Chinese and English Language Processing Strategies within Individuals[1]

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In the research of language development and language comprehension strategies, researchers attempt to discover 1) what learners bring to their learning task, and 2) how they apply what they have to the new language. (Rice, 1989). In the area of L2 acquisition, one specific concern is how L2 learners move their processing strategies from their native language to the target language, and how they resolve the conflicts of syntax, semantics and pragmatics when they process language input. This study uses Bates and MacWhinneys functionalist processing model because the model provides a satisfactory means to detect how learners process conflicting information and the strategies they use in their processing.

The Competition Model and L2 Processing Strategies

The underlying idea in the competition model is that mental processing is competitive. The model tries to discover how speech is internally processed and why speakers select particular devices to express particular intentions. The processing system works in a bottom up and cue-driven fashion. There are four cues which can be used to determine the relationships among language elements. They are lexical items, morphological markers, word order, and prosody. In the process of interpretation, the cues are activated to converge or compete. When all the cues agree with each other, they form a coalition to converge on the same assignment of relationships like sentence 1. When there is a conflict among cues such as sentence 2, cues compete for dominance. Consequently, one of the cues wins over the possibilities. The probability for a cue to win largely depends on the language, ease of interpretation, perception, and etc.

1. The monkey pushes the cart.
2. The cart pushes the monkey.

MacWhinney (1989) pointed out that the nature of language learning and the nature of language are closely linked. One cannot reasonably answer the question How is language learned without first considering the question What is language. Language structure and processing are completely intertwined. Languages differ markedly in the strengths they assign to basic grammatical cues. For example, in English, the cue of preverbal positions is the strongest to identification of the subject role; whereas in Italian, agreement is a much stronger cue than word order. (Bates and MacWhinney, 1982). The choice of the cue is rather language specific.

Several empirical studies on L2 acquisition use the comprehension model to investigate the processing strategies employed by the L2 learners. Bates and MacWhinney (1981) investigated the comprehension strategies of German EFL and Italian EFL speakers. They compared the data of German EFL and Italian EFL speakers with the native German and Italian speakers. In their experiment, they asked subjects to report a subject/agent of a number of speech sentences which consisted of two nouns and one verb in varied orders and with different cues (animacy and word order). Transfer of L1 processing strategies was found for all L2 subjects. Despite the fact that the EFL were quite fluent in English, their data were still quite in between the native language and the target language. For example German speakers of EFL depend on lexical semantic cues to a greater degree than native English speakers do. Their English comprehension strategies were more similar to those employed by native German speakers interpreting German sentences than by native English speakers interpreting English sentences. Bates and MacWhinney pointed out that the strategy transfer from the native language to the target language may be the source that impeded the attainment of native-like selections and native-like fluency.

Miao (1981) studied Chinese sentence comprehension strategies by the English-speaking learners of Chinese (CFL) and the native Chinese speakers. The sentences that the subjects heard were also a sequence of two nouns and a transitive verb, presented in the three possible orders of noun verb noun, verb noun noun, and noun noun verb. Nouns had either animate or inanimate references. The results of the study showed that Chinese native speakers relied more heavily on the semantic factor of lexical meaning than on word order in interpreting Chinese sentences, whereas native English speakers of Chinese relied on the information of both word order and lexical meaning. The English-speaking learners of Chi-

nese transferred English word order strategies in the interpretation of the Mandarin sentences.

Liu, Bates, and Li (1992) conducted a study of sentence interpretation in early and late bilingual speakers of English and Chinese. Their results showed that late Chinese-English bilinguals transfer animacy-based strategies to English sentences; late English-Chinese bilinguals transfer certain English-like word order strategies to their interpretation of Chinese. Early Chinese-English bilinguals display a variety of transfer patterns. Along the similar lines, Gass (1987) noted that in moving from semantic-dominant language to a syntactic dominant one, learners have to go through at least two steps. First, learners have to recognize the importance of the concept of word order in a second language. From there they are able to determine the word order in that language. However, to move in the other direction, from syntactic to semantic language, seems to be much easier. Gass proposed that there are universal language interpretations strategies with semantics being a stronger one than syntax. (1987: 344)

In a more recent study, Sasaki (1994) showed that native speakers of Japanese use similar case marking-based strategies in processing both Japanese and English, whereas native speakers of English adjust their cue reliance differently when processing English and Japanese. As the learners' proficiency in Japanese increases, their case-marker dependency in Japanese also increases. Sasaki revised Gass' suggestion concerning the universal prepotency of semantics. He proposed that lexical semantics provides the most widely transferable type of cues, whereas transfer of grammatical cues can be blocked when L1 and L2 are mismatched. When transfer of grammatical cues is blocked, lexical semantics emerges as a substitute, even if it is not the most influential in the L1.

Purpose of the Study

Many previous studies showed that there is little evidence of transfer of L1 (Italian, German, and Japanese) processing strategies to the interpretation strategies of target language of English. However, the studies by Miao (1981) and Liu et al (1992) showed different results in the way that the English speakers transferred their L1 (English) processing strategies of word order cues into their interpretation of L2 Chinese sentences. The native English speakers learning Chinese 'relied on both word order and lexical meaning.' (Miao, 1981:109).

The explanations for the inconsistencies between the results of Miao (1981), Liu et al (1992) and the other studies such as by Gass (1987), Sasaki (1991) need to be pursued. The present study investigates the processing strategies across the languages of English and Chinese. It compares the differences and similarities in processing strategies between L1 and L2 within individual learners. In doing so, we attempt to discover the process of interlanguage comprehension, how L2 learners move from the strategies used in their native language to the target language, and the universal language interpretation strategies. (Gass, 1987: 344) The study will use Competition Model because it provides the theoretical base upon which the strategies used in processing speech will be detected.

Chinese Word Order

Chinese is generally considered a word order language. The word order determines the grammatical relations and word functions to a large extent. Sentences 3-6 are the examples of such:

3. Gǒu yǎo háizi. 狗咬孩子
   Dog bite child (The dog bites the child)
4. Háizi yǎo gǒu. 孩子咬狗
   Child bite dog (The child bites the dog).
5. Háizi gǒu yǎo. 孩子狗咬
   Child dog bite (The dog, which verses other animals, bites the child).
6. Yǎo gǒu háizi. 咬狗孩子
   Bite dog child (The child is requested to bite the dog).

The variations of word order make sentences 3-6 semantically and pragmatically different. On the other hand, a close examination reveals that there is flexibility and freedom with the word order of Chinese sentences: 1) Chinese is a topic-prominent language. The topic is at the beginning of the sentence and is not necessarily the subject or the agent of the sentence. Thus, the subject of a sentence can be frequently missing. Furthermore, the topic-comment structure of Chinese language allows a great flexibility with the word order of a sentence. The SVO order (sentences 3-4) is the canonical form, and the SOV, OSV (sentence 5), and VOS (sentence 6) orders are all the possible or acceptable forms. 2) The syntactic structure of Chinese is loose. The grammatical category of subject is not structurally well-defined. Li and Thompson (1981) proposed that the strategy in

determining the basic word order for Chinese language is primarily the factor of meaning. Semantic factors rather than grammatical ones determine the order of the major constituents with respect to the verb. For example, different from English, Chinese does not have dummy subjects. Word orders in Chinese are not independent of principles of meaning. 3) Li and Thompson (1981) pointed out that it is not easy to define the basic order of Mandarin Chinese. Mandarin Chinese 'has some of the features of an SOV language and some of those of an SVO language, with more of the former than of the latter.' (1981: 23)

Since Chinese is a topic-prominent language, and the position of the subject is flexible, interactions and conflicts of Chinese word order, topic, and semantic cues occur quite frequently. Different languages use different cues. When word order and semantic cues conflict in Chinese sentences such as in sentence 2, Chinese speakers would use semantic cues and assign the surface subject to 'the monkey', an animate noun. In Chinese, semantic/pragmatic cues seem play a major role and have the greatest weighting.

Hypotheses

Based on Competition Model and the findings of previous studies, the following four hypotheses were made.

1. Native English speakers depend more heavily on word order cues than lexical-semantic cues when interpreting English sentences.
2. Native Chinese speakers depend more heavily on lexical-semantic cues than word order cues when interpreting Chinese sentences.
3. Native English-speakers of CFL learners depend more heavily on word order than lexical-semantic cues when interpreting Chinese sentences.
4. Native Chinese speakers of EFL learners depend more heavily on lexical-semantic than word order cues when interpreting English sentences.

Method

Subjects

Thirty three subjects participated in the study. Twenty-two were native English speakers and eleven were native Chinese speakers. Among the 22 native English speakers, 11 learned Chinese for one year, and eleven learned Chinese for

two or more than two years. Most of them were enrolled in Chinese language classes in a college in the U.S.A. The 11 native Chinese speakers were all in the U.S.A. They learned English for three or more years. All the subjects began to learn the foreign language after puberty. Table 1 presents the information on the subjects. In this study, the Chinese native speakers of EFL were all at the advanced level. Since the emphasis of this study is on the English-speaking students acquiring Chinese as a foreign language, the data of ESL students at the low proficiency level were not pursued.

L1	English	Chinese
L2	CFL	EFL
Number	22	11
Levels of L2	Lower N=11 Higher N=11	Advanced
Sex	M=12 F=10	M=4 F=7
Average Age	Lower: 22 High: 24.5	30

Table 1. Subjects

Procedure

The stimulus tapes were made by native speakers of English and Chinese, respectively. The lexical items, word order and animacy cues used in the stimulus sentences in both English and Chinese were identical. Fourteen nouns (seven animate and seven inanimate) and seven verbs were used. (See Appendix) All the sentences composed of two nouns and one verb and varied in terms of word order and animacy. Each sentence was in the order of NVN (noun-verb-noun), VNN (verb-noun-noun), or NNV (noun-noun-verb). The animacy cue was presented

with the two nouns of a sentence in the order of AI (animate-inanimate), IA (inanimate-animate), or AA (animate-animate). All the sentences can be classified into nine types as presented in Table 2. In the English version, all the verbs were in the third person singular form and the present tense. The definite article 'the' preceded each noun.

TYPE	EXAMPLE
NVN	
AA	The cow pats the monkey.
AI	The dog looks at the table.
IA	The table bites the cat.
VNN	
AA	Eats the fish the cat.
AI	Kisses the dog the chopsticks.
IA	Pushes the cart the calf.
NNV	
AA	The dog the cat bites.
AI	The fish the car t grabs.
IA	The chair the monkey pushes.

Table 2. Nine types of stimulus sentences

Subjects were tested individually and in two periods of time. The first time was in their native language, that is, the English speakers were tested in Eng-

lish and the Chinese speakers were tested in Chinese. The second time was in their foreign language, that is, the native English speakers were tested in Chinese and the native Chinese speakers were tested in English. The interval between the first and second tests was more than two weeks. This interval was made purposely to avoid a carry-over effect of the first test to the second one.

The instruction at the beginning of the tape told subjects that they were to listen to 36 sentences and they were to respond as to which was the subject of the sentence or the one who did the action. There were 8 second intervals between each sentence. At the test, the reaction time of the subject to stimulate sentences was not recorded. The reaction time was not controlled as a variable in this study. The student was required to report the subject of the sentence that they heard. The responses were recorded by the researcher. When subjects were tested in their foreign language, the vocabulary items were reviewed right before the test to make sure that the vocabulary items were understood.

Many of the stimulus sentences are ungrammatical. The rationale behind is to maximally explore the possibilities of comprehension strategies used by the native speakers and L2 learners. MacWhinney, Pleh, & Bates (1985) pointed out that to process grammatical and ungrammatical sentences manipulates the same sets of cues and processing patterns. Thus the use of ungrammatical sentences is considered appropriate.

Results

The data were analyzed with one dependent variable of the choice of the first noun, and three independent variables of language, word order, and animacy. An ANOVA design was used in analysis of the data. T-tests were used to detect the differences between the students of CFL at the lower and the higher levels. T-tests were also used to discover if there were significant differences between the tests of their native and their second languages within individuals.

The ANOVA analyses indicate that language, word order, and animacy are all significant variables. The effects of word order and animacy on the interpretation of the sentences are significant: Language x Word Order, $F_{(2,4)} = 37.69$, $p < 0.01$; Language x Animacy, $F(2,4) = 32.07$, $p < 0.01$; Language x Word order x Animacy, $F_{(4,8)} = 4.42$, $p < 0.05$. The two-way interactions Word Order x Animacy, $F(2,2) = 3.88$, $p < 0.05$ is also significant.

Word Order

Table 3 shows the percentage of first noun choice as a function of word order by all the groups. When the sentence is in NVN orders, the first noun is selected most frequently. The NVN pattern is the canonical word order and the first noun in NVN sequences is commonly considered the subject/agent of the sentence in both English and Chinese. The percentage for English speakers to select first noun in NVN pattern is 88.10% in English and 82.01% in CFL. For example, 18 English speakers chose 'ball' as the subject when interpreting the sentence 'the ball bites the cat' in English, and 13 chose 'ball' as the subject when interpreting the same sentence in Chinese. The percentage for Chinese speakers to select first noun in NVN pattern is 60.10% in Chinese and 65.15% in EFL. For example, 6 Chinese speakers chose 'table' as the subject when interpreting the sentence 'the table kiss the ball' in Chinese and 8 chose 'ball' as the subject when interpreting the same sentence in English. The first noun is chosen most frequently in NVN patterns and least frequently in VNN patterns. The percentage for English speakers to select the first noun in VNN patterns is 11.90% in English and 30.39% in CFL; and for Chinese speakers is 38.64% in Chinese and 37.12% in EFL. Table 3 also indicates that the strategy of selecting the second noun in non-canonical sequences of VNN and NNV is used by English speakers. This finding is consistent with the findings of previous studies (Bates, McNew, MacWhinney, Devescovi & Smith, 1982; Miao, 1981; Harrington, 1987)

Figure 1 illustrates the effects of first noun choice as a function of word order. It shows that the English speakers rely on the word order cue most in interpreting English sentences, and Chinese speakers rely on it least in interpreting Chinese sentences. The L2 groups (EFL and CFL) are between the first language groups. The comprehension pattern of EFL resembles the Chinese L1 much more than CFL resembles the English L1. In other words, inter-language groups are approaching more closely to the Chinese than to the English comprehension pattern. Figure 1 also indicates that the CFL groups at both the lower and higher levels are adopting the comprehension strategies of their target language and the learners at the higher level are even more so.

	English	Chinese	EFL	CFL low	CFL high
NVN	88.10	60.60	65.15	84.85	79.17
VNN	11.90	38.64	37.12	34.10	26.67
NNV	26.98	53.03	43.18	37.12	37.50

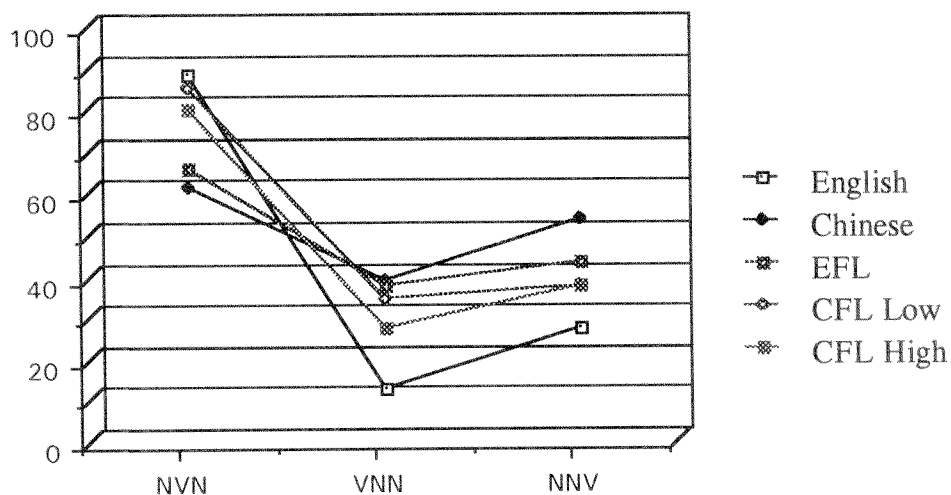TABLE 3. Percentage of First Noun Choice
as a Function of Word Order

Figure 1. Percentage of first noun choice as a function of word order

Animacy

As Table 4 indicates, the first noun is selected most frequently in AI se-
quences and least frequently in IA sequences. The Chinese speakers selected the
first noun in AI sequences 93.18% of the time, e.g. to choose 'horse' as the sub-
ject in the sentence 'the horse the cup eats', and in IA sequences 9.85% of the
time when interpreting Chinese sentences; and 90.40% of the time with AI se-

quences and 8.33% of the time with IA sequences when interpreting EFL sentences. In comparison, the English speakers depended less on animacy cues than the Chinese speakers. Figure 2 shows the first noun choice as a function of animacy. Animacy cues have a greatest effect on Chinese L1 and least effects on English L1 sentence comprehension with EFL and CFL in between. The effects of animacy on Chinese L1 and EFL sentence comprehension are almost identical. The CFL group is adopting the strategy of animacy. The CFL group at the higher level used more animacy cues than the CFL group at the lower level (even though the differences between the two levels are small). The CFL group is between the English and Chinese groups. It resembles the target language of Chinese on one hand, and is influenced by its first language of English on the other hand.

	English	Chinese	EFL	CFL low	CFL high
AA	42.46	46.97	46.21	57.57	48.33
AI	58.33	95.45	90.91	73.48	74.17
IA	29.37	9.85	8.33	25.06	20.83

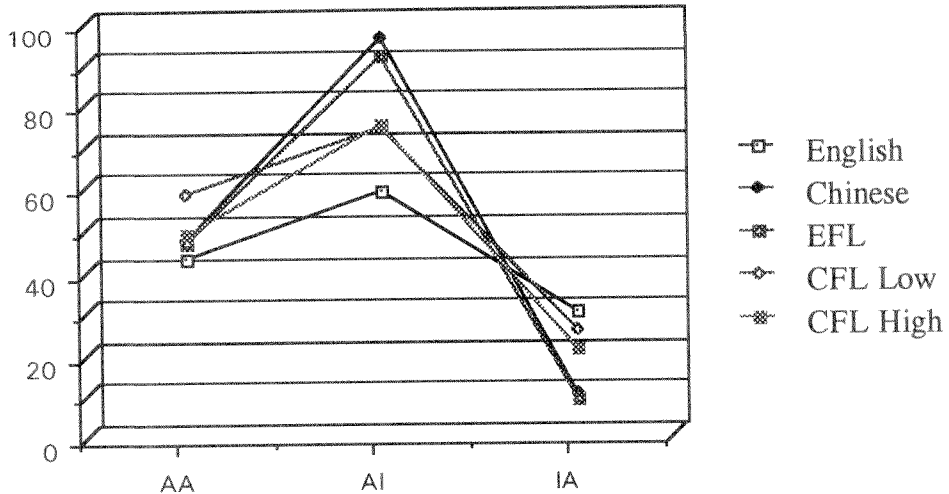TABLE 4. Percentage of First Noun Choice
as a Function of Animacy

Figure 2 Percentage of first noun choice as a function of animacy

A close examination of the responses of English speakers reveals that three subjects out of 22 consistently used animacy cue with all the sentences in both English and Chinese. In other words, their pattern of responses is similar to the pattern of Chinese speakers. It appears that the Italian group in Bates et al (1982), the Japanese groups in Harrington (1987) and Sasaki (1991), the Chinese group in Miao (1981), the English animacy sub-group in this study, and the Spanish-English bilingual Group 2 in Wulfeck, Juarez, Bates, & Kilborn (1986) shared the similar comprehension strategies of using animacy cues as the predictor of the sentence subject. Because the number of English animacy sub-group is small (14% of the total), their responses will be discussed within the group of English speakers.

Interaction of Word Orders and Animacy

Canonical sequence NVN. Table 5 presents the percentage of the first noun choice with the interaction of word order and animacy. We first look at NVN sequences. In NVN sequences and when the semantic cues are in AA or AI orders, the first noun was selected most frequently by all the groups, especially when it is in AI sequences, that is, when syntactic and semantic cues converge. When the sentences are in AA sequences, the first noun was chosen by Chinese

speakers in Chinese at 61.36% of the time which is the lowest among all the groups. A closer examination revealed that the native Chinese-speakers relied heavily on lexical/semantic cues, and assign the agent to the noun of the animal which is bigger and stronger even though the noun is in the object position. For example, in the sentence 'the fish eats the cat', the subjects seemed to think that the fish was unlikely to eat the cat, and therefore, should be the patient regardless of its sentence- initial position. When the sentence is in IVA sequences, the first noun was selected most frequently (75.00%) by English-speakers in responding English sentences (e.g. to choose 'the car' as the subject in sentence 'the car looks at the monkey'), and least frequently by Chinese speakers.

	English	Chinese	EFL	CFL low	CFL high
NVN					
AA	89.28	61.36	72.73	95.46	77.50
AI	100.00	100.00	100.00	100.00	100.00
IA	75.00	27.27	22.73	59.04	60.00
VNN					
AA	8.33	25.00	22.73	36.37	25.00
AI	23.81	93.18	88.64	56.81	55.00
IA	4.76	0.00	0.00	9.10	0.00
NNV					
AA	28.57	56.82	43.18	40.90	42.50
AI	47.62	97.73	84.09	63.63	67.50
IA	4.76	2.27	2.27	6.81	2.50

TABLE 5. Percentage of First Noun Choice
as a Function of Word Order and Animacy

Non-canonical Sequences VNN and NNV. The first noun in VNN and NNV sequences was selected much less frequently than in NVN sequences. It is only in AI orders that the first noun was selected frequently by Chinese (not English) speakers when interpreting Chinese and EFL sentences (93.18% in VAI and 97.73% in AIV, and 88.64% in VAI and 84.09% in AIV, respectively). For example, most Chinese speakers chose 'the horse' as the subject in the sentence 'bites the horse the chopsticks' and chose 'the cow' in the sentence 'the cow the chopsticks bites' when interpreting both Chinese and English sentences.

The first noun was selected rarely by English-speakers when interpreting VNN and NNV sequence in English. The percentage for the native English speakers to select the first noun in VAI and AIV sequences in Chinese are moderate (55.91% and 65.57% respectively). The percentage for the CFL group to select the first noun in AA and IA orders in the non-canonical word orders is low (30.68% and 4.55% in VNN sequences and 41.70 and 4.64% in NNV sequences). This suggests that when the word order of sentence is non-canonical, the strategies used by CFL subjects are the half way between their target language and their first language with the inclination for the animacy strategy.

In addition, our data can be summarized as showing two important differences among the responses of the groups. 1). English-speakers selected the first noun in the NVN sequences more frequently than Chinese speakers. Furthermore, this difference is specified in the AVA and IVA orders. (In the AI order, the first noun was selected 100% of the time by all the groups). When the nouns of the sentence are in the IVA order where the canonical word order cue conflicts the animacy cue, the first noun was selected at the 75% of the time by English-speakers, e.g. to choose 'the pen' as the subject in the sentence 'the pen pats the dog', and 59.55% by CFL learners, 27.00% of the time by Chinese speakers, and 22.73% of the time by EFL learners. This indicates that English-speakers depend on word order cues, whereas Chinese-speakers rely on animacy cues regardless of the word position in the sentence.

2) When the sentence is non-canonical (in VNN or NNV sequences), the first noun choice does not vary greatly with English speakers (sd = 17.34). The strategy of second noun choice was used quite consistently only by the English speakers, e.g. to choose 'the chopsticks' as the subject in the sentences 'bites the ball the chopsticks', and 'the ball the chopsticks bites'. The responses of the Chinese speakers varied greatly from 95.45% of the time for AI in VAI and AIV se-

quences (e.g. to choose 'the fish' as the subject in the sentence 'holds the fish the ball' and 'the fish the ball holds'), to 1.13% of the time for IA in VIA and IAV sequences in Chinese (sd = 43.56), and 86.32% of the time for AI in VAI and AIV sequences to 1.13% of the time for IA in VIA and IAV sequences in EFL (sd = 39.09). The first noun choice by the CFL group is moderate with the preference of the animacy for the AI order 60.68% of the time.

Discussion

The Comprehension Strategies of First and Second Languages

The results of this study showed that Chinese native speakers rely heavily on semantic cues in interpreting Chinese sentences. They consistently selected animate nouns as agents in both canonical and non-canonical word orders. For example, when the animacy and word order cues conflict in IVA sequences, Chinese speakers chose the second noun regardless of the word position. Whereas the English native speakers take the word order as the important cue regardless of animacy. Therefore, hypotheses 1 and 2 were supported.

Hypothesis 4 was supported that the native Chinese-speakers of EFL depend more heavily on animacy than word order cues in their interpretation of English sentences. The small difference between Chinese L1 and EFL is that the latter seems to be aware of the importance of word order in the target language and moves towards the direction which emphasizes the word order strategy. The EFL learners all had formal English classes for about ten years and have stayed in the USA for more than two years. Their English is at the advanced level. Yet their EFL comprehension strategies are primarily influenced by their first language. This suggests that animacy is a factor of great strength.

The CFL group is different. Unlike the EFL group, the strategies the CFL group used are not so much similar to the strategies used in English L1 sentence comprehension. Thus, hypothesis 3 was not supported because the CFL learners showed more of the in-between features of both animacy and word order. On one hand the CFL group still relied on the word order strategy used in their L1 sentence comprehension; on the other hand, the CFL group was clearly aware of the semantic importance of the target language and used the animacy cues to a large extent. In comparison, the move that the CFL group made toward their target language comprehension strategies is much greater than the EFL group, even

though the proficiency level of the CFL group is not necessarily higher than the EFL group.

Therefore, the findings of this study suggest that in moving from a syntactic dominant language to a semantic/function dominant one, it is easier for the L2 learners to realize the importance of the semantic factors of the target language and adopt the semantic strategy. It is more difficult for L2 learners whose L1 is a semantic dominant language to capture the syntactic feature of the target language and to use word order strategies. This finding of the study is consistent to the findings of Gass (1987) and Sasaki (1991). Both of their subjects showed that to move from L1 English to L2 Italian or Japanese is easier than in the reverse direction. Gass pointed out 'it is difficult to let go off a semantic strategy, but relative easy to latch on to one.' (Gass, 1987: 343).

The Processes of Interlanguage Comprehension

Miao (1981) proposed that different from children who process the sentences according to a certain canonical sentence schema, adults may have several sentence schemata which reflect the different types of sentences used in a particular language in addition to an important canonical sentence schema in their mind. Thus, when sentences deviate from the standard form, adults can process the sentences through different schemata. In other words, adults have more schemata and flexibility to deal with sentences of different word orders.

The results of this study support Miao's proposition. First, many subjects seem to know that the factors in determining the subjects of English and Chinese sentences vary to certain degree. When the subjects of CFL learners were asked about the strategies they used after their second tests, most of them indicated that they felt that the grammar and the word order were more important with English, and animacy with Chinese sentences. When they were tested in English, they felt that there was a flexibility or playfulness with English word order and paid attention to the possibility of the different word order arrangements. When they did the test in Chinese, they tried to make sense out of the stimulus sentence and used the animate noun as the subject. Even the subjects who used the same strategy in processing their native and target languages also made such comments. Thus, it suggests that the learners are aware of the difference between two languages. Further, they accept the difference, and use the schemata to capture the different factors in different languages.

Second, it seems that a learner goes through a process of interlanguage comprehension in different modes. When the word order of the given sentence is canonical and animacy feature is plausible (e.g., in the SVO sequence), L2 learners initially use grammatical cues, process the sentence through surface structure, and assign the notion of subject according to the word order sequence. That is why the EFL group selected the first noun in NVN sequence more frequently than the Chinese L1 group. However, when the word order contradicts the meaning and the lexical constraint, learners will compare the given sentence to the standard sentence in their mind to find out how deviant the given sentence is. Under such circumstances, comprehension is based on the relative strength of word order or semantic factors. When the word order and animacy cues are neutral, it is more likely that learners will use world knowledge and assign the subject/agent of the sentence according to the lexical meaning and logical relations of the nouns in regard to the verb. The lexical meaning and semantic constraints seem to be the backup strategies in the process of sentence comprehension.

One explanation for the use of lexical meaning and semantic factors as the backup strategies by both learners of pragmatically/semantically dominant language such as Chinese and the syntactically dominant language such as English is directly related to the cognitive psychology of language acquisition. The lexicon/semantics-based strategies reflect the general human cognitive disposition and the way we process information. Bowerman (1989) proposed that young children are sensitive to language-specific principles of semantic categorization. The semantic organization of language is itself reflection of deep seated properties of our perceptual and cognitive organization. Cognitive/perceptual understanding is established before certain linguistic forms are acquired. In other words, in applying linguistic forms to referents, we often classify spontaneously on the basis of categorization principles that play a role in the semantic systems of natural languages, whereas syntax-based patterns are not directly derived from the cognitive functional constraints. The results of this study support the hypothesis of Bowerman: when syntactic and semantic cues are equally weak, L2 learners tend to apply their general schema to interpret the sentence.

A number of studies in L2 acquisition showed that semantic/pragmatic cues are the backup strategies when syntactic cues are omitted. Sasaki (1994) reported that when the most reliable cues of case markers in the Japanese language system were omitted, the JFL subjects depended heavily on lexical-semantic cues to determine the grammatical roles of the sentence. This study also showed the

strong transfer of animacy cue of Chinese to English. MacWhinney (1987) proposed that if a cue has similar mappings in both L1 and L2, positive transfer is most likely to occur. Lexical/semantic cues are most likely to have the straight forward mapping in L1 and L2. Consequently, semantic cues become the backup strategies in interlanguage sentence comprehension.

Processing Variations Between L1 and L2 Within Individuals

Variations in comprehension strategies used by the native English-speaking subjects are large. Thirty-six percent (N = 8) of the English-speaking subjects had the unitary system which functions in the same manner for both English and Chinese sentences. Among eight of the subjects, five of them consistently used word order cues when interpreting both English and Chinese sentences. They had a bias to SVO, VOS and OSV sequences. Three of them used the animacy cue primarily in their interpretation of both English and Chinese sentences. As a result, their responses are similar to the responses of Chinese-speaking subjects. It should be noted that the only two English-speaking subjects whose ages are over forty in this study both chose to use the animacy cue in their comprehension of both English and Chinese sentences. The study by Liu et al (1992) also showed that there are significant differences among the bilinguals who were first exposed to their second language at different ages. Further research may needed to investigate the relationship between age factors and comprehension strategies.

The rest of fourteen native English-speaking subjects used the different modes of processing strategies in interpreting English and Chinese sentences. They primarily used word order strategy with English sentences. When interpreting Chinese sentences, they used word order strategy with NVN and VNN orders to certain extent, as well as the animacy cue with the NNV order.

It is clear that a number of individuals have a distinctive strategy preference. These individuals did not change their strategy mode when interpreting their native and target languages. Their preference is not related to their target language proficiency. Two native English-speaking subjects used the word order cue in interpreting Chinese sentences and their levels of Chinese were very advanced. In addition, the English-speaking subjects who preferred the animacy cue with both Chinese and English varied greatly in their levels of Chinese proficiency. The individual preference for the comprehension strategy found in this study coincides with the findings in Wulfeck et al (1986). The Spanish-English bilingual

Group 2 of Wulfeck et al used the animacy cue in interpreting both their L1 and L2 sentences. Yet one difference between this study and Wulfeck et al is that their subjects were bilinguals, while the subjects in this study are adult L2 learners.

Variations in comprehension strategy used by the native Chinese-speaking subjects are much smaller in comparison to the native English-speaking subjects. This suggests that animacy is a strong factor in Chinese sentence comprehension and is overwhelmingly transferred to the L2 English sentence interpretation. It also indicates that Chinese language, which is highly meaning and pragmatics oriented, has a strong influence on the native Chinese speakers when they learn a foreign language. We would posit that the semantic/pragmatic operation in the process of sentence comprehension is so strong that the native speakers of semantic/pragmatic languages such as Chinese will transfer their semantic strategies to their foreign language learning. Indeed, we found the evidence of the strong transfer of Japanese to English by the subjects of Harrington (1987) and Sasaki (1991, 1994), of Italian to English by the subjects of Gass (1987) and Bates and MacWhinney (1981), and the animacy preference of English speakers in Harrington (1987) and this study.

Conclusion

This study investigates comprehension strategies employed by native English and Chinese speakers when interpreting English and Chinese sentences. Three findings can be stated. The first is that it is much easier and faster for native speakers of a syntactic language such as English to move to a semantic/pragmatic language such as Chinese than the reverse. CFL learners show strong sensitivity to the semantic factors of the target language, and their comprehension pattern approximates that of the native Chinese speakers to a large degree. EFL learners seem to be aware of the word order factors of the target language and move in that direction. Yet, EFL learners show much greater L1 transfer in their interlanguage comprehension than CFL learners. Thus, the second finding of this study is that in the acquisition of a syntactic language by a native speakers of a semantic language, the transfer of L1 comprehension strategies is much stronger than vice versa.

Based on the observations, we propose that comprehension strategies of Chinese are generally characterized with more semantic features than syntactic features. The semantic strategy is of great strength, and the meaning-based approach is the backup strategy in interlanguage comprehension development.

Third, individual preferences and individual processing variations are evident. The comprehension strategies of both the native and target language sentences within individuals indicate that there is a distinct strategy preference with a number of learners. While most individual learners use different processing modes when interpreting L1 and target languages, some individuals do not change their strategies. However, we do not know at this time what factors are correlate with strategy preference. The data from this study seem to suggest that age might be a factor. Further studies are needed to investigate this phenomenon. Also, based on the data of individual processing variation, we think that within-group variation should be taken into consideration when we investigate language-specific processing strategies.

This study suggests a number of areas for exploration in comprehension strategies. The function of the topic prominence in sentence processing needs to be further investigated, and the interaction between animacy and pragmatic cues is an important area in Chinese sentence processing. Furthermore, the relationship between language-specific strategies and individual preferences of strategies needs to be addressed and investigated. The causes of individual processing variations in interpreting a foreign language remains an important and interesting topic.

APPENDIX

Lexical items used. Translation equivalents were used for the Chinese version.
Animate nouns: horse, dog, cat, calf, fish, monkey, cow
Inanimate nouns: ball, pen, cup, table, chair, car, chopsticks
Verbs: bite, hold, pat, push, kiss, look at, eat

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