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이중언어와 문장 처리 전략: 한국어-중국어 이중언어자의 전략후행전이

Bilingualism and Processing Strategies: Backward Transfer in Korean-Chinese Bilinguals

이 귀 옥** 전 종 섭*** 박 혜 원**** 안 정 옥*****
(Kwee-Ock Lee) (Jong Sup Jun) (Hye-Won Park) (Jung-Ok Ahn)

요 약 이 논문은 한국어-중국어(=KC) 이중언어자의 문장 처리 전략을 실험적으로 연구하여 한국어 단일언어자의 문장 처리 전략과 비교함으로써 (1) KC 이중 언어에 나타나는 문장 처리 전략의 전반적 특징을 밝히고, (2) 제 1 언어 처리 전략과 제 2 언어 처리 전략 간의 간섭이 이중 언어 발달에 영향을 줄 수 있음을 보이는 것을 목적으로 한다. 이를 위해 우리는 중국 연변 조선족 집거촌의 만 3세부터 성인에 이르는 다양한 연령 집단에서 166 명의 피험자를 모집하여 실시간 주어/행동주 판정 실험을 실시하였다 (cf. Liu, Bates & Li, 1992). 실험 결과를 한국어 단일언어자 대상의 이전 연구와 비교하여 다음 결론에 도달하였다. 첫째, 한국어 단일언어 아동은 3-4세 경 생물성 (animacy)에 근거해 문장의 주어/행동주를 판별하는 반면, KC 이중언어 아동은 생물성 전략 이외에도 어순 전략을 많이 활용한다. 둘째, KC 이중언어자가 주어/행동주 판별에 형태소를 활용하는 시기는 10세 이후로 한국어 단일언어 아동의 5세 경과 비교하여 많이 늦다. 셋째, 한국어 단일언어자 성인은 형태소 전략을 최우선적으로 활용하는 반면, KC 이중언어자는 성인이 되어서도 형태소 전략 이외에 생물성 전략과 어순 전략을 적극적으로 활용한다. KC 이중언어자의 언어 수행은 생물성과 어순이 중요한 중국어의 영향을 받은 것으로 보이며, 이는 Liu, Bates & Li (1992)가 제안하는 조기이중언어자의 전략 후행 전이를 지지하는 결과라 할 수 있다.

주제어 bilingualism, processing strategy, linking, cue validity

Abstracts This paper reports our experimental study with Korean-Chinese (=KC) bilinguals as compared with Korean monolinguals. We aim to find KC bilingual speakers' sentence processing strategies, and the interaction between the L1 and L2 grammars in bilingual development. To this end, we recruited 166 subjects of all age groups from age 3 to adult in the Korean autonomous community in Yanji, China, and did a classical subject/actor identification test, where subjects are supposed to pick out the subject/actor of both sensical and nonsensical sentences (cf. Liu, Bates & Li, 1992). We compared our results with our previous work on monolingual Koreans, and found out that KC bilinguals rely on word order as well as animacy; that KC bilinguals make use of morphology at age 10 as compared with age 5 for monolinguals; and that KC bilingual adults rely on animacy and word order as well as morphology, while monolingual Korean adults rely solely on morphology for sentence interpretation. Given that animacy and word order play an important role in the Chinese grammar, our finding lends support to the backward transfer which Liu, Bates & Li (1992) propose for early bilingualism.

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** 경성대학교(Kyungsung University)
*** 서울대학교(Seoul National University)
**** 울산대학교(University of Ulsan)
***** 호원대학교(Howon University)
연구세부분야: Language acquisition, Bilingualism

주소 : (Corresponding Author: 전종섭)
서울시 관악구 신림동 산 56-1 (우) 151-742
서울대학교 인문대학 대학영어
전화 : 02-880-5864
Fax : 02-880-5881
E-Mail : jongsupjun@korea.com

1. Introduction

Mapping a linguistic *form* onto its *function/role* is crucial in sentence interpretation. Language users should somehow assign surface strings of sounds to a limited number of grammatical functions or thematic roles. The linking problem between form and function/role is a crucial part of many frameworks in both generative grammar and functionalist theories.

In the generative tradition, linking is expressed by rules or principles; e.g. the theta criterion in GB [1] (cf. theta-checking [2]); correspondence rules in conceptual semantics [3-5]; the functional schemata in LFG [6]; and the HPSG syn-sem attribute value matrices [7]. Language development is characterized as the presence or absence of rules or principles. One implication of this view is the *continuity hypothesis* (=CH): once a child gets a correct rule, (s)he continues to maintain the rule as adults (cf. [8], esp. part III).[1] Monolingual adult English speakers rely on word order to identify the subject/actor of a sentence [8]. According to CH, once English speaking children learn to use word order for sentence interpretation, they continue to maintain the rule as adults. The target grammar for word order may be expressed by the head-first/final parameter [1], or correspondence rules among independent representational levels of grammar [3-6]. Language development is characterized as the presence or absence of rules/principles.

On the other hand, functionalists often view linking as part of the *heuristics* in our general cognitive capability to maximize the efficiency of language processing [13]. In the heuristics-based linking, language users who have to figure out which string of sounds is the subject or the actor of a sentence rely on cognitive strategies. They sometimes use the animacy strategy, assuming that an animate NP is the subject/actor of the sentence. They may consider the linearly first NP as the subject/actor of the sentence following the word order strategy. They may look at morphological case or verb agreement to correctly assign function/role to surface forms.

Earlier studies in the functionalist tradition have discovered that different languages adopt different strategies for linking between form and function/role. English listeners heavily rely on word order for sentence comprehension, while Italians make overwhelming use of agreement and animacy [14]. Chinese speakers, on the other hand, use an animacy-based strategy [15]. Lee, Jun & Park [16] show that Korean speakers rely solely on morphological case in the presence of overt case-markers to figure out correct linking between form and function/role. These studies have adopted the classical design, where subjects are presented with both sensical and nonsensical sentences with two-place action verbs, and then asked to pick out the subject/actor of each sentence [17-18].

The functionalist approaches to language processing imply the gradual development of processing strategies, i.e. the *gradual development hypothesis* (=GDH). In GDH, children's processing strategies either persist or change in the adult grammar.[2] Monolingual adult English speakers may not have used the word order strategy since childhood; monolingual Italian speakers may have used something other than agreement in their childhood; and monolingual Chinese speakers may have used something other than animacy when young. Language development is characterized as efforts to facilitate sentence processing using cognitive strategies regardless of the acquisition of the target grammar. One question immediately arises: which view is more plausible between CH and GDH?[3] In this paper, we provide

1) CH in this paper is similar to, but not exactly the same as either the strong continuity hypothesis (=SCH; [9], [10]) or the weak continuity hypothesis (=WCH; [11], [12]). Like SCH and WCH, CH views the adult grammar on a continuum of the child grammar. Unlike SCH and WCH, CH does not have much to say about the inventory of lexical and functional categories provided by UG. Rather, CH is a specific proposal on the development of a rule system. In this sense, CH is closer to what Kilborn [8] dubbed the competence-based theory of acquisition.

2) GDH differs from Borer and Wexler's [19] maturation hypothesis (=MH), in that MH lies in the tradition of the competence-based view of language, whereas GDH takes the performance-based perspective of language. In MH, certain rules/principles become accessible only after children's language reaches some maturational stages; hence, the language faculty *per se* is characterized by the presence/absence of rules/principles. On the other hand, in GDH, the language faculty allows various processing strategies for certain developmental steps; for instance, the animacy strategy at age 4 is replaced by the morphology strategy at age 5.

3) An anonymous reviewer points out that the comparison between CH and GDH is not appropriate, in that CH, as a competence-based theory, makes predictions only about *competence* without much regard for *performance*. Chomsky's [20] original intent was to restrict the theoretical concern only to the knowledge of language, i.e. *competence*. Notice, however, that it is this restricted concern of language that makes many influential linguists believe that Chomsky is on the wrong track. Jackendoff [5] convincingly argues that a theory that can explain both competence and performance is far better than a

experimental evidence for the strategy-based linking; i.e. children adopt linking strategies that are available under their limited language proficiency.

Researchers are also interested in a developmental issue with bilingual speakers, since different default strategies of two languages may crash or interrupt with each other for bilinguals. L1 strategies sometimes override L2 strategies (*forward transfer*); or L2 strategies override L1 strategies (*backward transfer*). It is possible to have two discrete sets of strategies for L1 and L2 (*differentiation*). It may be the case that L1 and L2 strategies are mixed into a third unknown set of strategies (*amalgamation*).

In this paper, we report the backward transfer effect with 166 Korean-Chinese (=KC) bilingual speakers at various age groups (from age 3 to adult), who were exposed to L2 (i.e. Chinese) before age 4. Our result supports Liu, Bates & Li's [18] thesis that early bilinguals show backward transfer. Liu, Bates & Li's [18] outstanding work has been done with adult speakers, and it was hard to find an overall developmental profile of how the competition of different strategies results in the end state, i.e. the backward transfer, for adult speakers. In our study, we tested subjects of all age groups, so we could address the developmental issue better than Liu, Bates & Li.

The paper has the following organization. Section 2 briefly sums up earlier works on the mapping problem. Section 3 presents four hypotheses about the interaction between L1 and L2 grammars for bilinguals, and sums up earlier works on the issue. Section 4 presents the test design and results of our current study. Section 5 is the discussion of our experiment results, and section 6 is the summary and conclusion.

2. Performance-Based Works on the Mapping Problem

While generative theories characterize language in terms of the presence or absence of domain-specific rules, functionalist or performance models tend to view language within a larger frame of general cognition. Performance models are particularly efficient in accounting for children's gradual development of linguistic knowledge. During the last decade, children's strategic interpretation of sentences has received much attention cross-linguistically [8, 14, 17-18, 25-26]. These studies emphasize language performance on the basis of processing cues and the competition among valid cues; the presence or absence of a particular rule plays a relatively insignificant role in these approaches unlike competence-based works (cf. [8]).

Most functionalist works on the sentence interpretation strategy, i.e. the mapping problem between form and function/role, have adopted the experimental design in which subjects are presented with both sensical and nonsensical sentences containing two nouns plus one transitive verb, and are asked to identify the actor (or subject) of the sentence [17-18].[4] For instance, an English speaker hears an ungrammatical sentence *The pencils is kissing the elephant*, followed by a question *Who did the action of kissing?* The use of nonsensical sentences, according to Liu, Bates & Li [18], is analogous with the use of visual illusion in the vision literature.

The target sentence contains at least three types of cues to assign a linguistic form to the appropriate function/role. First, the word order cue tells that the first NP *pencils* is the subject/actor of the sentence, since it is linearly first. Second, the animacy cue tells that the second NP *elephant* should be the subject/actor of the sentence, since it is animate. Finally, the morpho-syntactic agreement cue as shown by the 3rd person singular *be*, i.e. *is*, shows that the first NP *pencils* must not be the subject/actor of the sentence.

These cues compete each other to determine the form-function mapping in a sentence. The competition is resolved differently from language to language. Most English speakers pick out *pencils* as the subject/actor of the sentence, which suggests that English speakers tend to adopt the word order strategy for sentence comprehension. On the other

competence theory that has nothing to say about processing. Furthermore, it is not only functionalist theories [21-24] that are to blame for connecting competence and processing; generative theories like conceptual semantics [3-4], LFG [6], and HPSG [7] all address processing issues of grammar. In short, a competence grammar that cannot explain processing is not justified as much as it was in 1965 (i.e. Chomsky's [20] *Aspects of the Theory of Syntax*); and there are a number of generative theories that concern about processing and esp. psychological reality in the field.

4) There is a potential problem in assuming that the actor is equivalent to the subject of the sentence: thematic roles are not in one-to-one correspondence with grammatical functions (cf. [27]). Fortunately, the potential problem does not arise in the experimental design above, in that researchers use two-place action verbs, where the actor role consistently corresponds to the subject of the sentence.

hand, Italian speakers make overwhelming use of agreement and animacy [14]. Chinese speakers use an animacy-based strategy to figure out the function/role of an NP [15]. Languages share such surface cues as animacy, word order, and morphology. The cue validity varies cross-linguistically.

3. Sentence Processing and Bilingualism

Lee, Jun & Park [16] did an experimental study of sentence processing strategies with 86 monolingual Korean speakers at all age groups. What we found is that children at age 3 use the animacy strategy with some word order effect; that morphology comes into play at age 5; that adolescents at age 10 use mixed strategies of morphology, animacy, and word order; and that adults after 20 resort solely to morphology in the presence of case-markers. Our previous study with monolingual speakers clearly supports the gradual development view, in that language development is not characterized as the presence or absence of rules. Rather, children try to maximize the efficiency of language processing by relying on interpretation strategies available under their limited language capacity.

Chinese is a language which lacks in morpho-syntactic device to mark the function/meaning for a form. Earlier works on Chinese show that animacy or word order is particularly important for linking. Miao [28], Miao et al. [15], and Liu, Bates & Li [18] consistently report that Chinese subjects heavily rely on the animacy cue to interpret Chinese sentences.[5]

In the present study, we focus on the sentence interpretation strategy of Korean-Chinese bilingual speakers. As in our previous study with monolingual Koreans, we aim to understand how Korean-Chinese bilinguals assign function/role to surface forms in the real-time processing of language.

Bilingual speakers are placed in two-language settings. Researchers have proposed at least four hypotheses of bilingual language performance [13, 17, 30-31].

(1) Four hypotheses of bilingual language processing:
   a. Differentiation: Strategies appropriate for the second language (L2) are acquired and applied exclusively in the context of L2 (i.e., the bilingual behaves essentially as a monolingual in each language);
   b. Forward transfer: Strategies appropriate for the first language (L1) are applied, perhaps inappropriately, to the second language (L2);
   c. Backward transfer: L2 strategies that have been learned and applied to L2 come to supplant L1 strategies; and
   d. Amalgamation: New stratigies may be adopted in the course of L2 learning and become assimilated into one amalgamated set that is applied to processing in both languages.
   ([8, 924)

Differentiation is ideal, but hard to find. Most earlier studies on the sentence processing strategy report forward transfer [25, 30-33]; Vaid & Pandit [34] report the amalgamation effect with some of their Hindi-English bilingual subjects.[6] Backward transfer -- the interruption of the L2 strategies into the L1 strategies -- was first reported by Liu, Bates & Li [18] for Chinese-English bilinguals depending upon their age of exposure to L2: speakers exposed to L2 before age 4 or between 12 and 16 display a strong backward transfer effect.

Given that Korean makes extensive use of the morpho-syntactic cue whereas Chinese relies on animacy or word order, we expect some transfer or interruption of strategies between the two languages among Korean-Chinese bilinguals. To this end, we have modified and replicated Liu, Bates & Li's [18] experimental design with 189 Korean-Chinese bilinguals (75 males and 91 females) in various age groups to see the validity of different cues. Unlike many earlier studies with languages like English, Italian, and Chinese which tested only adult subjects to see the end effect of the strategy transfer, we tested virtually all age groups from children to adults. This way, we could not only find out the interaction between L1 and L2 strategies in adult grammar, but also the role of strategy in the overall language development for bilingual speakers.

5) The role of word order varies from study to study. Miao [28] and Chen et al. [29] observe no significant effect of the word order cue in Chinese, whereas Miao et al. [15] report significant roles for both animacy and word order.

6) Vaid & Pandit also report 5 cases of differentiation.

4. Present Study

4.1. Subjects

We tested 189 Korean-Chinese bilinguals (75 males and 91 females) in Yanji (연변) autonomous Korean community in China. Yanji is particulary useful for our purpose, since Koreans (i.e. 조선족) make 39 % of the local population as of year 2003 [35]. Yanji area is what we call a Korea in China; members of the Korean community are raised as bilinguals of Korean (L1) and Chinese (L2); and they are exposed to Chinese through such various sources as mass media, nurseries, kindergartens, etc. before age 4. Despite half a century long history of the Korean immigration into the area, members of the Yanji Korean community preserve the Korean culture and language well, and makes the entire community a natural habitat of ideal bilinguals [35].

<Table 1> summarizes the number of subjects in each age group with the mean and standard deviation of their ages. None of our subjects reportedly have language impairment or intellectual deficits.

<Table 1> Subjects of the study:[7]

	Age Group	Actual Range (Y;M)	Mean (Y;M)	SD (Y;M)	N
Bilinguals (Korean-Chinese)	Age 3	2;05-4;00	3;06	0;04	49
	Age 4	4.01-4.11	4;06	0;03	31
	Age 5	5;01-7;00	5;06	0;04	39
	Age 10	9-11 Y	10.0 Y	.6 Y	40
	Adults	17-24 Y	20.0 Y	1.1 Y	30

4.2. Procedure and Material

The design of the experiment is simple: subjects listened to a sentence carefully, and chose the subject/actor of the sentence by responding to the experimenter's question *Who did the action?* Target sentences were all stated in the past tense, and composed of two nouns and one transitive verb randomly selected from the word list in (2)

(2) a. Animate nouns:
enni 'girl', oppa 'boy', khokkili 'elephant', komtoli 'bear', kkulkkuli 'pig', kangaci 'dog', thokki 'rabbit', songaci 'calf', koyangi 'cat'
b. Inanimate nouns:
uyca 'chair', yenphil 'pencil', chayksang 'desk', phwungsen 'baloon', panana 'banana', sakwa 'apple', kong 'ball'
c. Verbs:
kkaymulta 'to bite', mekta 'to eat', milta 'to push', ttaylita 'to beat', pota 'to see', capta 'to catch, hold', tencita 'to throw'

All the verbs in (2c) were excerpted from S-H Lee's [36] list of the verbs that more than 50 % of two-year-old Korean children use in their voluntary speech according to their parental reports.

Target sentences include both sensical and nonsensical ones, as shown in (3).

(3) a. thokki-ka kangaci-lul cap-ass-e-yo
rabbit-NOM puppy-ACC hold-Pst-Dec-Hon
nwu-ka cap-ass-ci-yo?
who held-Q-Hon
'A rabbit held a puppy (by the hand, etc.). Who did the holding action?'
b. yenphil-i songaci-lul ttayli-ess-e-yo
pencil-NOM calf-ACC beat-Pst-Dec-Hon
nwu-ka ttali-ess-ci-yo?
who beated-Q-Hon
'A pencil beated/hit a calf. Who did the beating action?'

In our experimental design, three cues were introduced: animacy, morphological case, and word order. Following previous studies [8, 14, 18], we varied animacy in three dimensions: Animate NP followed by Animate NP (=AA); Animate NP followed by Inanimate NP (=AI); and Inanimate NP followed by Animate NP (=IA). Morphological case defines two case frames: NOM-ACC (=NA), and ACC-NOM (=AN). Three types of animacy plus two case frames define

7) For age 3 group, only 1 child was 2;05, and the other 48 children were over 3;00. For age 5 group, only 1 child was 7;00, and the other 38 children were under 6;00. For adults group, one subject was 17 years old, and the other 29 were over 19 years old. These outliars were included in each age group, since there was no significant difference between each of these outliars and the age group (s)he belongs to. The mean and the standard deviation columns also show that there were not many outliars in each age group.

six types of test sentences in (4).[8]

(4) I. AAVNA: Animate-NOM Animate-ACC Verb
thokki-ka kangaci-lul cap-ass-e-yo
rabbit-NOM puppy-ACC held
II. AAVAN: Animate-ACC Animate-NOM Verb
komtoli-lul kkulkkuli-ka kkaymul-ess-e-yo
bear-ACC pig-NOM bit
III. AIVNA: Animate-NOM Inanimate-ACC Verb
komtoli-ka yenphil-ul mek-ess-e-yo
bear-NOM pencil-ACC ate
IV. AIVAN: Animate-ACC Inanimate-NOM Verb
thokki-lul uyca-ka mil-ess-e-yo
rabbit-ACC chair-NOM pushed
V. IAVNA: Inanimate-NOM Animate-ACC Verb
yenphil-i songaci-lul ttayli-ess-e-yo
pencil-NOM calf-ACC beated
VI. IAVAN: Inanimate-ACC Animate-NOM Verb
uyca-lul khokkili-ka kkaymul-ess-e-yo
chair-ACC elephant-NOM bit

Three sentences were made for each type in (4), so each subject was asked exactly 18 questions.

Unlike in previous studies mostly with Indo-European languages, we did not vary the word order in our experiment. We simply used one fixed word order, namely NP-NP-V. We did not control word orders like NP-V-NP, and V-NP-NP, because such word orders generate far more unnatural sentences in Korean than in most Indo-European languages.

4.3. Results

One interesting assumption of earlier studies of this sort is that percent correct has no meaning, since we are dealing with nonsense sentences as well as sensical ones. Following Bates & MacWhinney [14], researchers coded subjects' responses into a dependent variable *percent choice of the first noun as agent*. In this method, a score of 1 means that the subject always chooses the first noun as the agent of the sentence; a score of 0 means that the subject always chooses the second noun as the agent of the sentence; and a score of 0.5 indicates that the subject performs at chance level.

On the contrary, we found that percent correct can have *some* meaning even for nonsense sentences in our restricted experimental design. We have already shown that morphological case is the most reliable cue to identify the function/role of an NP in the monolingual Korean grammar [16]. The word order plays a role only when case morphology is absent. Crucially, all the test sentences in our experiment have overt case-markers, and monolingual Korean adults, i.e. our controls, unanimously pick out nominative-marked NPs as the subject/actor of the sentence. So we coded our subjects' responses into a dependent variable percent correct, and found out a neat correlation between the response patterns and the age variable. We also coded the subjects' responses into *percent choice of the first noun as agent* following Bates & MacWhinney's [14] methodology. The result was almost the same as coding into the variable *percent correct*, but a little bit more complicated.

We gave our subjects a score of 1 whenever they choose the nominative-marked NP as agent, and a score of 0 whenever they fail to choose the nominative-marked NP as agent. <Table 2> summarizes the mean scores for each sentence type with respect to age groups.[9]

<Table 2> Mean of *Percent Correct* for sentence types:

	Age Group	N	I. AAVNA	II. AAVAN	III. AIVNA	IV. AIVAN	V. IAVNA	VI. IAVAN
Bi (KC)	Age 3	31	61	45	71	13	33	65
	Age 4	27	72	36	84	25	46	72
	Age 5	38	71	37	89	17	56	74
	Age 10	40	96	45	98	47	89	83
	Adults	30	93	60	98	67	84	93

8) The labels for sentence types in (4) are somewhat confusing: the first two letters on the lefthand side of V(erb) refer to the animacy frame, and the last two letters on the righthand side of V refer to the case frame.

9) Notice that the numbers of subjects (i.e N) in <Table 2> are smaller than in <Table 1> especially for children under age 5: eighteen children at age 3, four at age 4, and one at age 5 could not respond to most of the questions. <Table 2> shows the descriptive statistics after excluding these 23 children from the analysis. In our earlier study with 86 monolingual Koreans, only four children under age 5 were excluded from the analysis. Granting that the total number of monolingual Koreans is about half the number of bilingual subjects (i.e. 86 vs. 166), 23 exclusions need some explanation. See 5.1 and Footnote 10 for a possible account.

5. Discussion

5.1. Animacy vs. Word order

Sentence types III, IV, V, and VI can be categorized in terms of what we call expected scores of animacy and word order. Expected scores are simply the particular score we expect a subject to get in case the subject uses either one of the animacy or the word order strategies. So, for instance, with the sentence type "V. IAVNA", subjects would make incorrect responses in case they followed only the animacy strategy, since the animate noun in this sentence type is marked accusative. On the other hand, subjects would make correct responses in case they followed only the word order strategy, since the linearly first NP is marked nominative in this sentence type. <Table 3> summarizes the four sentence types with reference to expected scores.

<Table 3> Animacy vs. word order with reference to *expected scores*

Animacy / Word Order	Expected Score = 0 (Incorrect)	Expected Score = 1 (Correct)
Expected Score = 0 (Incorrect)	IV. AIVAN	VI. IAVAN
Expected Score = 1 (Correct)	V. IAVNA	III. AIVNA

<Table 4> compares Korean-Chinese bilingual speakers with monolingual Koreans in terms of the mean of percent correct for each sentence type in <Table 3>. The mean scores for monolingual Koreans come from Lee, Jun & Park [16].

First, for the sentence type "VI. IAVAN", only the expected score for animacy is 1. Bilingual children under age 5 did relatively well in spite of the scrambled subject position; the differences among 65, 72, and 74 are not significant (Games-Howell$_{post\ hoc}$, p=.907 & p=.730 for the differences between age 3 and 4, and between age 3 and 5 respectively). One way ANOVA reveals that there is a significant age difference in this type (F(4, 161)=5.519, p=.000); the difference between adolescents and adults is not significant (p=.286). Therefore, the significant effect is due to the difference between under age 5 and over age 10. The fact that children under age 5 did relatively well shows that the animacy strategy is available under their limited linguistic knowledge. The fact that adolescents and adults did far better than children shows that they make use of morphology as well, since the expected score for word order is 0 in this type. This finding is contrasted with our previous finding with monolingual Koreans: monolingual Koreans performed well at all age levels. We interpreted this as a strong animacy effect under age 5, and a joint effect of animacy and morphology after adolescence [16].

Secondly, for the sentence type "V. IAVNA", only the expected score for word order is 1. There is a significant age difference among subjects (F(4, 161)=26.097, p=.000). Post hoc tests reveal that the differences between age 3 and

<Table 4> Mean of *Percent Correct* by speaker types

	Expected Scores		Speaker Type	Age Group				
	Animacy	Word Order		3	4	5	10	Adults
IV. AIVAN	0	0	KC Biling	13	25	17	47	67
			K Mono	22	17	33	60	100
V. IAVNA	0	1	KC Biling	33	46	56	89	84
			K Mono	36	48	80	93	100
VI. IAVAN	1	0	KC Biling	65	72	74	83	93
			K Mono	91	88	90	97	99
III. AIVNA	1	1	KC Biling	71	84	89	98	98
			K Mono	91	95	100	100	100

4, and between age 4 and 5 are not significant (p=.430 & .553 respectively); and that the differences between age 5 and 10 or above are very significant (p=.000 & .005 respectively). Here, we see a weak word order effect plus some morphology effect after adolescence. Bilinguals do not behave much differently from monolinguals under age 4. Interestingly, however, monolinguals did far better at age 5, and also after adolescence. We interpret this as an important sign that bilinguals do not have exactly the same grammar as monolinguals. In other words, Korean-Chinese bilinguals somehow grasp the morphology strategy, but they still do not reach the point of perfection of monolingual Korean speakers.

Thirdly, subjects' performances became much worse with "IV. AIVAN" than "V. IAVNA". For the type "IV. AIVAN", neither animacy nor word order is available to the subjects. They have to rely soly on morphology. The prediction is that bilingual speakers will do better after adolescence than under age 5; and that monolingual speakers after adolescence will go through dramatic improvement since they make use of the morphology cue skillfully. The prediction is nicely confirmed by the actual data: for bilinguals, there is a significant age effect for "IV. AIVAN" ($F(4, 161)=17.613$, $p=.000$), but the differences between age 3 and 4, and between age 3 and 5 are not significant (p=.398 & .963 respectively); and for monolinguals, there is a significant difference among age groups ($F(4, 77)=31.85$, $p=.000$), but post hoc analyses show that the differences among ages 3, 4, and 5 are not significant.

Finally, look at the sentence type "III. AIVNA". When the expected scores for both animacy and word order are 1, subjects perform generally well at all age groups. Monolingual speakers are not interesting: their performance is perfect. Bilingual speakers also do very well for all age groups, but there is a significant difference among age groups as well ($F(4, 161)=9.345$, $p=.000$). The difference is due to the split between under age 4 and over age 5: there is no significant difference between age 3 and age 4 (p=.137), but a very significant difference between age 3 and age 5 or above (p=.003 & .000 respectively).

Two questions immediately arise. Why could the bilingual children under age 4 not perform as well as the children over age 5 in "III. AIVNA", in that both animacy and word order conspire to tell them which NP is the subject/actor of the sentence? How could the bilingual speakers at age 5 and above perform as well as monolinguals, given that bilinguals cannot make use of the morphology cue as well as monolinguals? Our working hypothesis for the first question is that bilingual children, although both animacy and word order are available to them, cannot make use of these cues for a particular language with desired agility.[10] Given that previous crosslinguistic studies on language acquisition have reported children's wide use of animacy and word order at early ages [37], it is not clear why our bilingual subjects could not use processing cues as well as monolingual children. We leave this question for our future research.

The second question is more interesting. Unlike monolingual Koreans, Korean-Chinese bilinguals cannot make use of morphology dexterously. Nevertheless, for the sentence type "III. AIVNA", bilinguals perform as well as monolinguals. This is because "III. AIVNA" is the type where both animacy and word order conspire to pick out the correct subject/actor of a sentence. This strongly suggests that Korean-Chinese bilinguals mix the animacy and possibly word order strategies with the morphology strategy. (5) presents the summary of our finding so far.[11]

(5) Sentence interpretation strategy for Korean-Chinese bilinguals:
   a. Children strongly resort to the animacy strategy to identify the actor/subject of a sentence at very early ages;
   b. Children use the word order strategy to identify the actor/subject of a sentence at very early ages, but the effect is smaller than animacy;
   c. Adolescents and adults make use of the

10) This explains why there are far more invalid subjects (i.e. exclusions) with bilinguals than with monolinguals under age 5.

11) For monolingual Koreans, Lee, Jun & Park [16] suggest the following strategies:
   a. Children strongly resort to the animacy strategy to identify the actor/subject of a sentence at very early ages;
   b. Children use the word order strategy to identify the actor/subject of a sentence at very early ages, but the effect is much smaller than animacy;
   c. Children over age 5 seem to make use of the morphology cue to identify the actor/subject of a sentence;
   d. Adolescents make more use of the morpho-syntactic information, but they rely on such other strategies as animacy and word order as well; and
   e. Adults make exclusive use of the morpho-syntactic information to assign function/role to surface forms.

<Table 5> Mean of *Percent Correct* for two animate NPs

	Expected Scores		Speaker Type	Age Group				
	Animacy	Word Order		3	4	5	10	Adults
I. AAVNA	0.5	1	KC Biling	61	72	71	96	93
			K Mono	73	74	90	97	99
II. AAVAN	0.5	0	KC Biling	45	36	37	45	60
			K Mono	36	45	43	50	100

morpho-syntactic information, but they rely on their earlier strategies like animacy and word order as well; and

d. Adults never get to the point where they can rely solely on morphology like monolingual Koreans

5.2. Two Animate NPs

We see an interesting morphology effect in "I. AAVNA" and "II. AAVAN". In these sentence types, we have two animate NPs. If animacy were the only determining factor, subjects would perform at chance levels, simply because both arguments are animate. <Table 5> sums up the percent correct for bilinguals as compared with monolinguals in Lee, Jun & Park [17].

Korean-Chinese bilinguals did far better for "I. AAVNA" than for "II. AAVAN" at all age groups. For "I. AAVNA", there is a significant age difference ($F(4, 161)=12.091$, $p=.000$); but post hoc analyses show that the difference is due to the difference between children under age 5 and adolescents/adults ($p=.71$, between ages 3 and 5; $p=.000$, between ages 5 and 10). Notice that the first NP for this word order is marked nominative; the word order strategy allows the children to pick out the correct NP as the subject/actor of the sentence. Adolescents and adults almost always pick out the correct subject/actor of the sentence, since they make use of the morphology strategy. In (5), we suggested that adolescents and adults make use of word order as well as morphology. In this sentence type, the word order and morphology conspire to pick out the first NP as the subject/actor of the sentence, which explains the bilingual speakers' high rate of correct responses. The overall pattern of bilinguals is similar to that of monolinguals except that the morphology effect comes into play at age 10 for bilinguals, and at age 5 for monolinguals (cf. [16]), which is consistent with our generalizations in (5).

For "II. AAVAN", however, word order does not tell much about the linking problem: the linearly first NP is marked accusative. We find a small significant age difference for this sentence type ($F(4, 161)=2.884$, $p=.024$). But post hoc analyses reveal that this difference is almost negligible: the significant effect is just due to the difference between age 5 and adults ($p=.036$); even the difference between age 4 and adults is not significant ($p=.052$). This strongly supports the generalizations in (5) that Korean-Chinese bilingual adults rely on word order and animacy as well as morphology unlike Korean monolinguals. On the contrary, Korean monolingual adults never fail to pick out the correct subject/actor of the sentence, a telling difference between monolinguals and bilinguals (cf. [16]).

6. Summary and Conclusion

Two questions were raised in the beginning: the continuity hypothesis vs. the gradual development hypothesis; and the strategy transfer in bilingual language development. Our previous study with monolinguals [16] supports the gradual development hypothesis; i.e. language users rely on processing strategies that are available under their limited language capacity. Our current study provides evidence for the gradual development hypothesis along the same line. Bilinguals do not just sit back and wait until they master a certain rule or principle of a target grammar. Their language performance cannot be explained by simply assuming the presence or absence of rules. Rather, bilinguals actively participate in construing a sentence with various heuristics with their incomplete grammar. Various cues like animacy, word order, and morphology compete with one another for bilinguals to make a best guess for a given sentence.

Moreover, bilinguals never reach the point of perfection for a target grammar. This would be a mystery under the competence-based view of grammar: *How could we explain the 70 % correct responses in case a certain rule were present or absent?* Under the performance-based view of grammar, 70 % correct responses is a natural consequence of the interaction among various cues and cue validities depending upon age.

As we discussed in section 4, Chinese is a language where animacy and word order play a more salient role. On the other hand, morphology is more important for linking than anything else in Korean [16]. As is clear from our discussion so far, Korean-Chinese bilinguals in our study clearly show a more salient animacy/word order effect than monolingual Koreans. This is just the expected result, if the L2 strategies interrupt the L1 strategies for bilinguals (*backward transfer*). In the literature, more forward transfers have been reported than the backward transfer. To our knowledge, Liu, Bates & Li's [18] pioneering observation that speakers exposed to L2 before age 4 have not been independently motivated by a large-scale study that shows an overall path of bilingual development. Our study makes a unique contribution to the developmental issue, in that we studied Korean-Chinese bilingual subjects at all age groups, and could provide a general picture of language development showing how backward transfer could occur throughout the entire stages of bilingual development.

References

[1] Chomsky, Noam (1981). *Lectures on Government and Binding: the Pisa Lectures.* Dordrecht: Foris.

[2] Chomsky, Noam (1995). *The Minimalist Program.* Cambridge, MA: MIT Press.

[3] Jackendoff, Ray (1990). *Semantic Structures.* Cambridge, MA: MIT Press.

[4] Jackendoff, Ray (1997). *The Architecture of the Language Faculty.* Cambridge, MA: MIT Press.

[5] Jackendoff, Ray (2002). *Foundations of Language: Brain, Meaning, Grammar, Evolution.* Oxford: Oxford Univ. Press.

[6] Bresnan, Joan (ed.) (1982). *The Mental Representation of Grammatical Relations.* Cambridge, MA: MIT Press.

[7] Pollard, Carl & Sag, Ivan A. (1994). *Head-Driven Phrase Structure Grammar.* Chicago: Univ. of Chicago Press.

[8] Kilborn, Kerry (1994). Learning a Language Late: Second Language Acquisition in Adults. In Morton Ann Gernsbacher (ed.), *Handbook of Psycholinguistics.* New York: Academic Press.

[9] Hyams, Nina (1986). *Language Acquisition and the Theory of Parameters.* Dordrecht: Reidel.

[10] Lust, Barbara (1999). Universal Grammar: The Strong Continuity Hypothesis in First Language Acquisition. In W. C. Ritchie & T. K. Bhatia, *Handbook Of Child Language Acquisition.* San Diego: Academic Press.

[11] Vainikka, Anne (1993). Case in the Development of English Syntax. *Language Acquisition* 3, 257-324.

[12] Vainikka, Anne & Young-Scholten, Martha (1998). The Initial State in the L2 Acquisition of Phrase Structure. In Wayne O'Neil (ed.), *The Generative Study of Second Language Acquisition.* London: Lawrence Erlbaum Associates, Publishers.

[13] MacWhinney, Brian (1992). Competition and Transfer in Second Language Learning. In R. J. Harris (ed.), *Cognitive Processing in Bilinguals.* Amsterdam: North-Holland.

[14] Bates, Elizabeth & MacWhinney, Brian (1989). Functionalism and the Competition Model. In B. MacWhinney & E. Bates (eds.), *The Crosslinguistic Study of Sentence Processing.* New York: Cambridge Univ. Press.

[15] Miao, X., Chen, G. & Ying, H. (1986). Sentence Comprehension in Chinese. In Zhu Man-Shu (ed.), *Studies in Child Language Development.* Shanghai: East China Univ. Press.

[16] Lee, Kwee-Ock, Jun, Jong Sup & Park, Hye-Won (2003). Sentence Interpretation Strategies in Korean: Evidence for a Performance-Based View of Language. *Korean Journal of Applied Linguistics* 19-2, 25-39.

[17] Bates, Elizabeth & MacWhinney, Brian (1982). Functionalist Approaches to Grammar. In E. Wanner & L. Gleitman (eds.), *Language Acquisition: The State of the Art.* New York: Cambridge Univ. Press.

[18] Liu, Hua, Bates, Elizabeth & Li, Ping (1992). Sentence Interpretation in Bilingual Speakers of English and Chinese. *Applied Psycholinguistics* 13, 451-484.

[19] Borer, Hagit & Wexler, Kenneth (1987). The Maturation of Syntax. In T. Roeper & E. Williams (eds.), *Parameter Setting*. Dordrecht: Reidel.

[20] Chomsky, Noam (1965). *Aspects of the Theory of Syntax*. Cambridge, MA: MIT Press.

[21] Van Valin, Robert D., Jr. & LaPolla, Randy J. (1997). *Syntax: Structure, Meaning and Function*. Cambridge: Cambridge Univ. Press.

[22] Goldberg, Adele (1995). *Constructions: A Construction Grammar Approach to Argument Structure*. Chicago: Univ. of Chicago Press.

[23] Langacker, Ronald (1988). An Overview of Cognitive Grammar. In Brygida Rudzka-Ostyn (ed.), *Topics in Cognitive Linguistics*. Amsterdam: John Benjamins Publishing Company.

[24] Langacker, Ronald (1991). *Foundations of Cognitive Grammar, Vol. 2, Descriptive Application*. Stanford: Stanford Univ. Press.

[25] Gass, Susan (1987). The Resolution of Conflicts among Competing Systems: A Bidirectional Perspective. *Applied Psycholinguistics* 8, 351-378.

[26] Harrington, Michael (1987). Processing Transfer: Language-specific Processing Strategies as a Source of Interlanguage Violation. *Applied Psycholinguistics* 8, 351-378.

[27] Jun, Jong Sup (2003). *Syntactic and Semantic Bases of Case-Assignment: A Study of Verbal Nouns, Light Verbs, and Dative*. Ph.D. Dissertation, Brandeis University. (Ann Arbor, MI: ProQuest Company)

[28] Miao, Xiaochun (1981). Word Order and Semantic Categories in Chinese Sentence Comprehension. *International Journal of Psycholinguistic Research* 8, 23-33.

[29] Chen, S. Tzeng, O. & Bates, E. (1990). Sentence Interpretation in Chinese Aphasia. Unpublished ms., Univ. of Southern California; Univ. of California, Riverside; Univ. of California, San Diego.

[30] Kilborn, Kerry (1987). *Sentence Processing in a Second Language: Seeking a Performance Definition of Fluency*. Ph.D. Dissertation, Univ. of California, San Diego.

[31] Kilborn, Kerry & Ito, T. (1989). Sentence Processing Strategies in Adult Bilinguals. In B. MacWhinney & E. Bates (eds.), *The Crosslinguistic Study of Sentence Processing*. New York: Cambridge Univ. Press.

[32] Kilborn, Kerry (1989). Sentence Processing in a Second Language: The Timing of Transfer. *Language and Speech*, 32(1), 1-23.

[33] McDonald, J. (1987). Sentence Interpretation in Bilingual speakers of English and Dutch. *Applied Psycholinguistics* 8, 379-415.

[34] Vaid, J. & Pandit, R. (1991). Sentence Interpretation in Normal and Aphasic Hindi Speakers. *Brain and Language* 41-2, 250-274.

[35] 이귀옥 외 6 인 (2003). 중국 연변 조선족 아동의 이중언어 환경. 부산: 서림출판사.

[36] 이수향 (1999). 1 1/2-2 세 정상아동의 용언발달 조사연구. 이화여대, 석사학위 논문.

[37] Slobin, Dan (ed.) (1985-1992). *The Cross-Linguistic Study of Language Acquisition*. Vols. 1-5. Hillsdale, NJ: Lawrence Erlbaum.