to the analysis of sign languages even for sophisticated sign language researchers.

3. Sign Languages and Young Creole Languages

Relative syntactic uniformity of sign languages cannot, however, be accounted for entirely by the modality effects. It has been pointed out by previous researchers in ASL

(Fischer 1978, Gee & Goodhart 1988) that ASL exhibits striking similarities to young creole languages in grammatical structures. This is summarized in Aronoff, Meir, and Sandler (2005:307):

> "These commonalities include: no distinction between tensed and infinitival clauses, no tense marking but a rich aspectual system, no pleonastic subjects, no true passives, the occurrence of transitive verbs with agent subjects as intransitives with patient/theme subjects as well, pervasive topic-comment word order; both young creole languages and ASL make extensive use of content words as grammatical markers; neither young creole languages nor ASL use prepositions to introduce oblique cases; both use preverbal free morphemes to express completive aspect; and both rely heavily on prosodic cues like intonation for expressing certain syntactic relations (such as those encoded by relative clauses and conditionals in other languages)."

As pointed out by Aronoff, Meir, and Sandler (2005), there are three factors which likely contribute to the similarities between sign languages and young creole languages: language origin, conditions of acquisition, and age. Let us briefly examine these factors. Sign languages, like pidgins, arise spontaneously when people who do not share a common language need to communicate, as demonstrated in the emergence of Nicaragua Sign Language in the 1980s.[6] Less than 10% of deaf children are born to deaf parents. In other words, more than 90% of the children are born to hearing parents who do not sign. Thus, deaf children use home signs and gesture to communicate with each other before they enter the deaf school for formal education. As a result, most deaf children are not exposed to a full-fledged language in early childhood and they have to develop a linguistic system on the basis of impoverished and inconsistent input. This situation is no different from the situation in which creole speakers of "the first generation" develop a language from a pidgin in the mixed environment of other languages. Just as young creole languages evolve from pidgins and other ambient languages, sign languages develop from inconsistent and mixed sources of home signs and gestures. The conditions under which sign languages are acquired also resemble those under which the youngest creole languages are acquired. They differ from young creole languages in that each generation of deaf children faces the same conditions of inconsistent and impoverish input. In this sense, sign languages are re-creolized with each and every generation of signers (Fischer 1978). The development of full-fledged sign languages is heavily dependent upon the establishment of schools for the deaf. The education system gathers deaf children together to form a stable community with its own cultural and social institutions which in turn sustain the conventionalization of a linguistic system. The establishment of schools for the deaf in Europe began in late eighteenth century. ASL can be traced back about two hundred and fifty years old, while TSL can be traced back to the early nineteenth century when schools for the deaf were

[6] The spontaneous emergence of Nicaragua Sign language is, however, recently disputed by Polich (2005).

established shortly after Taiwan was colonized by Japan in 1895. According to Woodward (1978), ASL had resulted from the creolization of French Sign Language which was brought to the United States in 1816. Similarly, TSL can be a result of creolization of Japanese Sign Language when brought to Taiwan in 1915, when deaf education was established in Taiwan by the Japanese government.

While sign languages are young languages, they have rich, simultaneous inflectional morphology, as illustrated in section 2.2. In this respect, they differ markedly from young creole languages, which normally have little morphology, inflectional or derivational. Here, an important distinction needs to be made in sign languages between simultaneous morphology and sequential morphology. As examined briefly in section 2.2, simultaneous morphology in sign languages is largely inflectional. Moreover, general patterns of agreement, classifier predicates, and aspectual modulations are exhibited across different sign languages, notwithstanding their variations from one language to another. Compared with the abundance of simultaneous morphology, sequential morphology appears to be very limited. This is true for ASL and ISL (Aronoff, Meir & Sandler 2005) as well as for TSL (Tsay, Myers, Tai & Lee 2008). Furthermore, sequential morphology is derivational and is specific to individual sign languages, and variations in sequential morphology are considerably larger than the simultaneous morphology within each individual sign language. It should also be noted that, whereas simultaneous morphology is more transparent in iconic motivations, sequential morphology appears to be arbitrary.

Aronoff, Meir and Sandler (2005) refer to the rich inflectional morphology in sign languages as "the young language puzzle." They solve the puzzle by means of modality effects. They argue that inflectional morphology in sign language is not due to age, as in the case of spoken languages but, rather, due to modality effects. In spoken languages, inflectional morphology takes a much longer time to develop than does derivational morphology. In sign languages, iconic simultaneous morphology is based on spatial cognition, proving itself more suitable than arbitrary sequential morphology. Thus, while sign languages are young languages, they have rich, simultaneous inflectional morphology, but little sequential morphology.

4. The Chinese Puzzle

One cannot fail to notice that Chinese grammar also exhibits common structural features noted between sign languages and young creole languages. Yet, Chinese is definitely not a young language. The Chinese puzzle is therefore created: if the development of inflectional morphology in spoken language is a function of age, why didn't Chinese, during the course of its long history, develop a rich inflectional morphology, as did European languages? The question can be answered, if we assume that Chinese was a creole language to start with, and that Chinese had opted to utilize functional mappings rather than inflections for making distinctions among different word classes to indicate different parts of speech. It is true that, to a certain extent, parts of speech in Modern Chinese can be characterized by their syntactic distributions within the framework of

prototype theory (Tai 1997). Nonetheless, justifying part-of-speech assignments in Modern Chinese is often controversial (McCawley 1992). Lacking inflectional morphology, Modern Chinese seems generally to rely on functional mappings (Tai 1982). It appears that the one-syllable-for-one-word monosyllabic structure of the Chinese language came to exist before the introduction of Chinese characters. Thus, the trinity of one character for one syllable and one word was already firmly rooted in Chinese language even before the period of Classical Chinese, as evidenced in the inscriptions on oracle bones in the Shang Dynasty (c. 16th-11th century B.C.) The use of functional mappings can be illustrated by the following examples from classical texts. The first two sets of examples are taken from the *Laozi (Daodejing)* and the *Zhuangzi*, with translations provided by Harbsmeier, as reported in Wenzel (2007), and the third example is a well-known example from the *Lunyu (The Analects* of Confucius), with translation provided by Pulleyblank (1995).

A. 老子：

知不知上
know \ not \ know \ top
‘To know that you don’t know is best.’
(or ‘know and to believe not to know is best.’)

不知知病
not \ know \ know \ sick
‘Not to know that you know is sick.’
(or ‘Not to know and to believe to know is sick’)

夫唯病病故不病
- \ only \ sick \ sick \ thus \ not \ sick
‘Only who is sick of this sickness is not really sick.’
(or ‘Who is only sick of this sickness is not really sick.’)

B. 莊子：

生生者不生
life \ life \ - \ not \ life
'What gives life to what is living does not live itself.'

C. 論語：

君君，臣臣，父父，子子
ruler \ ruler, minister \ minister, father \ father, son \ son
Let the ruler act as the ruler should, the minister as a minister, the father as father, the son as son.

The (A) example from the *Laozi* shows that the meaning of each word as well as their compositional meaning can only be properly interpreted from the contextuality of Laozi's philosophy. The word 病 can function as predicate adjective 'to be sick', as transitive verb 'to be sick of', or as a noun 'sickness'. Similarly, in the (B) example from the *Zhuangzi*, the word 生 can function as transitive verb 'to give birth to', as noun 'living things', or as intransitive verb 'to live'. In the (C) example from Confucius, nouns function as verbs, akin to denominal verbs in English (Tai 1997, Chan & Tai 1995).

In sum, the Chinese puzzle can be solved if we assume that Chinese was a creolized language to start with, and that it had opted to use functional mappings rather than inflectional morphology to indicate parts of speech. The monosyllabic structure motivated the preservation of the logographic writing system, which in turn may have perpetuated the employment of functional mappings because of the high compatibility of one character for one monosyllabic word.[7] Thus, despite the age of the language, Chinese grammar has managed to serve its purposes without developing inflectional morphology.

5. World Knowledge and Syntax

Functional mappings require contextuality for proper interpretation. The interface between functional mappings and textual information is, in essence, no different from the interface between conceptual structure and world knowledge. There are two kinds of inference, logical inference and pragmatic inference. While the former depends on formal syntactic rules and their logical implications, the latter relies on the computation of conversational content based on relevance to reality and the intentions of the speaker and the hearer.[8] Let us use *word order* and *argument selection* to show how pragmatic inference can play a key role in Chinese syntax.

When a sentence has an animate subject and an inanimate object, native speakers of Beijing Mandarin seem to accept all six possible word orders except VSO. This can be illustrated in (1) with the intended meaning 'He ate the apple.'

(1) a. Pingguo ta chi-le. 'He ate the apple.'
apple he eat-Asp
b. Ta pingguo chi-le.
c. Ta chi-le pingguo.
d. Chi-le pingguo, ta.
e. Pingguo chi-le, ta.
f. * Chi-le ta, pingguo.

[7] Notice that the Japanese had to develop the kana system for inflectional morphology when it adopted the Chinese writing system during the Tang Dynasty (618-907 A.D.).

[8] See Sperber and Wilson (1995) for a detailed account of the notion of relevance and inference in human cognition and communication.

The relative freedom of word order freedom in (1) is permitted because there is no ambiguity with respect to the grammatical relationship between the agent and the patient. It is not surprising to find that ASL also allows all possible word orders except VSO when there is only one plausible way to interpret the grammatical relations in a sentence (Fischer 1975). The picture is, however, a little complicated here and deserves a brief discussion. Note that there is a pause (and a drop in amplitude) before the postposed subject 'ta' in (1d) and (1e). The OSV order in (1a) can be taken as a sentence with topicalized object. (1c) is the canonical SVO order. Our main concern here will be the grammaticality of the SOV order in (1b), as compared with (2b) and (3b). When both subject and object are animate**,** there are two scenarios. In the first scenario, the relation that the verb denotes is unlikely to be reversed. For example, in (2), in the real world, it is unlikely that the rabbit eats the tiger. We might expect (2b) to be as acceptable as (1b). However, native speakers of Beijing Mandarin would still feel uncomfortable with it, even though there is no misunderstanding of the meaning of the sentence.

(2) a. Tuzi laohu chi-le. 'The tiger ate the rabbit.'
rabbit tiger eat-ASP

b. ? Laohu tuzi chi-le.
c. Laohu chi-le tuzi.
d. Chi-le tuzi, laohu.
e. ? Tuzi chi-le, laohu.
f. * Chi-le laohu, tuzi.

In the second scenario, both subject and object are animate and in the real world their relationship, as denoted by the verb, can be reversed, as in the case of (3). In this situation, (3b) is ungrammatical with the intended meaning as shown, 'The tiger ate the lion.' It can only mean 'The lion ate the tiger.'

(3) a. Shizi laohu chi-le. 'The tiger ate the lion.'
lion tiger eat-ASP

b. * Laohu shizi chi-le.
c. Laohu chi-le shizi.
d. Chi-le shizi, laohu.
e. ? Shizi chi-le, laohu.
f. * Chi-le laohu, shizi.

Sentences (1b), (2b) and (3b), taken together, show that the functional role of word order arises to meet the need to avoid ambiguity in semantic functions such as agent versus patient, or in syntactic functions such as subject versus object. They also show that the object property of animacy also plays an important role in Chinese word order. Our observation here is consistent with previous psycholinguistic findings that animacy as a validity

cue weighs more than word order in the Competition Model proposed by Bates and MacWhinney (cf. Li & Bates 1993).

We now turn to argument selection in Chinese to see how pragmatics plays a role in argument selection in Chinese grammar. Consider the following verbal phrases in construction with the verb *chi* 'to eat.'[9]

(4)	Chi niuroumian. eat beaf noodles	'Eat beaf noodles.'
(5)	Chi Sichuan guan. eat Sichuan restaurant	'Dine at a Sichuan restaurant.'
(6)	Chi da wan. eat large bowl	'Eat a large bowl (of food).'
(7)	Chi wanshang. eat evening	'(The banquet/meal) is in the evening.'
(8)	Chi touteng. eat headache	'(The medicine) is for headache.' (or 'Take it for headache.')

Examples (4)-(8) show that a transitive verb in Mandarin Chinese like *chi* 'to eat', besides its regular theme object argument, can take location, instrument, time, reason, and other expressions as its object argument. Li (2001) adopted light verb syntax proposed by Huang (1997) for Chinese to account for this and other kinds of unselected subject and object arguments in Mandarin Chinese. Thus, the surface transitive verb *chi* is embedded under the empty higher light verb phrase and verb phrases containing abstract verbs such as AT, USE, and FOR. However, the formal account would not be able to explain why the transitive verb *he* 'to drink' cannot have the same set of unselected object arguments as *chi* 'to eat'. It appears that eating is such an important activity in Chinese culture that, for communicative efficiency, its syntax is simplified with rich pragmatic inferences. In a frequency count by Tao (2000), the frequency of *chi* is much higher than *he* and other related verbs. In terms of Zipf's (1935) law, the more frequently a word is used in a language, the shorter is the word. We can extend this law from the length of a word to the length of a phrase or sentence.

6. Conclusions

Sign languages, despite their youth, have enriched, simultaneous inflectional morphology due to modality effects from the visual-gestural mode of communication. In contrast, young creole languages have little inflectional morphology. While morphology in sign languages is iconically-based, inflectional morphology in spoken languages is

[9] We exclude metaphoric expressions such as *chi-cu* 'be jealous', *chi-kui* 'be at a disadvantage' and *Zaijia chi fumu, chuwai chi pengyou* 'One lives on his parents when at home, but on friends when traveling.'

arbitrary. Aronoff, Meir, and Sandler (2005) propose that inflectional morphology in spoken language is a function of age, and that the arbitrariness of grammatical systems is a property of old languages, and not of human language. Chinese, despite its long history, still lacks inflectional morphology. The Chinese example shows that a very old language does not have to develop inflectional morphology. While we view arbitrariness not to be the fundamental property of human language, we are of the opinion that arbitrariness and iconicity are both due to modality effects: arbitrariness to the auditory-vocal modality of spoken languages and iconicity to visual-gestural modality of signed languages.

With respect to typological features, Chinese grammar exhibits a striking similarity to that of sign languages and creole languages. These features include: no tense marking but a rich aspectual system, pervasive topic-comment word order, and several others, as mentioned in section 3. Furthermore, as with young creole languages, Chinese lacks inflectional morphology. The Chinese puzzle can be solved if we assume that Chinese was a creole language to start with and that it had opted for functional mappings rather than inflecttional morphology to indicate parts of speech and other kinds of grammatical functions. This strategy is compatible with Nisbett's (2003) theory that Chinese cognition focuses on relations between individuals rather than on the attributes of an individual. The introduction of Chinese characters for monosyllabic words in the early history of this language may also have contributed to the perpetuation of the monosyllabic structure.

Finally, as in the case of sign languages, Chinese prefers pragmatic inferences to formal syntactic constraints, with the result of simplifying the syntax. Given the fact that both sign language and Chinese optimize world knowledge to simplify syntax, the "Simpler Syntax" hypothesis recently advanced by Culicover and Jackendoff (2005) can be made even simpler. Liddell (2003) suggests that sign languages make great use of non-linguistic cognition to achieve the same effect of communication as in spoken languages. We are tempted to speculate here that Chinese and young creole languages would fall into the middle of the continuum from sign languages to inflectional spoken languages in making use of non-linguistic cognition, in addition to pragmatic inference and world knowledge. It is our hope that this speculation can lead to meaningful research questions regarding the interface between grammar and meaning in human communication.

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