A DEVELOPMENTAL STUDY OF THE INTERPRETATION OF ANAPHORA IN JAPANESE: AN INTERIM REPORT*

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Abstract

A written comprehension test consisting of passages containing non-null anaphora (forward nominal, predicate, and sentential) was given to 628 subjects (students from the third grade of primary school through college) in order to grasp how they interpret anaphors with explicit and non-explicit antecedents. An analysis of their interpretation of anaphors revealed the following. 1) For children at the primary school level, interpretation of sentential anaphora and predicate anaphora is more difficult than that of nominal anaphora. 2) Interpretation of anaphora with a non-explicit antecedent is more difficult than that with an explicit antecedent for children at the primary school level. 3) Younger children (especially third graders) tend to choose a surface string which corresponds to an NP when the anaphora is difficult to understand.

1. Introduction

In recent years, anaphora has became a central issue in linguistic research, since it provides both theoretical and empirical grounds for pursuing several major problems in the Revised Extended Standard Theory (cf. Chomsky 1975, 1977, 1980, 1981). This paper is concerned with the interpretation of anaphora in Japanese. In order to clarify the developmental aspects of anaphora in Japanese, we have made an experimental study on the interpretation of anaphora by Japanese school children. In this section, we will first give a rough specification of anaphora, and then explicate the theoretical background for our developmental study.

1.1 Types of Anaphora

(1) is an example of pronominal anaphora in Japanese. (English translations for the following examples can be found in Section 3.1.1.)

(1) Watashitachi ningen wa, doogu o tsukuri, <u>sore</u> o tsukatte seikatsushite imasu. Dewa, yasei no doobutsu wa doo deshoo ka. Doobutsu demo, ichiban rikoo da to iwareru chinpanjii kurai ni naru to, nani ka doogu o tsukau no de wa nai deshoo ka. [<u>sore</u> = doogu]

(Test Item I)

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In a linguistic context or discourse like (1), the interpretation of the pronoun sore 'them' is determined by the interpretation of another preceding expression doogu 'tools,' which is its antecedent. Words or phrases used in this way are called anaphors, and expressions to which these words or phrases refer are called antecedents. Thus, anaphora is defined in terms of anaphors and their antecedents.

The following sentences illustrate three types of anaphora in Japanese: nominal anaphora, predicate anaphora, and sentential anaphora. This classification of a-naphora is made in terms of the syntactic categories of antecedents.

(2) Nominal Anaphora

Tsukaikata o shiranaide sore o tsukau to konpyuutaa wa konran o maneku koto ga aru. 'When you use it without knowing how, the computer can cause confusion.' [sore = konpyuutaa]

(3) Predicate Anaphora

Gakkyuubunko no hon o naraberu no ni, irogami ya teepu o tsukatte irowakesuru koto mo arimasu. Tatoeba, doowa no hon ni wa aka, denki no hon ni wa kiiro, shakaika no hon ni wa ao, to yuu yoo ni, yakusoku o kimete oku no desu. Soo suru to, yomitai hon o sagasu no ni benri desu. [soo (suru) = irogami ya teepu o tsukatte irowakesuru]

(Test Item XII)

(4) Sentential Anaphora

Chinpanjii wa, abunai to kizuita toki wa, yobu yoo na koe o dashite, nakamani shirasemasu. Mata, tabemono ga mitsukatta toki wa, sakebigoe o agete shirasemasu. . . .

Kore ni taishite, ningen wa, abunai no wa, dokuhebi ga iru kara na no ka, raion ga kita kara na no ka, soretomo shingoo ga aka ni kawatta kara na no ka, kuwashiku shiraseru koto ga dekimasu. Sore wa, ningen ga kotoba o tsukau kara desu. . . .

Kotoba o tsukau to monogoto o kuwashiku shiraseru koto ga dekiru dake de naku, me no mae ni nai monogoto o omoiukabetari, iroiro na koto o kangaetari suru koto ga dekimasu. Tatoeba, watashitachi ga, "Yamanobori o shita to shimasu." to kaite aru bun o kyooshitsu de yonda to shimasu. Kono baai, hontoo wa kyooshitsu no naka ni iru noni, yamanobori no yoosu o sugu omoiukaberu koto ga dekimasu. Keredomo, kotoba o motanai chinpanjii ni wa sore wa taihen muzukashii koto da to omowaremasu. [sore = me no mae ni nai monogoto o omoiukabetari iroiro na koto o kangaetari suru koto]

(Test Item IX)

There are other ways to classify anaphora: for example, forward versus backward anaphora, sentence versus discourse anaphora, and non-null versus null anaphora. Forward anaphora (exemplified in (1)) refers to a situation where the antecedent precedes its anaphor, while backward anaphora (exemplified in (2)) refers to a situation where the antecedent follows its anaphor. Sentence-level (intrasentential) anaphora refers to an anaphoric context where the antecedent and the anaphor are in the same sentence (example (1)), while discourse-level (intersentential) anaphora refers to one where the antecedent and the anaphor are in different sentences (example (3)). Finally, non-null anaphora refers to an anaphoric context where the anaphor is a non-null linguistic expression (examples (1-4)), while null anaphora refers to one where the anaphor is not lexically expressed (examples (5) and (6)).

(5) Taroo wa Hanako o aishite iru. Jiroo mo ɸ da. [ɸ = Hanako o aishite iru]
'Taroo loves Hanako, and Jiroo does ɸ, too'.

(6)   Chinpanjii wa, arizuka no chiisana ana o mitsukeru to, chikaku no kino kawa o haide kite, ha to te o umaku tsukatte, nagasa 20 senchi gurai no hosoi boo o tsukurimasu. Chinpanjii wa kono boo o tsukuru no ni, shinayaka de tsuyoi ki no kawa o sagashimasu. Soo de nai to, ϕ_1 ana ni ϕ_2 sashikomu toki ni, ϕ_2 tochuu de oretari magattari shite, shiroari no tokoro made todokanai kara desu. [ϕ_1 = chinpanjii, ϕ_2 = boo]

(Test Item XI)

In explaining how anaphora is understood, we must clarify how the interpretation of anaphora is carried out: that is, we must examine the problem of determining the antecedent of an anaphor. Recent studies have demonstrated that various properties of syntactic and semantic structure of sentences or discourse, as well as inference, can interact to determine the interpretation of anaphora (cf. Carden 1982, Chomsky 1972, Corum 1973, Greene 1980, Kartturnen 1977, Jackendoff 1972, Lakoff 1970, Lakoff and Ross 1973, Lasnik 1976, Nash-Webber 1977 and 1978, Nash-Webber and Reiter 1977, Postal 1969, Reinhart 1976, Ross 1971, Stenning 1981, Terazu et al. 1980, Terazu 1983b, Wasow 1979, Webber 1978, etc.).

In examples (1)–(4), the antecedents can be linguistically identified as a substring or a constituent (of the syntactic representation) of the sentence. The following examples, however, show that this is not always the case.

(7)   "Ha ha ha." Tamotsu ga waraimashita. Tamotsu wa, tobiorikaketa hisashi no tokoro kara, isoide Kazuya o tasuke ni koyoo to shite ita tokoro datta no desu.

Tokoroga, Kazuya wa, moo te ga itaku natte, eda kara ochimashita. Kazuya no ashi no saki kara yane made wa, 50 senchi gurai shika hanarete imasen deshita kara. Kazuya wa bujini yane ni orita no desu. Sore o mite Tamotsu mo anshinshimashita. Anshinshita node tsui waratte shimatta no desu. [sore = Kazuya ga bujini yane ni orita]

(Test Item VI)

(8)   Nezumi wa neko o odorokashite iru tsumori desu ga, neko wa soo wa kanjite imasen. Nezumi to neko no shita koto ya kimochi no kuichigai ni kiotsukete, omoshiroi tokoro o nukidashite mimashoo. [soo = nezumi ga neko o okorokashite iru]

(Test Item VIII)

(9)   Mukashi wa, hitobito ga yoso no hito to hanasu koto ga, hotondo arimasen desita kara, hoogen dake o tsukatte ite, nan no fuben mo arimasen deshita. Tokoroga, konnichi dewa, kootsuukikan mo hattatsushi, mata, seikatsu no hitsuyoo kara, hitobito ga iroiro na chihoo e dekakeru koto ga ooku narimashita. Soreni, iroiro na chihoo de umare sodatta hitobito ga issho ni seikatsu suru koto mo mezurashii koto dewa naku narimashita. Soo naru to, hoogen dake de hanashite ite wa otagai ni hanashi ga tsuujinakattari, imi o torichigaetari suru koto ga okorimasu. Sokode, Nihonjuu no doko no hito ni mo tsuujiru kotoba ga hitsuyoo ni narimashita. Soshite, sore o tadashiku tsukau koto ga taihen taisetsu na koto ni narimashita. [soo (naru) = hitobito ga iroiro na chihoo e dekakeru koto ga ooku nari iroiro na chihoo de umare sodatta hitobito ga issho ni seikatsusuru no mo mezurashii koto de wa naku naru]

(Test Item X)

(10)   Monshirochoo no furusato wa, Yooroppa da to kangaerarete iru. Yooroppa kara Chuuooajia o hete Chuugoku ya Shiberia ni sumitsuki soko kara nihon ni watatte kita to kangaeru koto ga mottomo sujimichi ni atte iru yoo da. Naze nara, hakusai ya kyabetsu nado, monshirochoo no suki na shokumotsu de aru yasairui no hirogarikata ga, soo da kara de aru. [soo (da) = Yooroppa kara Chuuooajia o hete Chuugoku ya Shiberia o tootte Nihon e to yuu mono da]

(Test Item XIII)

(11)   Gosai no toki, Faaburu wa, ie no kurashi ga kurushikatta node ojiisan no ie ni azukerareta. Soko wa yama no naka no ikkenya datta node, Faaburu wa kachiku ya tori ya mushi nado o tomodachi ni shite kurasu koto ni natta.

   Aru natsu no hi no yuugata no koto, ie no chikaku no yabu de, chiichii naite iru mono ga atta. Faaburu wa, <u>sore</u> ga nan no koe ka wakaranakatta. [<u>sore</u> = chiichii to yuu nakigoe]

(Test Item IV)

(12)   Watashi wa ima, Hirabayashi de, rokujussai ijoo no ojiisan, obaasantachi, gojussai kara sanjussai made no ojisan, obasantachi, nijuudai to juudai no wakai hitotachi no, mittsu no nenreebetsu guruupu ni wakete, zembu de juunin no hito ni tsuite sono kotoba o shirabete imasu. Shirabekata wa tsugi no yoo na mono desu. Mazu, hyaku no kotoba o erabi, sore o e ni kaite, mite moraimasu. Soshite, <u>sore</u> o nan to yonde iru ka o kikimasu. [<u>sore</u> = e ni kaita mono]

(Test Item V)

The expression in square brackets at the end of each example indicates the possible antecedent. It can be seen that the possible antecedents in (7)–(12) cannot be identified as syntactic substrings which occur in the discourse. Instead, the possible antecedents in (7)–(10) are indirectly derived by making reference to the semantic (or logico-semantic) representation of the sentences.

In (7), the sentential anaphor <u>sore</u> refers to the proposition, <u>Kazuya ga bujini yane ni orita</u> 'Kazuya landed safely on the roof.' In (8), the sentential anaphor <u>soo</u> refers to the proposition, <u>nezumi ga neko o odorokashite iru</u> 'the mouse is frightening the cat.' These interpretations are derived by extracting only the propositional content of the surface string <u>Kazuya wa bujini yane ni orita</u> 'Kazuya (topic) landed safely on the roof,' and <u>nezumi wa neko o odorokashite iru tsumori desu</u> 'the mouse (topic) is trying to frighten the cat.' Propositional content refers to a predicate and its arguments at the level of logico-semantic representation. Thus, the thematization (linguistically realized by the particle <u>wa</u>) and modality expressions (e.g. <u>tsumori</u>) are not included in the propositional content.

In (9), the sentential anaphor <u>soo</u> (<u>naru</u>) refers to the proposition <u>hitobito ga iroiro na chihoo e dekakeru koto ga ooku nari iroiro na chihoo de umare sodatta hitobito ga issho ni seikatsusuru no mo mezurashii koto de wa naku naru</u>, which results from combining the semantic interpretation of two sentences. (10 is an example of predicate anaphora. One possible antecedent of <u>soo (da)</u> of (10) may be represented as <u>Yooroppa kara Chuuooajia o hete Chuugoku ya Shiberia o tootte Nihon e to yuu mono da</u>. The anaphoric relation observed in (10) is, in a sense, sloppy. This interpretation is derived first by determining the route of spreading of the vegetables from VPs in the surface string <u>Yooroppa kara Chuuooajia o hete Chuugoku ya Shiberia ni sumitsuki soko kara Nihon ni watatte kita</u> '<it> passed through Central Asia, settled in China and Siberia, and from there <it> came to Japan' and then by supplying predicates which are appropriate for the subject of the predicate anaphor. Thus, in (10), the subject of the anaphor is <u>yasairui no hirogarikata</u> 'the spreading of vegetables' and this NP cannot be a subject of verbs like <u>sumitsuku</u> 'settle' or <u>watatte kuru</u> 'come' which actually occur in the linguistic discourse.

These examples indicate how an antecedent which is not explicit in the linguistic context is captured at the level of semantic representation by the interaction of several semantic interpretation rules (cf. Terazu 1983b). Examples (11) and (12)

constitute additional, more interesting instances of anaphora which involve non-explicit antecedents. In (11), the nominal anaphor <u>sore</u> refers to <u>chiichii to yuu nakigoe</u> 'the sound of something crying' and in (12), the nominal anaphor <u>sore</u> refers to <u>e ni kaita mono</u> 'things which have been drawn.' In (11), although the antecedent is not mentioned in the discourse its interpretation is restricted by the noun <u>koe</u> 'voice' (which follows the anaphor) which involves a sound. If in place of <u>nan no koe</u> 'what kind of voice,' <u>nani</u> 'what' occurs (i.e. <u>Faaburu wa sore ga nani ka wakaranakatta</u> 'Fabre didn't know what it was'), the antecedent can be something like <u>chiichii to naite iru mono</u> 'the thing which was crying' rather than <u>chiichii to iu nakigoe</u> 'the voice/sound of something crying.' In (12), the antecedent of the anaphor is not the action which is mentioned in the discourse (<u>e ni kaite</u> 'draw a picture') but what results from that action (<u>e ni kaita mono</u> 'things which have been drawn'). (11) and (12) are thus examples of inferential anaphora, since, the antecedents of these nominal anaphors are accounted for by inference from the linguistic context or discourse and not by syntactic structure (cf. Terazu et al. 1980 for a more detailed discussion of inferential anaphora).

1.2 Aims

Since the advent of transformational grammar in linguistic theory, a great deal of research has been conducted on the interpretation of anaphora. Attention has recently been paid to the acquisition of anaphora (e.g. Ingram and Shaw 1981, Lust et al. 1980, Solan 1978, etc.), and such work provides further empirical basis for the linguistic theory of anaphora.

As we have stated in the previous section, anaphoric relations can be captured both on the basis of the structural properties of the discourse which contains the anaphor and its antecedent, and the semantic interpretation of the discourse. Thus, determination of the antecedent of an anaphor involves two components: (1) the structural determination of the possible antecedents for the anaphor in question (e.g. Reinhart 1976), and (2) the semantic specification of the antecedent (e.g. Webber 1978). In the study of adult grammar, both of these have been extensively examined, especially in English.

In the study of child grammar, the acquisition of structural restrictions on anaphora has been examined and discussed a great deal (e.g. C. Chomsky 1969, Ingram and Shaw 1981, Lust 1981 and 1983, Lust et al. 1980, Solan 1978 and 1981). However, the problem of the semantic specification of anaphora (that is, how children assign a reading to an anaphor on the basis of the semantic interpretation of the antecedent which does not violate general structural constraints on anaphora) has not been pursued. Thus at the present stage of research it is not yet known whether or not the linguistic ability to structurally determine the antecedent of an anaphor emerges at the same time as the ability to determine it semantically.

A developmental study of the semantic specification of anaphora is a prerequisite for research on the acquisition of anaphora, since the interpretation of anaphora does not consist solely of using structural factors to determine the antecedent. Furthermore, it can speak to the general questions of how children develop the mechanism of semantic interpretation and how cognitive development interacts with development of linguistic ability.

As discussed in the previous section, the interpretation of anaphora depends crucially upon the logico-semantic representation of the linguistic context or discourse, and upon some inference triggered by the various syntactic and semantic properties associated with this linguistic context. Our research aims at clarifying how children develop the mechanism for the semantic specification of anaphora. To this end, as a preliminary examination we gave a written comprehension test to Japanese primary school, junior high, senior high and university students. This test was mainly designed to pursue the following questions:

(13)   a. How do children at various ages semantically determine the antecedent of an anaphor? Does the development of this ability depend on the type of anaphora, i.e. nominal anaphora, predicate anaphora, sentential anaphora; anaphora which includes explicit linguistic antecedents, and anaphora which includes non-explicit antecedents?

   b. What kinds of heuristic devices do children use when they come across an anaphor which they find difficult to understand?

2. Experiment

2.1 Materials

The test consisted of 55 items which were divided into two overlapping groups: one for primary school students (24 items) and the other for students in junior high school through university (50 items). (The latter group included most of the items (19 items) in the former group). For primary school students, we made three test versions, each containing 8 items. For the other students, we made five versions, each containing 10 items. No subject received more than one version of the test.

Most of the test items were passages extracted from Japanese language textbooks for primary school students. most of which are for third and fourth grades. Such textbooks were adequate for our test since they include vocabulary and syntactic structure that are appropriate for the children they are designed for. (For details. see Uyeno et al. 1983.)

In this paper we will report the results of the 13 test items. which we have so far analyzed. All 13 of these were given to primary school students. and 9 items were given to students in junior high school through university. All of them involved non-null forward anaphora. Table 1 illustrates the type of anaphora each item involves. The bottom row of the table shows the grade level of the textbook from which each item was taken: asterisks (*) indicate that they had actually been used in class by the primary school children who were subjects of this test.

2.2 Subjects

The total 628 subjects consisted of primary school students (72 third graders aged 8-9 years, 74 fourth graders aged 9-10 years, 70 fifth graders aged 10-11 years, 73 sixth graders aged 11-12 years), students in the first and second year of junior high school (74 aged 12-13 years and 77 aged 13-14 years, respectively), and students in senior high school (83 students aged 15-17 years) and university (105 students aged 18-20 years). First and second graders were excluded from the test

Table 1 Test items, types of anaphora involved, and the source
(levels of textbooks) of the test items

Test Items	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Types of Anaphora	E	E	E	NE	NE	NE	NE	NE	E	NE	E	E	NE
	Nominal Anaphora					Sentential Anaphora					Predicate Anaphora		
Source (grade)	3*	4	4	4	4	4*	4	3*	3*	4	3*	3	4

E: anaphora which includes an explicit antecedent
NE: anaphora which indludes a non-explicit antecedent
*: textbooks subjects previously used

Table 2 Test items and the distribution of subjects by their grade in school

grade in school		test items	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
P	3	O	34							34				34	34
		T		38	38	38	38	38	38		38	38	38		
	4	O	34							34				34	34
		T		40	40	40	40	40	40		40	40	40		
	5	O	31							31				31	31
		T		39	39	39	39	39	39		39	39	39		
	6	O	37							37				37	37
		T		34	34	34	34	36	36		36	34	36		
J	1	O								27				32	32
		T			39	42	42	42	42		42				
	2	O								36				29	34
		T			41	41	41	41	41		41				
H		C								44	44			42	44
		T			39	39	39	39	39						
U		G								48	48			37	
		K			57	57	57	57	57						57
total per item			136	151	327	330	330	332	332	291	328	151	153	276	303

P: primary school
J: junior high school
H: senior high school
U: university
O in P: Primary School attached to Ochanomizu University
T in P: Primary School attached to Toyama University
O in J: Junior High School attached to Ochanomizu University
T in J: Junior High School attached to Toyama University
C in H: Chubu Senior High School, Toyama Prefecture
T in H: Toyama Senior High School, Toyama Prefecture
G in U: Tokyo Gakugei University
K in U: Kyoto University

because this type of written comprehension test was regarded as inappropriate for children at this level.

The distribution of subjects and schools for the 13 test items we are focusing on in this report is shown in Table 2.

2.3   Procedure

The written tests which included the 13 items in Table 1 were administered in the 6 schools and 2 universities cited in Table 2. Subjects were given the tests in the classroom. They were asked to write down their answers within 15 minutes.

The following are directions which were written on the test sheet. Direction 1 was given to primary school students and Direction 2 to students in junior high school through university.

(14) Directions

Direction 1: Tsugi no bunshoo o yonde kudasai. Sorezore no bunshoo no naka de   o hiita kotoba wa donna koto o sashite imasu ka. Bunshoo no naka no kotoba o tsukatte kotaete kudasai.
'Please read the following passages. What does each underlined word refer to? Please answer by using words which are in the passage.'

Direction 2: Tsugi no kaku bunshoo o yonde kudasai. Sorezore no bunshoo no naka ni tsukawarete iru shijigo wa donna koto o sashite imasu ka. Bunshoo no naka no goku o sankoo ni shite mondai no shijigo ga sasu to omowareru koto o tekisetsu na katachi de shitekishite kudasai.
'Please read the following passages. What does each demonstrative word in the passages refers to? Write what each demonstrative in question indicates by using words or phrases found in passages in appropriate forms.'

3.   Results and Discussion

3.1   Results

In this section, we will first present the 13 test items and the types of responses which were given to each item. (3.1.1) As discussed in 2, subjects were given directions stated as in (14) and asked to write down their answers without any further restriction. Thus, various answers were obtained in response to each test item. These were grouped into several types (i.e. a, b, c, . . .) which were judged crucial to our interests. For each test item, the frequency of responses according to type was calculated. These are presented in the form of histograms in Figs. 1-13 shown in 3.1.2. The vertical axes indicate the grade of the students examined and the horizontal axes indicate the percent of each type of responses. In 3.1.3 we present a description of the results, referring to the test items in 3.1.1 and the histograms in 3.1.2.

3.1.1   Test items and responses (A literal English translation follows each example.)

Test Item 1. (nominal anaphora, anaphor: <u>sore</u>)

Watashitachi ningen wa, doogu o tsukuri, <u>sore</u> o tsukatte seikatsushite imasu. Dewa, yasei no doobutsu wa doo deshoo ka. Doobutsu demo, ichiban rikoo da to iwareru chinpanjii kurai ni naruto, nani ka doogu o tsukau no de wa nai deshoo ka.

(Aozora 3, Part 2, Mitsumura Tosho, p. 70)

'We human beings make tools and live by using them. How about wild animals? Don't at least animals like chimpanzees, which are said to be the most intelligent (animals), use some kind of tools?'

Responses:
a. (ningen ga tsukutta) doogu 'the tools (which humans make)'
b. doogu o tsuku [ru/ri] 'making tools'
c. sono ta 'other responses'

Test Item II. (nominal anaphora, anaphor: <u>sore</u>)

Mukashi wa, hitobito ga yoso no hito to hanasu koto ga, hotondo arimasen desita kara, hoogen dake o tsukatte ite, nan no fuben mo arimasen deshita. Tokoroga, konnichi dewa, kootsuukikan mo hattatsushi, mata, seikatsu no hitsuyoo kara, hitobito ga iroiro na chihoo e dekakeru koto ga ooku narimashita. Soreni, iroiro na chihoo de umare sodatta hitobito ga issho ni seekatsusuru koto mo mezurashii koto dewa naku narimashita. Soo naru to, hoogen dake de hanashite ite wa otagai ni hanashi ga tsuujinakattari, imi o torichigaetari suru koto ga okorimasu. Sokode, Nihonjuu no doko no hito ni mo tsuujiru kotoba ga hitsuyoo ni narimashita. Soshite, <u>sore</u> o tadashiku tsukau koto ga taihen taisetsu na koto ni narimashita.

(Atarashii Kokugo 4, Part 1, Tokyo Shoseki pp. 75-76)

'In the old days people usually didn't have the chance to speak to people in other areas, so there was no problem in using one's local dialect. However, nowadays, due to advances in the means of transportation and the requirements of day-to-day living, people often travel to other areas. In addition, it has become common for people who were born in different areas to live together. With this being the case, if people use only their local dialects they will not be able to communicate with others or there will be misunderstandings. It has therefore become necessary to have a language that will be understood by everyone anywhere in Japan. And it has become very important to use [it/this language] correctly.'

Responses:
a. [(Nihon juu no) doko no hito ni mo tsuujiru kotoba/kyootuugo]
   'a language that will be understood by everyone anywhere in Japan'
b. kotoba 'a language'
c. sono ta 'other responses'
d. mukaitoo 'no response'

Test Item III. (nominal anaphora, anaphor: <u>sore</u>)

Watashi wa ima, Hirabayashi de, rokujussai ijoo no ojiisan, obaasantachi, gojussai kara sanjussai made no ojisan, obasantachi, nijuudai to juudai no wakai hitotachi no, mittsu no nenreebetsu-guruupu ni wakete, zembu de juunin no hito ni tsuite sono kotoba o shirabete imasu. Shirabekata wa tsugi no yoo na mono desu. Mazu, hyaku no kotoba o erabi, <u>sore</u> o e ni kaite, mite moraimasu. Soshite, sore o nan to yonde iru ka o kikimasu.

(Shoogaku Kokugo 4, Part 1, Nihon Shoseki, pp. 35-36)

'I am now at Hirabayashi, dividing men and women over 60, men and women from 30 to 50, and young people in their teens and 20's into three groups. I'm examining the speech of a total of 10 people. The method of examination is as follows: first, I choose 100 words, draw a picture of each word, and show <u>it</u> to the people. Then I ask what to call it.'

Responses:
a. (eranda) hyaku no kotoba '100 words (that are chosen)'
b. [(eranda) hyaku no kotoba ga arawasu mono/sashishimesu mono]
   'what the 100 words (that are chosen) represent'
c. sono ta 'other responses'
d. mukaitoo 'no response'

Test Item IV. (nominal anaphora, anaphor: <u>sore</u>)

Gosai no toki, Faaburu wa, ie no kurashi ga kurushikatta node ojiisan no ie ni azukerareta. Soko wa yama no naka no ikkenya datta node. Faaburu wa kachiku ya tori ya mushi nado o tomodachi ni shite kurasu koto ni natta.

Aru natsu no hi no yuugata no koto, ie no chikaku no yabu de, chiichii naite iru mono ga atta. Faaburu wa, <u>sore</u> ga nan no koe ka wakaranakatta.

<div align="right">(Atarashii Kokugo 4, Part 2, Tokyo Shoseki, p. 82)</div>

'When Fabre was five years old, living at home became difficult and so Fabre moved to his grandfather's house. Since it was an isolated house in the mountains, Fabre had to manage by making friends with domestic animals, birds, insects, and so on.

On summer evening there was something crying "chie-chie" in the bushes near the house. Fabre didn't know what kind of voice <u>it</u> was.'

Responses:
a. (ie no chikaku no yabu de) (chiichii(to)) naiteiru mono
   'the thing which was crying ("chie-chie") (in the bushes near the house)'
b. chiichii to iu [nakigoe/oto] 'the voice/sound of something crying'
c. sono ta 'other responses'
d. mukaitoo 'no response'

Test Item V. (nominal anaphora, anaphor: <u>sore</u>)

Watashi wa ima, Hirabayashi de, rokujussai ijoo no ojiisan, obaasantachi, gojussai kara sanjussai made no ojisan, obasantachi, nijuudai to juudai no wakai hitotachi no, mittsu no nenreebetsu guruupu ni wakete, zembu de juunin no hito ni tsuite sono kotoba o shirabete imasu. Shirabekata wa tsugi no yoo na mono desu. Mazu, hyaku no kotoba o erabi, sore o e ni kaite, mite moraimasu. Soshite, <u>sore</u> o nan to yonde iru ka o kikimasu.

<div align="right">(Shoogaku Kokugo 4, Part 1, Nihon Shoseki, pp. 35-36)</div>

'I am now at Hirabayashi, dividing men and women over 60, men and women from 30 to 50, and young people in their teens and 20's into three groups. I'm examining the speech of a total of 10 people. The method of examination is as follows: first, I choose 100 words, draw a picture of each word, and show it to the people. Then I ask what to call <u>it</u>.'

Responses:
a. (hyaku no kotoba o erabi) e ni [kaita/kaite mite moratta] mono
   'the things which have been drawn (after choosing 100 words)'
b. (hyaku no kotoba no) e 'the pictures (of 100 words)'
c. e ni kaita hyaku no kotoba 'the 100 words which have been drawn'
d. sono ta 'other responses'
e. mukaitoo 'no response'

Test Item VI. (sentential anaphora, anaphor: <u>sore</u>)

"Ha ha ha." Tamotsu ga waraimashita. Tamotsu wa, tobiorikaketa hisashi no tokoro kara, isoide Kazuya o tasuke ni koyoo to shiteita tokoro datta no desu.

Tokoroga, Kazuya wa, moo te ga itaku natte, eda kara ochimashita. Kazuya no ashi no saki kara yane made wa, 50 senchi gurai shika hanarete imasen deshita kara, Kazuya wa bujini yane ni orita no desu. <u>Sore</u> o mite Tamotsu mo anshinshimashita. Anshinshita node tsui waratte shimatta no desu.

<div align="right">(Kagayaki 4, Part 1, Mitsumura Tosho, p. 13)</div>

' "Ha, ha, ha," Tamotsu laughed. Tamotsu was about to rush, from the eave where he had jumped, to Kazuya for his rescue. But Kazuya's hands were hurting and so he fell from the branch. It had only been about 50 cm from Kazuya's foot to the roof, so Kazuya landed safely on the roof. Tamotsu was relieved to see <u>this</u>. Because he was relieved, he broke out laughing.'

Responses:
a. Kazuya <u>wa</u> buji ni yane ni orita 'Kazuya (topic) landing safely on the roof'
b. Kazuya <u>ga</u> buji ni yane ni orita 'Kazuya landing safely on the roof'
c. (buji ni) orita 'landing (safely)'
d. sono ta 'other responses'
e. mukaitoo 'no response'

Test Item VII. (sentential anaphora, anaphor: <u>sore</u>)
    Kuruma ni noseta onnanoko wa, hontoo wa nan datta no deshoo. <u>Sore</u> ga doko de wakaru ka, hanashiatte mimashoo.
                                            (Shoogakkoo Kokugo 4, Part 1, Gakkoo Tosho, p. 15)
    'What was the girl really riding in the car? Let's talk about how we know <u>this</u>.'

Responses:
a. (kuruma ni noseta) onnanoko wa (hontoo wa) nan datta [no ka/no deshoo]
   'what the girl (riding in the car) (really) was'
b. (kuruma ni noseta) onnanoko ga (hontoo wa) nan datta [no ka/no deshoo]
   'what the girl (riding in the car) (really) was'
c. (hontoo wa) nan datta [no ka/no deshoo] 'what (it) (really) was'
d. kuruma ni noseta onnanoko no shootai 'the identity of the girl riding in the car'
e. sono ta 'other responses'
f. mukaitoo 'no response'

Test Item VIII. (sentential anaphora, anaphor: <u>soo</u>)
    Nezumi wa neko o odorokashite iru tsumori desu ga, neko wa <u>soo</u> wa kanjite imasen. Nezumi to neko no shita koto ya kimochi no kuichigai ni kiotsukete, omoshiroi tokoro o nukidashite mimashoo.
                                            (Aozora 3, Part 2, Mitsumura Tosho, p. 15)
    'The mouse is trying to frighten the cat, but the cat [doesn't feel <u>that way</u>./isn't frightened.] Let's look at what the cat and the mouse did and at the differences in their feelings, and then list some interesting points.'

Responses:
a. nezumi <u>wa</u> neko o odorokashite iru 'the mouse (topic) is frightening the cat'
a'. nezumi <u>wa</u> neko o odorokashite iru <u>tsumori</u> (desu)
    'the mouse (topic) is trying to frighten the cat'
b. nezumi <u>ga</u> (neko o/jibun o) odorokashite iru 'the mouse is frightening (the cat)'
b'. nezumi <u>ga</u> (neko o/jibun o) odorokashite iru <u>tsumori</u> (desu)
    'the mouse is trying to frighten (the cat)'
c. (neko o/jibun o) odorokashite iru '<it> is frightening (the cat)'
c'. (neko o/jibun o) odorokashite iru <u>tsumori</u> '<it> is trying to frighten (the cat)'
d. (neko ga/jibun ga) (nezumi ni) odorokasarete iru
    '<(the cat)> <is> frightened (by the mouse)'
e. sono ta 'other responses'

Test Item IX. (sentential anaphora, anaphor: <u>sore</u>)
    Chinpanjii wa, abunai to kizuita toki wa, yobu yoo na koe o dashite, nakamani shirasemasu. Mata, tabemono ga mitsukatta toki wa, sakebigoe o agete shirasemasu. . . .
    Kore ni taishite, ningen wa, abunai no wa, dokuhebi ga iru kara na no ka, raion ga kita kara na no ka, soretomo shingoo ga aka ni kawatta kara na no ka, kuwashiku shiraseru koto ga dekimasu. Sore wa, ningen ga kotoba o tsukau kara desu. . . .
    Kotoba o tsukau to, monogoto o kuwashiku shiraseru koto ga dekiru dake de naku, me no mae ni nai monogoto o omoiukabetari, iroiro na koto o kangaetari suru koto ga dekimasu.

Tatoeba, watashitachi ga, "Yamanobori o shita to shimasu." to kaite aru bun o kyooshitsu de yonda to shimasu. Kono baai, hontoo wa kyooshitsu no naka ni iru noni, yamanobori no yoosu o sugu omoiukaberu koto ga dekimasu. Keredomo, kotoba o motanai chinpanjii ni wa <u>sore</u> wa taihen muzukashii kotoda to omowaremasu.

<div align="right">(Aozora 3, Part 2, Mitsumura Tosho, pp. 78–80)</div>

'When chimpanzees sense danger they warn others in their group by giving a call. Similarly, when they find food they inform others by letting out a cry. . . .

In contrast to this, human beings can fully describe the kind of danger that is present, such as that there is a snake nearby, that a lion is approaching, or that the traffic signal has turned red. This is because human beings [have/use] language. . . .

By using language, we can not only describe things fully but we can also imagine things which are not present and think about a variety of things. For example, suppose that we are in the classroom, and we read the sentence "Suppose you are climbing a mountain." In this case even though we are actually in a classroom we can easily imagine how it is to climb a mountain. However, <u>this</u> is extremely difficult for chimpanzees who don't have language.'

Responses:
a. (hontoo wa kyooshitsu no naka ni iru noni) yamanobori no yoosu o sugu ni omoiukaberu koto
   'easily imagining how it is to climb a mountain even though we are actually in a classroom'
b. me no mae ni nai monogoto o omoiukabe [ru/tari iroirona koto o kangaetari suru] koto
   'imagining things which are not present and thinking about a variety of things'
c. (yoosu o) (sugu) omoiukaberu koto 'imagining (things) (immediately)'
d. sono ta 'other responses'
e. mukaitoo 'no response'

Test Item X. (sentential anaphora, anaphor: <u>soo</u> (naru))
   Mukashi wa, hitobito ga yoso no hito to hanasu koto ga, hotondo arimasen desita kara, hoogen dake o tsukatte ite, nan no fuben mo arimasen deshita. Tokoroga, konnichi dewa, kootsuukikan mo hattatsushi, mata, seikatsu no hitsuyoo kara, hitobito ga iroiro na chihoo e dekakeru koto ga ooku narimashita. Soreni, iroiro na chihoo de umare sodatta hitobito ga issho ni seikatsu suru koto mo mezurashii koto dewa naku narimashita. <u>Soo</u> naru to, hoogen dake de hanashite ite wa otagai ni hanashi ga tsuujinakattari, imi o torichigaetari suru koto ga okorimasu. Sokode, Nihonjuu no doko no hito ni mo tsuujiru kotoba ga hitsuyoo ni narimashita. Soshite, sore o tadashiku tsukau koto ga taihen taisetsu na koto ni narimashita.

<div align="right">(Atarashii Kokugo 4, Part 1, Tokyo Shoseki pp. 75–76)</div>

'In the old days people usually didn't have the chance to speak to people in other areas, so there was no problem in using one's local dialect. However, nowadays, due to advances in the means of transportation and the requirements of day-to-day living, people often travel to other areas. In addition, it has become common for people who were born in different areas to live together. With <u>this</u> being the case, if people use only their local dialects they will not be able to communicate with others or there will be misunderstandings. It has therefore become necessary to have a language that will be understood by everyone anywhere in Japan. And it has become very important to use [it/this language] correctly.'

Responses:
a. [iroiro na chihoo de umare sodatta hitobito ga isshoni seikatsu o suru (koto ga mezurashiku naku [natta/naru]/mezurashiku naku naru] '[(it being common) for people who were born in different areas to live together/it becoming common]'
b. (kootsuukikan mo hattatsushi mata seikatsu no hitsuyoo kara) hitobito ga iroiro na chihoo e dekakeru koto ga ooku [natta/naru]
   'people often travelling to other areas due to the advances in the means of transportation

and the requirements of day-to-day living'
c. [hitobito ga iroiro na chihoo e dekakeru koto ga ooku nari iroiro na chihoo de umare sodatta hitobito ga issho ni seikatsu suru no mo mezurashii koto dewa naku naru/hitobito ga iroirona chihoo e dekaketari, iroiro na chihoo de umare sodatta hitobito ga issho ni seikatsusuru yoo ni naru]
'people often travelling to other areas and it becoming common for people who were born in different areas to live together'
d. sono ta 'other responses'
e. mukaitoo 'no response'

Test Item XI. (predicate anaphora, anaphor: <u>soo</u> (<u>de</u>))
Chinpanjii wa, arizuka no chiisana ana o mitsukeru to, chikaku no kino kawa o haide kite, ha to te o umaku tsukatte, nagasa 20 senchi gurai no hosoi boo o tsukurimasu. Chinpanjii wa kono boo o tsukuru no ni, shinayaka de tsuyoi ki no kawa o sagashimasu. <u>Soo</u> <u>de</u> nai to, ana ni sashikomu toki ni, tochuu de oretari magattari shite, shiroari no tokoro made todokanai kara desu.

(Aozora 3, Part 2, Mitsumura Tosho, p. 72)
'When chimpanzees find the small hole in an anthill they peel off some bark of a nearby tree and make a thin stick about 20 cm long, skillfully using their teeth and hands. In order to make these sticks, chimpanzees must look for tree bark which is pliant yet strong. [If the sticks are not made from <u>such</u> bark/<u>Otherwise</u>], when the chimpanzees insert them into the hole they will break or bend and won't be able to reach the white ants.'

Responses:
a. shinayaka de tsuyoi ki (no kawa) '(the bark of) a pliant and strong tree'
b. (boo o tsukuru no ni) shinayaka de tsuyoi ki no kawa o sagasu
'(In order to make sticks) <they> look for pliant and strong tree bark.'
c. sonota 'other responses'
d. mukaitoo 'no response'

Test Item XII. (predicate anaphora, anaphor: <u>soo</u> (<u>suru</u>))
Gakkyuubunko no hon o naraberu no ni, irogami ya teepu o tsukatte irowakesuru koto mo arimasu. Tatoeba, doowa no hon ni wa aka, denki no hon ni wa kiiro, shakaika no hon ni wa ao, to yuu yoo ni, yakusoku o kimete oku no desu. <u>Soo</u> <u>suru</u> to, yomitai hon o sagasu no ni benri desu.

(Shoogakkoo Kokugo 3, Part 1, Gakkoo Tosho, p. 28)
'One way to arrange the books of a classroom library is to use colored paper and tape to classify them. For example, we agree to use red for juvenile stories, yellow for biographies, green for sociology books, and blue for science books. If we <u>do</u> <u>this</u>, it will be easy to find the books we want to read.'

Responses:
a. [[doowa no hon ni wa aka, denki no hon ni wa kiiro, shakaika no hon ni wa ao, to yuu yoo ni/irowake o shite] yakusoku o kimete oku/yakusoku o kimete oku]
'by using red for juvenile stories, yellow for biographies, green for sociology books, and blue for science books, agree to classify by colors'
b. (gakkyubunko no hon o naraberu no ni) (irogami ya teepu o tsukatte) irowakesuru
'(use colored paper and tape to) classify <the books of a classroom library> (in order to arrange them)'
c. sonota 'other responses'
d. mukaitoo 'no response'

Test Item XIII. (predicate anaphora, anaphor: <u>soo</u> (<u>da</u>))

Monshirochoo no furusato wa, Yooroppa da to kangaerarete iru. Yooroppa kara Chuuoo-ajia o hete Chuugoku ya Shiberia ni sumitsuki soko kara nihon ni watatte kita to kangaeru koto ga mottomo sujimichi ni atte iru yoo da. Naze nara, hakusai ya kyabetsu nado. monshirochoo no suki na shokumotsu de aru yasairui no hirogarikata ga, <u>soo da</u> kara de aru.

<div align="right">(Shoogaku Kokugo 4, Part 1, Nihon Shoseki pp. 53-54)</div>

'The native place of the cabbage butterfly is thought to be Europe. It is reasonable to assume that from Europe it passed through Central Asia. settled in China and Siberia, and from there it came to Japan. This is because vegetables such as Chinese cabbage which are the foods the butterfly likes. <u>spread in this pattern</u>.'

Responses.
a. (mottomo) sujimichi ni atteiru 'it being (most) reasonable'
b. Yooroppa kara Chuuooajia o hete Chuugoku ya Shiberia [o hete/o tootte/ni hirogari/ni kite] Nihon ni ([to iumon da/hirogatte kita/watatte kita])
   '<it> spread from Europe through Central Asia to China and Siberia and then to Japan'
b'. Yooroppa kara Chuuooajia o hete Chuugoku ya Shiberia ni sumitsuki Nihon ni watatte kita
   '<it> came from Europe through Central Asia, settled in China and Siberia, and then <it> came to Japan'
c. monshirochoo to monshirochoo no sukina tabemono no [tsutawari/hirogari] kata ga [onaji/niteiru]
   'the spreading of the butterfly and the food which the butterfly likes are the same/similar'
d. sonota 'other responses'
e. mukaitoo 'no response'

3.1.2 Figures

In the following Figs. 1-13. the rate of responses according to type is shown in the form of histograms, where the vertical axes indicate the grade in school and the horizontal axes indicate the percent of total responses.

3.1.3 Description of results

In test items I and II, the correct response is <u>a</u> (e.g. (<u>ningen ga tsukutta</u>) <u>doogu</u>), which is a string that actually occurs in the discourse. Fig. 1 and 2 show that this response was predominant for all groups of children. At the sixth grade level more than 90% of the subjects gave the correct response to nominal anaphora with an explicit antecedent. The low rate of correct responses given to test item II by third graders might be due to the fact that this item was extracted from a fourth grade textbook.

As Fig. 3 shows, for test item III, the frequency of response <u>a</u> ((<u>eranda</u>) <u>hyaku no kotoba</u>) increased until the second year of junior high school when it reached 100%. It then progressively decreased among high school and university students. Response <u>b</u> ((<u>eranda</u>) <u>hyaku no kotoba ga</u> [<u>arawasu mono/sashishimesu mono</u>]), which is linguistically more sophisticated than response <u>a</u>, first appeared at the high school level and increased at the university level. Note that response <u>a</u> is a string that exists in the discourse, while response <u>b</u> is inferentially derived from the string that corresponds to response <u>a</u>.

The correct response for test item IV is <u>b</u> (<u>chiichii to iu</u> [<u>nakigoe/oto</u>]) as discussed in Section 1.1 (see (11)). As Fig. 4 shows, this response was increasing-
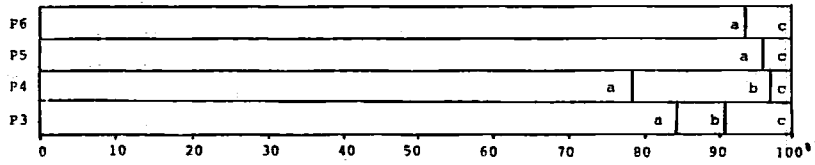
Fig. 1 *Rate of responses according to type for test item I.*
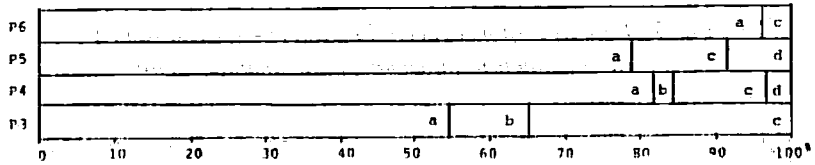*(explicit nominal anaphora, anaphor: sore)*

Fig. 2 *Rate of responses according to type for test item II.*
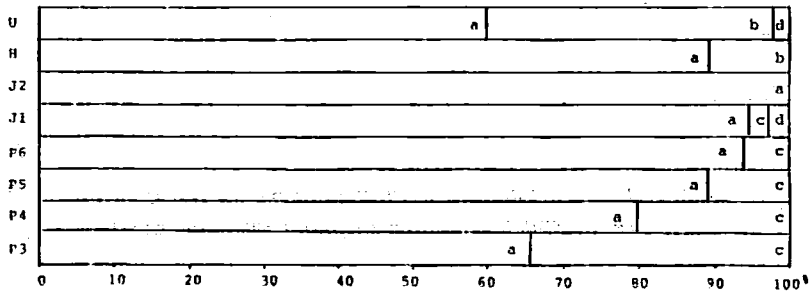*(explicit nominal anaphora, anaphor: sore)*

Fig. 3 *Rate of responses according to type for test item III.*
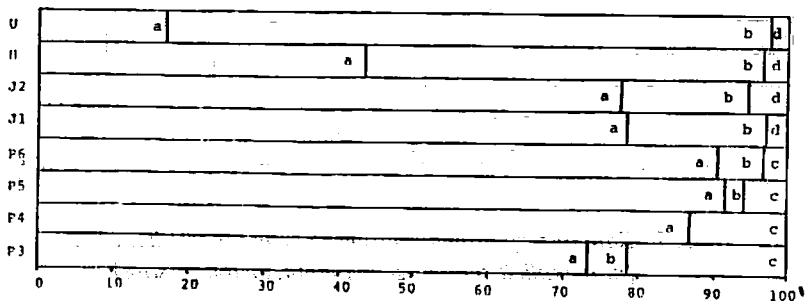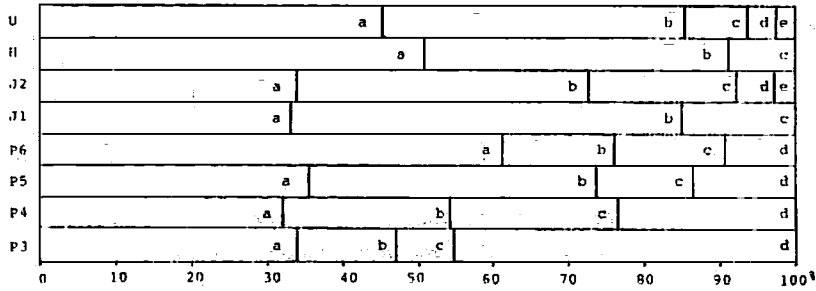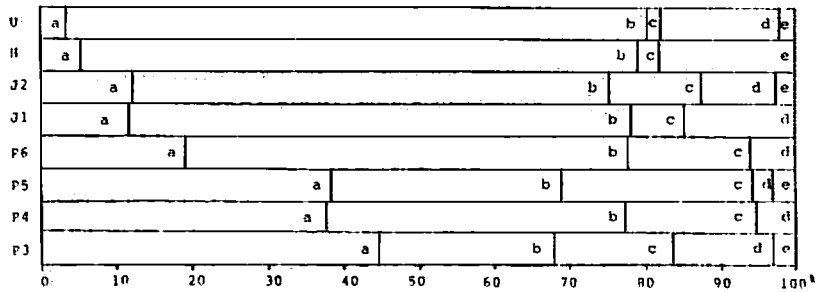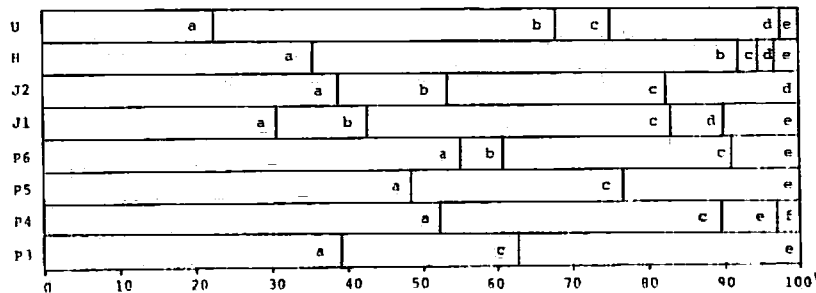*(explicit nominal anaphora, anaphor: sore)*

Fig. 4 *Rate of responses according to type for test item IV.*
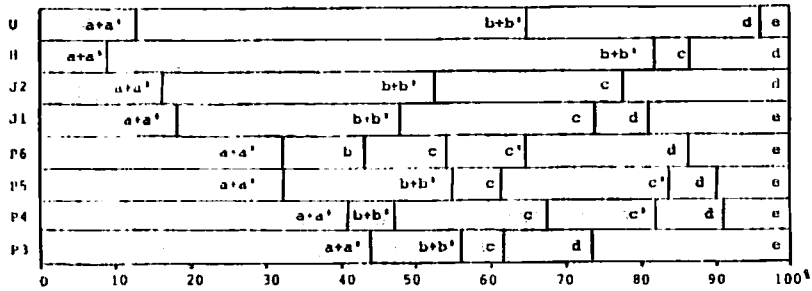*(non-explicit nominal anaphora, anaphor: sore)*

Fig. 5   *Rate of responses according to type for test item V.*
(non-explicit nominal anaphora, anaphor: sore)

Fig. 6   *Rate of responses according to type for test item VI.*
(non-explicit sentential anaphora, anaphor: sore)

Fig. 7   *Rate of responses according to type for test item VII.*
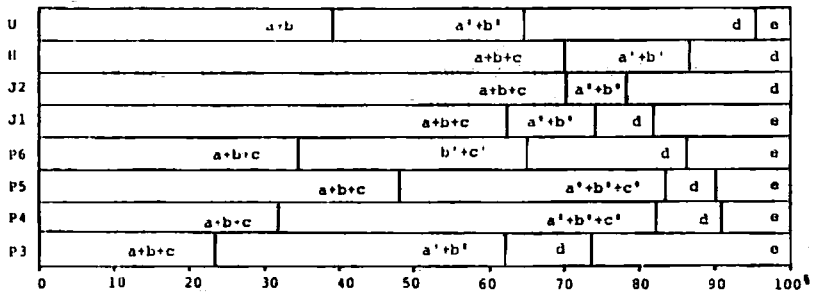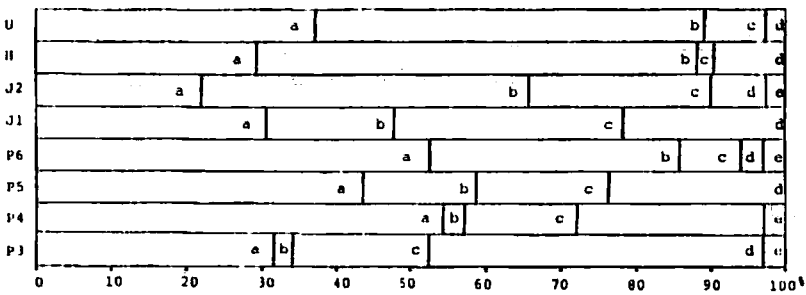*(non-explicit sentential anaphora, anaphor: sore)*

Fig. 8(1) *Rate of responses according to type for test item VIII.*
(non-explicit sentential anaphora, anaphor: soo)

Fig. 8(2) *Rate of responses according to type for test item VIII.*
(non-explicit sentential anaphora, anaphor: soo)

Fig. 9 *Rate of responses according to type for test item IX.*
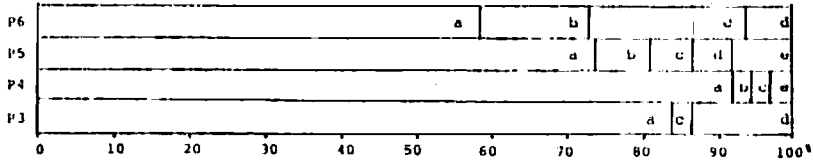*(explicit sentential anaphora, anaphor: sore)*

Fig. 10   *Rate of responses according to type for test item X.*
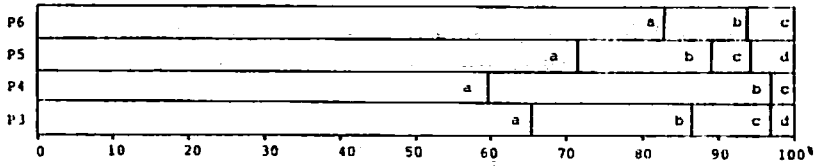   *(non-explicit sentential anaphora, anaphor: soo)*

Fig. 11   *Rate of responses according to type for test item XI.*
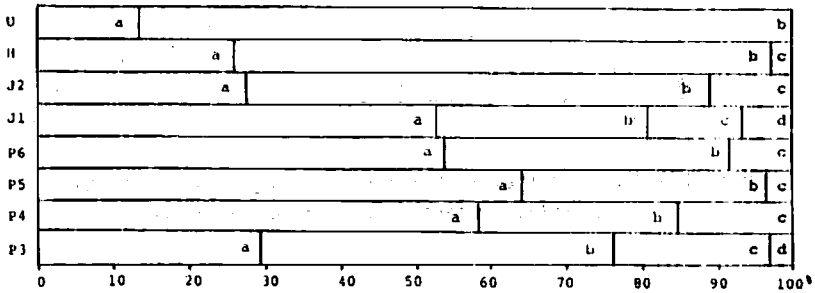   *(explicit predicate anaphora, anaphor soo (de))*

Fig. 12   *Rate of responses according to type for test item XII.*
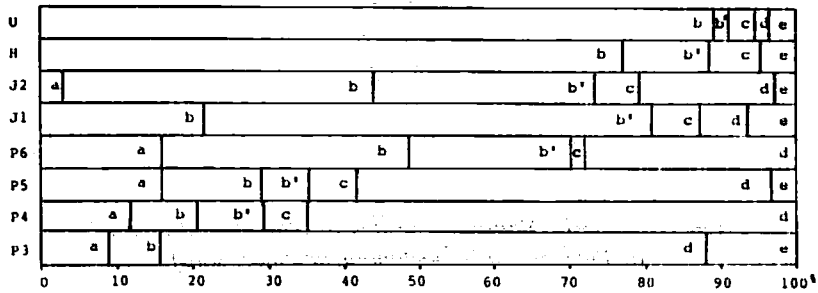   *(explicit predicate anaphora, anaphor soo (suru))*

Fig. 13   *Rate of responses according to type for test item XIII.*
          (non-explicit predicate anaphora, anaphor: soo (da))

ly prevalent beginning in the first year of junior high school, but it accounted for few of the younger age groups' responses. Response a ((chiichii to) naite iru mono), which is a string actually occurring in the discourse, was predominant until the high school level.

Test item V is an example of inferential anaphora (see the discussion on (12) in section 1.1. As Fig. 5 shows, various responses were observed for primary school subjects, but responses a and b predominated for the older subjects. Response a ((hyaku no kotoba o erabi) e ni kaita mono) corresponds to an antecedent that is inferentially derived, while response b ((hyaku no kotoba no) e) corresponds to a string that actually occurs in the discourse. Response a is more appropriate specification of the anaphor under consideration.

As discussed in section 1.1, the correct response for test item VI is b (Kazuya ga buji ni yane ni orita) which is an extraction of the propositional content of the sentence Kazuya wa buji ni yane ni orita in the discourse. Fig. 6 shows that this response increased at nearly every age level. However, for the younger age group the predominant response was a which is a string that actually occurs in the discourse, containing the thematization particle wa. The sixth grade level is the point where response b noticeably exceeds response a. In response c the subject of the sentence is not realized as an explicit linguistic expression, so it cannot be determined whether this is an extraction of propositional content as b or the reiteration of an actually occurring string as a. Some of the third grade subjects gave (bujini yane ni orita) Kazuya 'Kazuya, who landed on the roof safely' as an antecedent, which is categorized under d. These children mistook the anaphor in question as an nominal anaphor. In contrast, the subjects at the high school and university level gave (bujini yane ni orita) Kazuya no [yoosu/sugata] 'how Kazuya (who landed on the roof safely) looked' as an antecedent, which is also categorized as d.

Test item VII is another example involving extraction of propositional content. A tendency similar to that found for item VI can be seen in Fig. 7. However, there were few subjects at the primary school level who gave response b. One-third of the third grade subjects gave kuruma ni noseta onnanoko 'the girl riding in the car' as an antecedent, which is categorized under response e. The fact that the rate of correct responses given by primary school and junior high school subjects was lower in VII than in VI might be due to the fact that in the latter the linguistic context relevant for the interpretation of anaphora is a declarative sentence while in the former it is an interrogative sentence (for this point see the discussion in Terazu 1983 b). Note that several subjects in junior high school through university gave response d (kuruma ni noseta onnanoko no shootai 'the identity of the girl riding in the car') which is inferentially derived from a surface string.

As explained in Section 1.1, test item VIII was designed to clarify to the extent to which children can extract propositional content from a discourse. Item VIII contains the thematization particle wa and the modality expression tsumori. The thematization particle wa is included in responses a and a'. Responses c and c' do not include an explicit subject. The distinction between responses a, b, c on the one hand and a', b', c' on the other is that in the latter group the modality expression tsumori is included in the antecedent. In order to present the results more clearly, two histograms have been made: 8(1), which concerns the thematization particle wa, and 8(2), which concerns the modality expression tsumori. Fig. 8(1)

shows a tendency similar to that found for items VI and VII. The first year of junior high school is the point where responses b + b' which exclude thematization, noticeably exceeded responses a + a' which include thematization. Fig. 8(2) indicates that at the sixth grade level responses a + b + c which exclude the modality expression tsumori exceeded responses a' + b' + c'. It is also interesting to note that some subjects gave response d (something like (neko ga) nezumi ni odorokasarete iru), which is an expression in which the extracted propositional content is represented in passive form. This response was most frequent at the sixth grade level. The subjects who gave response d might have paid attention to the fact that the sentence containing the anaphor in question was stated from the cat's point of view while the immediately preceding sentence is stated from the mouse's point of view. Thus they might have converted the active proposition into passive in order to maintain the coherence of the discourse. From these observations it is clear that the sixth grade of primary school and the first year of junior high school is the critical period during which the logico-semantic representation of the sentence given by children becomes the same as that given by adults. At this time children can consistently separate the propositional content of a sentence from other logico-semantic properties.

Test item IX is an example of sentential anaphora with an explicit antecedent. The important point of this item is that it contains two surface strings which can be taken as antecedents. One is a surface string which corresponds to response a ((hontoo wa kyoshitsu no naka ni iru noni) yamanobori no yoosu o sugu ni omoiukaberu koto) and the other is one which corresponds to response b (me no mae ni nai monogoto o omoiukabetari iroiro na koto o kangaetari suru koto). Response a is a specific statement while response b is a more general statement and is considered to be a more appropriate response. At the primary school level, response a was predominant overall. The second year of junior high was the point where response b exceeds response a. The frequency of response b progressively increased from the junior high school level to the university level. Note that many of the third grade subjects gave kotoba o motanai chinpanjii 'chimpanzees who don't have language' which is categorized under response d as an antecedent. The high frequency of this error among the third grade children might be ascribed to the fact that test item IX is the longest of all the test items which, given the sentential anaphor (sore) which occurs in the last part of the discourse. might have made subjects' task more difficult.

The correct response for test item X is c ([hitobito ga iroiro na chihoo e dekakeru koto ga ooku nari iroiro na chihoo de umare sodatta hitobito ga issho ni seikatsu suru no mo mezurashii koto dewa naku naru/hitobito ga iroiro na chihoo e dekaketari, iroiro na chihoo de umare sodatta hitobito ga issho ni seikatsusuru yoo ni naru] 'people often travelling to other areas and it becoming common for people who were born in different areas to live together'). As mentioned above (see (9) in Section 1.1), this is the result of combining the semantic interpretation of two sentences. Fig. 10 shows that this response accounted for only a small proportion of the total responses for all age groups which were tested, but proportion does increase as children get older. The predominant response was a for all grades. This response consisted of the semantic interpretation of just one sentence, the one which immediately preceded the anaphor. Some subjects gave response b which consisted solely of the semantic interpretation of the sentence which preceded the

sentence that immediately preceded the anaphor.

Test item XI is an example of predicate anaphora with an explicit antecedent. The correct response for XI is a (shinayaka de tsuyoi kino kawa (de nai to)), which was predominant for all age groups which were tested. In general the frequency of this response increased with grade level. Subjects who gave response b might not have taken into consideration the fact that the sentence containing the anaphor in question includes other null nominal anaphors as in ... ana ni ø sashikomu toki, ø tochuu de oretari . . . 'when <they> insert <them> into the hole, <they> will break or . . .)' where both ø's refer to boo 'sticks' as discussed in Section 1.1.

Test item XII is another example of predicate anaphora with an explicit antecedent. Like test item IX which contains sentential anaphora, test item XII is interesting in that it contains two surface strings which can be taken as antecedents. One is a surface string which corresponds to response a (doowa no hon ni wa aka, denki no hon ni wa kiiro, shakai no hon ni wa ao to yuu yoo ni yakusoku o kimete oku) and the other is one which corresponds to response b ((gakkyuubunko no hon o naraberu no ni) (irogami ya teepu o tsukatte) irowakesuru). Response a is based on a specific description while response b is based on a more general statement and is considered to be a more appropriate response. For the younger age groups, response a was usually predominant while for the older ones, response b was predominant. This tendency is the same as that which was observed for test item IX. Notice that in both cases a surface string corresponding to response a which represents a specific situation occurs in the linguistic context which immediately precedes the anaphor.

To summarize, Fig. 9, 10 and 12 suggest that there is a tendency that, when different two surface strings can be antecedents, subjects will take the one which immediately precedes the anaphor. This tendency is stronger for younger children.

As discussed in Section 1.1, test item XIII is an example of predicate anaphora involving a non-explicit antecedent. The majority of third and fourth graders could not identify the antecedent correctly and gave yasairui no hirogari kata 'the way vegetables spread,' or hakusai ya kyabetsu (Chinese cabbage and cabbage,' or monshirochoo no sukina shokumotsu 'the food the cabbage butterfly likes' as antecedents, which is categorized under d in Fig. 13. Some of the primary school subjects gave response a (sujimichi ni atte iru 'reasonable'). They made a structurally correct assignment of the antecedent, that is, they chose a surface string which corresponds to the predicate phrase, but they chose a string which is not appropriate for the semantic specification of the anaphor in question. The correct response for XIII is something like response b. This response is remarkably predominant at the level of high school and university. Response b', which is a string that actually occurs in the discourse, accounted for a rather large portion of sixth grade through junior high school students' responses, and then decreased noticeably at the level of high school and university. Notice that there are some subjects who gave responses like c (monshirochoo to monshirochoo no sukina tabemono no [tsutawari/higogari] kata ga [onaji/niteiru] 'the spreading of the butterfly and the food which the butterfly likes are the same/similar'), which is semantically correct but is not structurally appropriate as an antecedent of predicate anaphora. The low frequency of correct responses given by primary school children might be attributed to the fact that this test item requires the subjects to refer to various kinds of extralinguistic

knowledge e.g. geographical knowledge about Europe, Central Asia, China, Siberia, and biological knowledge about plants and insects such as Chinese cabbage and cabbage butterflies. Fig. 13 can be regarded as a representation of how linguistic development interacts with cognitive development.

3.2 Discussion

In summary, the results of our tests have revealed the following:

(15)   a. Most children at the primary school level can correctly interpret nominal anaphora involving an explicit antecedent (as long as the disourse containing the anaphor does not exceed their reading comprehension ability) (cf. Test items I, II and III).

b. For the younger children, interpretation of predicate anaphora is a little more difficult than that of nominal anaphora (cf. Test items I and XI).

c. Many children are able to choose a surface string which corresponds to an NP as the antecedent for nominal anaphora, one which corresponds to a VP as the antecedent for predicate anaphora, and one which corresponds to an S as the antecedent for sentential anaphora. However, when there are two surface strings which can be potential antecedents, or when the anaphora in question involves a non-explicit antecedent. younger children (third and fourth graders) cannot interpret the anaphor correctly (cf. Test items IV, V, VI, VII, VIII, IX, XII and XIII). Furthermore, in some cases of anaphora with a non-explicit antecedent, many of the younger children cannot even correctly identify the antecedent structurally (cf. Test items V, VII and XIII. See also (g)).

d. The sixth grade of primary school and the first or second year of junior high school is the critical period during which the logico-semantic representation given by children becomes the same as that given by adults. By the second year of junior high school, children can consistently separate the propositional content of a sentence from other logico-semantic properties or extract some parts of the semantic representation of sentences or predicates and connect them (cf. Test Items VI, VII, VIII, IX and XIII).

f. When there are two surface strings which can be antecedents, children tend to choose the one immediately preceding the anaphor (cf. Test Items IX, X and XII).

g. The younger children (especially third graders) tend to choose a surface string which corresponds to an NP when the anaphora is difficult to understand (cf. Test Items VII, IX and XIII).

The analysis of the above results will be made on the basis of the following points. 1) to what degree did subjects make a structurally 'correct' assignment of an antecedent, where 'correct' refers to the case in which a surface string which corresponds to an NP is chosen as the antecedent for nominal anaphora, one which corresponds to a VP is chosen as the antecedent for predicate anaphora, and one which corresponds to an S is chosen as the antecedent for sentential anaphora. 2) to what degree did subjects make a semantically 'correct' assignment of an antecedent; that is, to what extent did subjects specify the interpretation of an anaphor which is appropriate to the discourse containing that anaphor. Table 3

Table 3   Comparison of correct structural and semantic identification of antecedents: percent of total structurally correct and semantically correct responses for each age group and for each item

Types of Anaphora	Nominal Anaphora													Sentential Anaphora						Predicate Anaphora					
Test Items	I		II		III		IV		V		VI		VII		VIII		IX		X		XI		XII		XIII	
(E/NE)	E		E		E		NE		NE		NE		NE		NE		E		NE		E		E		NE	
Types of Responses	a		b+a		b+a (h)		b		c+b+a		c+b+a		c+b+(d)		a/a'+b+(d)		a+b+c		c		a		b+a		b/b'+(c)	
	str	sem	str	sem	str	sem	str	sem	str	sem	str	sem	str	sem	str	sem	str	sem	str	sem	str	sem	str	sem	str	sem
3	85.3	55.3	55.3	55.3	65.8	65.8	79.0	5.4	55.3	34.2	84.2	23.7	63.2	0	73.6	(17.7)	52.6	2.6	86.8	2.6	65.8	65.8	76.5	47.1	17.6	8.8
4	79.4	79.4	85.0	82.5	80.0	80.0	87.5	0	77.5	32.5	45.0	40.0	90.0	0	91.2	(11.8)	72.5	2.5	97.5	2.5	60.0	60.0	85.3	26.5	33.7	(5.9)
5	96.8	96.8	79.5	79.5	94.0	94.2	94.9	2.6	87.2	35.9	94.9	30.8	94.9	2.6	93.5	(6.5)	76.9	15.4	87.2	5.2	71.8	71.8	96.3	32.3	19.4	(6.5)
6	94.6	94.6	97.0	97.0	94.2	94.2	97.1	5.9	91.2	61.8	94.4	58.1	91.7	5.6	86.5	(32.5)	94.1	33.3	20.6	83.3	71.8	71.8	91.9	37.8	35.5	(2.7)
1					95.1	95.1	97.6	19.0	100.0	33.3	85.7	66.7	90.5	19.1	81.5	(29.7)	78.2	16.7					81.2	20.1	53.1	(6.3)
2			100.0	100.0	95.1	17.1			92.7	34.2	87.8	63.4	82.8	31.6	100.0		90.3	43.9			89.7	62.1	73.6	47.1		(6.3)
H	100.0		100.0	100.0	97.4	53.8			100.0	51.3	82.1	74.4	94.8	59.0	100.0	(65.1)	90.9	59.1			97.6	71.4	88.6	84.1		(6.8)
U	98.2	(38.6)	98.2	98.2	98.2	80.7	94.7	45.6	82.3	77.2	75.4	68.4	95.8	(22.8)	64.6	(31.3)	97.9	52.1	100.0		65.8	81.2	91.2	92.9		(3.5)

str: structural identification of antecedents
sem: semantic identification of antecedents
Note. Percent of the parenthesized response types is indicated in parentheses.

presents a comparison of structurally correct identification of antecedents and semantically correct identification of antecedents. In this table, percent of total structurally correct and semantically correct responses for each age group and for each test item are shown.

This table illustrates the findings stated in (15a)–(15g). It is clear that in the interpretation of anaphora, there is a difference in the development of structural identification of an antecedent and semantic specification of an antecedent. The ability to make a structurally correct identification of an antecedent emerges by approximately the third or fourth grade level and therefore precedes the ability to make an interpretation that is semantically correct. The latter ability is still being developed during approximately the first or second year of junior high school level.

The important findings of this research can be summarized as follows:

(16)   a. Contrary to what is commonly believed, not all basic language acquisition is completed by age five or six years; rather, children at age 12 and 13 years (first and second year of junior high school) are still acquiring a basic part of linguistic knowledge: the logico-semantic representation of sentences and the ability to make inferences on the basis of this representation which in turn interacts with cognitive structures. This finding supports research by C. Chomsky (1969) which shows that children do not master control phenomena in English until age 10–12 years.

   b. The acquisition of syntactic structure and the acquisition of semantic structure are separate processes. This supports a study by Lust et al. (1980) on interpretation of pronominal anaphora showing that syntax and pragmatics are independent domains in early language development.

   c. In the case of interpretation of anaphora, children become sensitive to its structural aspects earlier than they are to its semantic aspects.

4. Concluding Remarks

In the present study we gave a written comprehension test to 628 primary school through university students in order to clarify development of the sensitivity to the semantic aspects of anaphora. It was found that, in the interpretation of anaphora, there is a difference in the development of structural identification of an antecedent and semantic specification of an antecedent. Specifically, it was shown that while the ability to structurally identify an antecedent emerges by the third or fourth grade level, the ability to semantically specify the antecedent is still being developed at the first or second year of junior high school level. The finding that children are still acquiring a basic part of linguistic knowledge above age ten years supports the findings of research by C. Chomsky. The finding that the acquisition of syntactic structure and semantic structure are independent processes supports research by Lust et al.

To further clarify the developmental process of the ability to semantically specify an antecedent, it will be necessary to examine younger children. As the present study was conducted in the form of a written examination, it was not practical to test children below the third grade level, but we would like to devise other means to test children from kindergarten through second grade. In addition, in order to

more fully understand the implications of the results of the present study for language acquisition, in general, it will be necessary to give similar tests to children acquiring other languages such as English.

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