Developmental Language Impairment in Japanese: A Linguistic Investigation

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Abstract

Gopnik (1992, 1994, 1995) attributes the linguistic deficits characteristic of a developmentally language-impaired (DLI) English familial aggregation to an impairment in the underlying grammar—more specifically, to an inability to construct implicit morphological rules that govern inflectional properties. This paper evaluates this hypothesis with preliminary empirical data from Japanese DLI individuals. If the impairment were one of the underlying grammar, its linguistic manifestations should be similar across diverse languages. A series of linguistically principled tests—tasks of syntactic comprehension (SC), grammaticality judgement (GJ), and tense-marking production—was administered to 8 DLI children, ranging in age from 8;9 to 12;1, 3 of whom had a positive family history of language impairment, and to 8 age-matched non-DLI children. A significant difference between the groups' performance levels was found. The data indicate that the manifestations in Japanese do, in fact, resemble those in English. Thus, the results from this study provide further empirical support for the linguistic hypothesis and suggest that some cases of DLI are genetic in origin.

0. Introduction†

This paper will present the results from a preliminary linguistic investigation of DLI[0] in Japanese. We will examine the hypothesis of Gopnik (1992, 1994, 1995) that the deficits characteristic of this disorder result from an inability to construct implicit grammatical morphological rules. If the manifestations observed in English were neither idiosyncratic nor due to particularities of the language, they should remain virtually constant across languages.

More specifically, Gopnik argues that DLI individuals are unable to construct abstract symbolic rules in their underlying grammar for certain inflectional properties such as TENSE and NUMBER. She hypothesizes that they can learn individual words such as *books* and *walked* by means of an association network, stored in declarative memory, but cannot generalize from these individual instances to build modularized implicit rules that would operate on an abstract category, such as a rule for constructing regular past-tense: STEM TENSE+PAST = LEXICAL STEM+-*ed*.

Unlike English and other Indo-European languages in which research on DLI is currently being conducted, such as German (Clahsen 1989; Clahsen, Rothweiler,

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[0] In the literature, the terms 'developmental language impairment (DLI)', 'specific language impairment (SLI)', and 'developmental dysphasia' are all used to denote roughly the same clinical diagnosis.

Woest & Marcus 1992), Italian (Leonard, Bortolini, Caselli, McGregor & Sabbadini 1992), French (Le Normand, Leonard & McGregor 1993), and Greek (Dalalakis 1994), Japanese is an agglutinative language, rich in verbal morphology. Although Japanese exhibits poor nominal inflection (e.g., NUMBER & GENDER), and verbal ageement, it does have rich verbal inflectional morphology (e.g., TENSE, ASPECT, NEGATION, CAUSATIVES and PASSIVES). Therefore, hypotheses concerning the inability of DLI speakers to construct inflectional rules can be directly addressed.

1. Linguistic Properties of DLI in English

In this section, those properties of language that are reported to be affected in English DLI speakers are discussed. We argue that, in DLI, language alone is implicated as a result of an impairment to the underlying grammar, not as the result of a general cognitive or peripheral disorder.

The fact that language alone is impaired in this disorder is not meant to imply that all aspects of language are affected. "Language is not a unitary phenomenon" (Gopnik 1992: 6); on the contrary, as has been argued by numerous researchers, it is a complex system composed of a hierarchy of abstract implicit rules which organize arbitrary words into constituents with internal structure. The data indicate that certain rules within this complex hierarchical system are implicated, such as morphological rules that govern the inflectional properties, while others are spared, such as syntactic rules that govern binding and word-order.

English DLI individuals are often reported to experience particular difficulty with morphological properties of language (Crystal, Fletcher & Garman 1976; Trantham & Pedersen 1976; Eisenson 1984; Crystal 1987; Johnston 1988; Leonard 1989; Gopnik 1990; Gopnik & Crago 1991; Loeb & Leonard 1991; Gopnik 1992; Leonard et al. 1992; Goad & Rebellati 1994; among others). Results from a wide variety of comprehension and production tests as well as from both spontaneous speech and written samples reveal that the DLI speakers are unable to systematically manipulate morphological marking. Gopnik (1992), for instance, reports that DLI individuals not only have difficulty producing appropriate morphological endings consistently, but, when asked to judge whether or not a sentence was grammatical with respect to its morphological features, performed no better than chance. Non-DLI individuals were able to judge ungrammatical sentences as unacceptable and made the appropriate feature-error correction, whereas the DLI individuals either missed the feature error altogether or incorrectly changed correct parts of the sentence. The morphological manifestations of the properties of TENSE, NUMBER, AGREEMENT, and ASPECT seem to be the most problematic for DLI speakers.

1.1. Tense

It has often been reported in the literature that English DLI speakers are unable to systematically manipulate the morphological marking of TENSE (Crystal et al. 1976; Miller 1981; Gopnik 1992, 1994, 1995; Leonard et alia 1992, among others). A closer examination of the property TENSE further indicates that the DLI children not only experience difficulty with this feature, but do not seem to have it encoded in their grammar (Gopnik 1994; Rice, Wexler & Cleave, in press) . With data from a wide variety of sources—spontaneous speech samples, elicited narratives, grammaticality judgement tasks of appropriately and inappropriately tense-marked verb forms and tense-changing tasks—Gopnik (1994: 109) argues that "the language impaired subjects do not have the intact underlying obligatory syntactic rule for tense, though they do appear to have the semantic notion of "pastness". She hypothesizes that is not the semantic notion of 'pastness' that they lack, since they do seem to mark events

which occurred in the past with lexical items such as temporal adverbials, it is simply the grammatical category of TENSE.

In addition, Ullman and Gopnik (1994), with data from a production task of past-tense inflectional morphology with regular, irregular, and novel verbs, demonstrate that DLI individuals produced past-tense marked forms when the frequency of past-tense form was high, relative to its stem, and unmarked forms when the frequency of the stem was high.

1.2. Number

Similarly, an analysis of the feature NUMBER reveals that English DLI individuals experience no difficulty differentiating between singular and plural, as evidenced by their performance on comprehension pointing tasks (Gopnik & Crago 1991; Gopnik 1992); however, they do have difficulty constructing plural forms (Crystal 1987; Crystal et al. 1987; Eisenson 1984; Leonard 1989; Gopnik 1990; Gopnik & Crago 1991; Leonard et al. 1992; Goad & Rebellati 1994). On a pilot nonsense plural formation task, Gopnik and Crago (1991) report that these individuals perform significantly differently from non-DLI individuals. This significant difference does not capture the actual nature of the responses of the DLI individuals: the so-called 'correct' responses of the DLI individuals were the by-products of the application of explicit grammatical rules. 'Add an *-s*' was a rule employed by one adult impaired speaker who continuously repeated it under her breath while applying it not only to nonsense nouns such as *wug*, but also to sibilant-final nonsense nouns such as *sass*, producing an illicit response (*sass-s*). Another subject used explicit analogies to produce plurals: by analogy with *zash-es* she produced the illicit *zoop-es* as the plural of *zoop* and *tob-es* as the plural of *tob*. Subsequent analysis of these data (Goad 1994) revealed that the DLI speakers were also using a strategy of substitution to construct plurals, namely substituting phonetically similar real plurals for the nonsense plurals such as *soup-s* for the plural of *zoop*. Goad also noted that on some occasions the DLI speakers did not assimilate the voicing specification of the plural affix *-s* to that of the stem-final obstruent, producing illicit forms such as [wʌgs] while on other occasions they seemed to be assigning stress to the syllabic affix, producing [Ɛs] for [Iz].

A follow-up study confirmed the results of the pilot study. Goad and Rebellati (1994) report that on an extended nonsense plural formation test the DLI speakers employed the same strategies that they had in the pilot study. They argue that these strategies are some of the same strategies that non-DLI children employ in the earliest stages of plural acquisition. Non-DLI children, however, only employ such strategies until they stop treating PLURAL as a separate word and incorporate it as an affix whereas the DLI speakers appear to employ them throughout their lives.

1.3. Aspect

It has been widely observed that English DLI individuals also experience difficulties with ASPECT (Trantham & Pedersen 1976; Crystal 1987; Gopnik 1990). In English it is marked by two independently generated morphemes: the *-ing* affix, which is freely generated on the verb and marked with the feature [+progressive] and *be* which is freely generated in the preverbal position and also marked [+progressive] (Travis 1984). Crystal (1987) reports that his impaired subject produced equivalent numbers of correct and incorrect aspectual constructions with both *be* and *-ing*. Gopnik (1990) reports that in spontaneous speech samples of the DLI speakers the following three forms are most prevalent: 'This *one is look*'; 'The *dragon drying* hisself'; 'The *witch is coming*' (p. 155). The DLI individuals also judged such illicit aspect-marked phrases as the first two types as acceptable on a grammaticality judgement test (Gopnik 1990). In a repetition task, the impaired subjects were able to correctly

repeat short simple aspect-marked phrases but were unable to do so with longer, more complex sentences such as 'All the girls sing and they are dancing' which was repeated as 'When the girls sing, *they dancing*' (p. 157). Trantham and Pedersen (1976) report that, on a 20-item test, the impaired child in their study produced 19 aspectual constructions: 7 proper constructions with both *be* and *-ing*, and 12 improper constructions: 6 with only *be* and 6 with only *-ing*.

2. Predictions for Japanese DLI Speakers

In this section, we will provide our predictions about the manifestations of DLI in Japanese, based on the hypothesis of Gopnik (1992) that the deficits characteristic of DLI can be attributed to an inability to construct implicit grammatical morphological rules. If the deficit is in the underlying grammar, as Gopnik argues, the manifestations observed in English should be manifested across diverse languages. More specifically, we predict that Japanese DLI speakers will experience difficulty constructing abstract implicit morphological rules which govern those inflectional properties shared by the two languages, namely TENSE and ASPECT. As indicated in the introduction, since Japanese does not exhibit nominal inflections there are no manifestations for the features of NUMBER and GENDER within noun phrases. In addition, we expect that this inability to construct implicit morphological rules will have the following language-specific manifestations: difficulty in manipulating morphological Case-marking, which will in turn trigger problems with both passive and causative constructions, and difficulty with complex verb formation. Finally, we also predict that those properties of language that appear not to be implicated in the English DLI individuals, such as the ability to construct syntactic rules that govern binding and word order, will not be affected in the Japanese DLI individuals.

2.1. Tense

Unlike in English, the grammatical feature of TENSE in Japanese is morphologically realized on both verbs and adjectives. In the verbal paradigm, it is realized in the form of an inflectional bound morpheme which attaches either directly to the verb root or after all other inflectional suffixes such as NEGATION and PASSIVE. There are two TENSE morphemes: *-(r)u*, which represents the present tense (or the non-past) and *-ta*, which encodes the past. There is no special morphology which denotes the future tense, however, the future is expressed by using either the present-tense morpheme or both the present-tense morpheme and an auxiliary which encodes probability (e.g., *-daroo* and *-deshoo*). The verbal paradigm is provided in (1).

(1)

	Present[1]	Past[2]	
a. Consonant-Final Roots:	*kak-u*	*kai-ta*	'write'
	yom-u	*yon-da*	'read'
b. Vowel-Final Roots:	*tabe-ru*	*tabe-ta*	'eat'
	mi-ru	*mi-ta*	'see'

In contrast to the verbal paradigm, there are two kinds of adjectival paradigms: adjectives and adjectival nouns. Both kinds of adjectives are inflected for TENSE. In

[1] Several Researchers disagree about the status of [r] in Japanese verb conjugation. Ashworth & Lincoln (1973) and de Chene (1982) argue that the [r] is actually a part of the present-tense morpheme while Sato (1975, 1985), Mester & Ito (1989) argue that it is an epenthetic consonant inserted to break up the illicit vowel hiatus. In this paper, we assume the latter, which allows a single present-tense suffix *-u*, is the right analysis.

[2] The past-tense suffix is underlyingly *-ta*. When it is added to a consonant-final stem, however, it triggers several morphophonemic rules: Velar Vocalization, Gemination, Coda Nasalization, and Voicing Spread, and thus is realized as *-da* (Itô & Mester 1986; Mester & Itô 1989). The *t*-initial suffix *-tara* of the conditional and that of the gerundive suffix *-te* exhibit the same morphological behaviour.

the case of adjectives, present (or non-past) TENSE is morphologically realized in the form of *-i* which attaches to the adjectival root while it is represented by the affix *-da* in the case of adjectival nouns. To inflect these adjectives for the past tense a different morphological realization of INFL is affixed to the adjectives: *-ka* and the same affix *-da* to the adjectival nouns, the past suffix *-ta* is subsequently attached which triggers gemination. The tensed adjectival paradigm is given in (2).

(2)	Present	Past	
a. Adjectives:	*taka-i*	*taka-kat-ta*	'high'
	atarashi-i	*atarashi-kat-ta*	'new'
b. Adjectival Nouns:	*kirei-da*	*kirei-dat-ta*	'pretty'
	shizuka-da	*shizuka-dat-ta*	'quiet'

The Japanese DLI individuals are predicted to have difficulty inflecting both of these lexical categories for TENSE. If it is true that "the obligatory requirement that tense be marked in the main clause is not present in the grammar of these subjects" (Gopnik, 1994:131), these DLI speakers should be unable to consistently produce appropriately tense-marked verbs and adjectives or make the correct judgement about inappropriately tense-marked verbs and adjectives since their impairment is not modality-specific.

2.2. Aspect

In Japanese, ASPECT is marked by attaching the gerundive affix *-iru* to V-te form. The aspectual construction, V-*te*-*iru*, is roughly equivalent to the English progressive, expressing the continuation of an action. The aspectual paradigm is illustrated in (3).

(3)	Aspect (Present Progressive)	
a. Consonant-Final Verb Roots:	*kai*[3]*-te-iru*	'be writing'
	yon-de-iru	'be reading'
b. Vowel-Final Verb Roots:	*tabe-te-iru*	'be eating'
	mit-te-iru	'be looking at'

The Japanese DLI individuals are predicted to have difficulty manipulating this construction. More specifically, one would predict that they will fail to produce appropriate aspectually marked forms in obligatory contexts. Even though they may produce some aspectually marked forms which look morphologically complex on the surface, they won't be able to use them in consistent manner. Similar to the previous predictions, the DLI speakers would be expected not only to produce ungrammatical forms but to judge them as acceptable.

2.3. Case-Marking

In contrast to English, Case is morphologically marked on all lexical noun phrases in Japanese. There are two types of Case markings: one is Structural Case which serves to identify the NP's structural position while the other is Inherent Case which is associated with a specific thematic role in the sentence. There are, at least, two Structural Case markers in Japanese: Nominative Case marker, *-ga*, and Accusative Case marker, *-o*, which are associated with subject and object positions, respectively. In addition, the Dative Case marker, *-ni*, has been argued to be a 'secondary' Structural Case which is mostly associated with the subject position of the embedded

[3] The verb root is consonant-final: *kak-* 'write'; however, the /k/ undergoes Velar Vocalization and converts *kak + te* to *kai + te*.

clause. In constrast, Inherent Case markers denote such as *-de* (Locative), *-e* (Goal), *-ni* (Beneficative), *-de* (Instrumental), and *-kara* (Ablative) denote specific thematic roles. In Japanese, these morphological Case markings are always obligatory except in cases where the Accusative Case marker, *-o*, is omitted in casual conversation.

These morphological Case markings in Japanese have interesting implications for DLI individuals. If DLI speakers do not lack semantic notions while they are insensitive to grammatical features in syntax, as Gopnik (1992) argues, it can be predicted that DLI speakers will experience great difficulty with Structural Case markers while they will show better performance with Inherent Case markers. More specifically, we predict that they will produce NPs which are unmarked for Case by relying soly on canonical word order or metalingistic knowledge such as the animacy of the NPs. They may produce NPs marked with an inappropriate Case markers by incorrectly assuming that Structural Case markers are associated with particular thematic roles (e.g., *-ga* = Agentive). Such errors are expected to occur both in production and on tasks of grammaticality judgement.

2.4. Complex Verb Formation

Japanese has numerous examples of V-V affixation and V-V compounds. Some examples of Japanese V-V complex words forms with the verb root *kak-* ('write') are provided below in (4).

(4) a. V-V Affixation

kak-e-ba	conditional	'would write'
kak-i-tai	desiderative	'want to write'
kak-are-	passive	'be written'

b. V-V Compounds

kak-i-kom-u	'write in something'
kak-i-wasure-ru	'forget to write something'
kak-i-machigae-ru	'make mistakes during writing'

There is an ongoing debate about where these complex verbs are formed. The Lexical approach (Farmer 1983; Kitagawa 1986; Miyagawa 1989; among others) proposes that Japanese complex verbs are formed in the lexicon while the syntactic approach (Baker 1988; Inoue 1989; Terada 1990; among others) assumes that some complex verbs are derived by head movement in the syntax. We will assume that some complex verbs are formed in the lexicon whereas some other complex verbs are derived in the syntax, as the latter approach claims. We will also adopt Kageyama's (1982) classification which distinguishes the two types of complex verbs in Japanese.

We predict that the Japanese DLI individuals will experience difficulty with those complex verb forms that are derived in the syntax, being unable to construct an implicit rule of 'Verb Movement'. In contrast, we predict that DLI speakers will have fewer problems manipulating complex verbs which are formed in the lexicon since they seem to rely solely on the lexicon, which is subserved by declarative memory, to construct their utterances (Paradis & Gopnik 1994).

2.5. Passive & Causative Constructions

We predict that DLI individuals will experience difficulty with passive and causative constructions since not only is the verbal morphology affected, as in English, but so is Case morphology. In the Japanese passive construction the Nominative particle *-ga* marks the derived subject (Patient), the Dative particle *-ni* marks the oblique Agent and the passive morphology is marked by adjoining the bound affix *-(r)are* to the

root. In the Japanese productive causative construction, the Nominative particle *-ga* marks the subject of the matrix clause, the Dative particle -ni marks the subject of embedded clause and the Accusative particle *-o* marks the object of the embedded clause when the causative complex contains a transitive base verb while the only argument in the embedded clause is marked by either the Dative particle *-ni* or the Accusative particle *-o* when the causative complex contains an intransitive base verb. Transitivity is morphologically marked by attaching the productive causative morpheme *-(s)ase-* to the root. Examples of these constructions are provided in (5).

(5) a. Active
Taroo-ga *Hanako-o* *osi-ta.*
Taro-NOM Hanako-ACC push-PAST
'Taro pushed Hanako.'

b. Passive
Hanako-ga *Taroo-ni* *os-are-ta.*
Hanako-NOM Taro-DAT push-PASS-PAST
'Hanako was pushed by Taro.'

c. Causative
Taroo-ga *Jiroo-ni* *Hanako-o* *os-ase-ta.*
Taro-NOM Jiro-DAT Hanako-ACC push-CAUS-PAST
'Taro made Jiro push Hanako.'

We predict that the DLI individuals will experience difficulty with the passive and causative constructions. More specifically, we predict that the Japanese DLI children will be unable to manipulate the verbal morphology of these constructions. Consequently, the DLI children will have problems understanding the role of Case morphology which is determined at the morphology-syntax interface.

3. Method

3.1 Subjects

In order to test these predictions, a battery of tests was administered to two groups of Japanese children: 8 DLI children (DLI) and 8 age-matched non-DLI children (NON-DLI). The 8 DLI individuals, ranging in age from 8;9 to 12;1 (mean age = 10;7), were selected from speech-language laboratories from a pool of subjects diagnosed as having DLI, from various elementary schools in Nagoya, Gifu, and Yokohama, Japan, according to the criteria in (6).

(6) Criteria for Developmental Language Impairment
1. *Tanaka Binet* or *WISC-R* performance IQ of 85 or better
2. normal hearing acuity
3. no motor handicaps or oral structural impairments
4. not autistic (as defined by DSM III-R, 1985)
5. no history of recurrent Otitis Media
6. no known neurological disorders
7. no prominent socioemotional problems

The above criteria are those standardly used to diagnose developmental language impairment (Tallal et al.1991) However, since the diagnosis is not based on the properties of the disordered language itself, it does not determine a single entity (Gopnik & Crago 1991; Cantwell & Baker 1978). Children who meet such criteria

form a population with a wide variety of language difficulties. Thus, the description of the deficit described in this paper may not hold for all Japanese DLI individuals.

Family histories of language disorder were also taken according to the following criteria in (7) (Tallal et al. 1991).

(7) Criteria for Positive Family History of Language Impairment[4]

That a first-degree relative reports two or more of the following problems:

1. below average or impaired school achievement in reading and writing
2. placement in a remedial class for writing or reading
3. kept back a grade or having failed a class
4. below average or impaired language development as a child
5. speech therapy

Three of the 8 DLI subjects that were selected according to the above criteria for DLI were also found to have a positive family history of language impairment: JIB, JIG and JIJ. All three had both mothers and siblings who were also impaired.

In addition, 8 age-matched non-DLI individuals were tested as controls. We chose age-matched children in order to demonstrate that non-DLI children of the same age group could perform the task without difficulty. A brief profile of the DLI individuals and that of the non-DLI controls are provided below.

Table 1. Profile of DLI Individuals (DLI)

DLI	*Date of Birth*	*Age*[5]	*Sex*
JIB*[6]	1984.07.30	8;9	male
JIF	1984.05.18	9;0	male
JII	1983.09.06	9;10	female
JIC	1982.10.23	10;7	female
JIJ*	1982.09.16	10;9	male
JID	1982.05.11	11;1	male
JIH	1981.09.06	11;9	male
JIG*	1981.05.28	12;1	male

Table 2. Profile of Age-Matched Controls (Non-DLI)

Non-DLI	*Date of Birth*	*Age*	*Sex*
JNJ	1985.10.26	8;9	male
JNE	1984.12.17	9;0	male
JNK	1984.04.02	9;10	male
JND	1983.04.07	10;7	female
JNO	1982.11.21	10;9	male
JNG	1982.05.11	11;1	male
JNF	1981.09.06	11;9	male
JNN	1981.12.09	12;1	female

[4] In this experiment the criteria of Tallal et al. (1991) were used to determine a positive family history of language impairment. However, after this experiment more precise criteria were developed by a behavioral geneticist on our research project, Dr. R. Palmour, which will be used in future studies.

[5] 'Age' indicates the subject's age at the time of testing.

[6] An Asterisk (*) indicates positive family history of language impairment.

3.2 Design

In order to test these predictions, a battery of Japanese linguistic tests , *Hattattsu-sei Gengoshoogai Kensa* (the Japanese Dysphasia Test) was developed. The battery which was designed to be parallel to that used by Gopnik & Crago (1991). Direct comparisons of the results of these tests could therefore be made between the English and Japanese DLI individuals. Nevertheless, there were numerous additions made to the tests since it was necessary to examine those properties of language that were specific to Japanese. The battery in its entirety was composed of 14 subsets. In this paper, however, we will report on the results of only 4 of these subtests: Syntactic Comprehension (SC), Grammaticality Judgement (GJ), Tense-Marking Production and Grammaticality Judgement-Tense (GJ-Tense).

3.3 Materials

3.3.1 Syntactic Comprehension (SC)

The test of SC consisted of a total of 40 stimulus sentences. These 40 sentences examined the following 6 categories: syntactic word order, active and passive voice, negation, number[7], reflexives, and possessives. The examples of each category were randomly distributed. The subject was presented with 5 consecutive arrays of pictures and was instructed to point to the picture that best illustrated the meaning of the sentence. The stimulus sentences were presented aurally to the subject by the experimenter. The subject also had the option of reading the stimulus sentence herself. Four pretest sentences were presented to ensure that the subject understood the task.

There were five possible responses for those arrays of pictures that contained four pictures: 1 correct (appropriate picture selection), 3 incorrect (inappropriate picture selection), or no response. Similarly, there were three possible responses for those arrays of pictures that contained 2 pictures: 1 correct, 1 incorrect, and no response. For each correct response the subject received 1 point.

3.3.2 Grammaticality Judgement (GJ)

The test of GJ consisted of a total of 60 stimulus sentences. These 60 sentences examined the following categories: Case-marking, passive constructions, causative constructions, 'GIVE' & 'RECEIVE' V-V complexes, intransitive & transitive verbs, word order, adjectives and adjectival nouns, and negation. The examples of each category were randomly distributed. The subject was instructed "Now you will hear some sentences. You are to tell me whether or not the sentence is correct. If the sentence does sound incorrect please try to correct it." The stimulus sentences were also presented aurally to the subject by the experimenter. The subject also had the option of reading the stimulus sentences herself. Four pretest sentences were presented to the subject to ensure that the subject understood the task.

The sentences which were ungrammatical contained errors of omission (i.e. Case particles were omitted in obligatory contexts); errors of substitution (i.e. appropriate Case particles were substituted with inappropriate Case particles; and intransitive verbs were substituted with transitive verbs); and errors of incorrect use (i.e. verb phrases were conjoined improperly, and affixes which adjoin only to adjectives were adjoined to adjectival nouns).

[7] Number, here, represents plurality. As we stated in section 2.0 Japanese makes no grammatical distinction for this feature; however, there are morphemes such as *-tachi*, *-gata*, *-domo* and *-ra* which can be used to mark NUMBER or 'abundance of' on formal personal pronouns and human proper nouns. Their use is not obligatory, thus we can only examine whether or not a subject could make a number distinction on a comprehension task since if a subject chose not to attach such an affix on a production task, the response would not be ungrammatical.

There were 3 possible responses for each stimuli: correct (appropriate judgement), incorrect (inappropriate judgement) or no response (unable to make a judgement). For each correct response the subject received 1 point. Incorrect stimuli and correct stimuli were scored separately, as were corrections of the errors of the sentences. The subject received 1 point for each appropriate correction of the target error.

3.3.3 Tense-marking Production

The test of tense-marking production consisted of a total of 10 stimulus sentences which all involved tense change. Two of the responses required present-tense regular forms, 4 required past-tense regular forms, 2 required present progressive aspectual forms, and 2 required a past-tense adjectival forms. The stimulus sentences were randomly distributed. The subject was instructed "Now you will hear some sentences which are incomplete. You are to make them complete by filling in the missing part." The stimulus sentences were again presented aurally to the child by the Japanese experimenter; however, the child could also read the stimulus sentence herself. Two pretest sentences were presented to ensure that the subject understood the task. The stimulus sentences were structured as in (8).

(8) *Mainichi* *Kazuo-kun-wa* *gakko-e* *ik-u*
every day TOP school-GOAL go-PRES
'Every day Kazuo goes to school.'

Kinou-mo *Kazuo-kun-wa* *gakko-e* _____.
yesterday-too TOP school-GOAL
'Yesterday too, Kazuo _____ to school.'

There were 3 possible responses for each stimulus sentence: correct (appropriately tense-marked response), incorrect (inappropriately tense-marked response, morphologically related response, or semantic equivalent), and no response (unable to respond). Only those responses with the appropriately marked tense changes were counted as correct and accordingly given 1 point.

3.3.4 Grammaticality Judgement—Tense (GJ-Tense)

The test of GJ-tense consisted of a total of 20 stimuli. These 20 sentences, unlike those of the general test of GJ, all examine properties of TENSE and ASPECT. The sentences which were ungrammatical contained verbs and adjectives which were mismarked for tense or verbs with inappropriate aspectual markers. The stimulus sentences were randomly distributed. The instructions for this test were the same as those used in the general test of GJ. Two pretest sentences were presented to children. The number of responses was the same as it was for the general test of GJ. The scoring was also identical.

3.4 Procedure

All of the DLI individuals were tested and audio-taped individually in the speech-language laboratories of their respective schools by two investigators. The non-DLI individuals were also tested and audio-taped individually by the same two investigators. One investigator gave the respective instructions of each test to the child, read aloud all of the stimulus sentences unless the child chose to read aloud the stimulus sentences herself, and recorded the responses of the child on individual test sheets. The other investigator audio-taped the experimental session, directed the

child's attention to the experimental stimuli, and also recorded the responses of the subject for verification. The recorded results of the investigators were subsequently checked against the audio-taped recordings for further verification of accuracy by 3 independent native Japanese speakers.

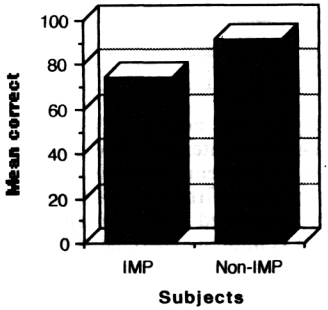
3.5 Results

Numerous two-tailed independent measures *t*-tests were performed. The results of these tests reveal clear significant difference between the performance of the DLI and the non-DLI individuals on all four tasks: syntactic comprehension, $t(14)=3.33$ $p=.005$; grammaticality judgement, $t(14)=5.22$ $p=.0002$; tense-marking production, $t(14)=4.32$ $p=.001$; and grammaticality judgement—tense, $t(14)=3.99$ $p=.001$.

3.5.1 Syntactic Comprehension (SC)

The overall performance of the DLI individuals on the test of SC was significantly different from that of the non-DLI individuals: $t(14)=3.33$ $p=.005$, as previously indicated. The means percent correct of the two groups of subjects on the test in it entirety (DLI: 74; Non-DLI: 91) are presented in Figure 1.[8]

Figure 1. Syntactic comprehension: Overall performance



Significant difference in the overall performance between the DLI and non-DLI children on the test in its entirety is revealing; however, to determine where exactly this significant difference lies we must examine the results of the 6 subsections of the test independently. There were too few items to perform statistical tests on these subsections; nevertheless, we can present tendencies by reporting group means.

The first syntactic category that we examined was word order. There were 10 SOV-ordered active affirmative sentences and 10 corresponding scrambled variants which contained the very same constituents as the SVO-ordered sentences. The results reveal that the DLI children, similar to the non-DLI children, experienced no difficulty understanding stimulus sentences in the 'canonical' SOV word order but, unlike the non-DLI children, they did experience difficulty understanding the scrambled counterparts. The means percent correct of each group are shown in Table 3.

[8] We have chosen to collapse individual results into group means for clarity of presentation; however, this is not meant to imply that the performance of the impaired subjects was homogeneous. As is commonly the case with developmentally language-impaired individuals, there was much variation in their performance, as can be seen in Appendix B.

Table 3. SC of Word Order: Mean % Correct

	DLI	Non-DLI
SOV (10)	95	100
Scrambled (10)	73	96

We next examined the distinction between active and passive voice. Six active affirmative sentences contrasted directly with 6 passive affirmative sentences. The results indicate that the DLI children had no difficulty understanding sentences in the active voice; however, they experienced difficulty understanding equivalent sentences in the passive voice. The performance of the DLI children on the passive voice stimuli suggests that they were relying on word order to comprehend these constructions, paying no attention to the verbal passive morphology and the change in Case-markers. They therefore would often select the illustration of the active-voice counterpart. Table 4 presents the group means.

Table 4. SC of Active and Passive Voice: Mean % Correct

	DLI	Non-DLI
Active V. (6)	94	100
Passive V. (6)	42	90

The third syntactic category was negation. We contrasted 4 active affirmative sentences with 4 active negative sentences. The only difference between the two groups of sentences was one morpheme in sentence-final position. The affirmative sentences ended with the present affirmative morpheme *-u* attached to the verb, whereas the negative sentences ended in the present negative morpheme *-nai*. The results reveal that only the DLI children experienced difficulty distinguishing between the two sets of stimulus sentences. Their selection of the appropriate illustration of the negative sentence was virtually no better than chance, as the means percent correct in Table 5 illustrate.

Table 5. SC of Affirmative & Negative Sentences: Mean % Correct

	DLI	Non-DLI
Affirmative (4)	92	100
Negative (4)	54	89

In contrast, as the tables 6-8 below represent, the DLI children seeemed to experience no difficulty perceiving the stimuli which involve the plural-marker *-tachi*, the reflexive *jibun* and the Genitive marker *-no*.

Table 6. SC of +PLURAL NPs: Mean % Correct

	DLI	Non-DLI
Unmarked (4)	100	100
+PLURAL (4)	100	100

Table 7. SC of Reflexive NPs: Mean % Correct

	DLI	Non-DLI
-Reflexives (2)	92	100
Reflexives (2)	94	100

Table 8. SC of Possessive NPs: Mean % Correct

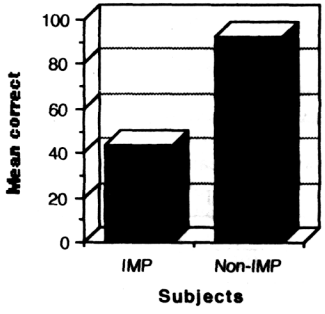
	DLI	Non-DLI
Possessives (4)	100	100

To summarize, the results of SC reveal that the DLI children experienced difficulty with morpho-syntactic constructions where the application of implicit morphological rules was necessary and virtually no difficulty with purely syntactic constructions. Thus, their means percent correct on SC of passive voice and negation differed greatly from those of the non-DLI children, while those of word order, reflexives and possessives closely resembled those of the non-DLI children.

3.5.2 Grammaticality Judgement (GJ)

The overall performance of the DLI children on the test of GJ was significantly different from that of the non-DLI children: $t(14)=5.23$ $p=.0002$[9] The means percent correct of the two groups of subjects on the incorrect stimuli of the test (DLI: 44; non-DLI: 92) are presented in Figure 2.

Figure 2. GJ: Overall performance



As on the test of SC, significant difference in the overall performance between the two groups on the test of GJ is revealing; however, we must examine the performance of both groups on the 10 grammatical categories independently to determine where exactly the differences lie. We also must compare the ability of the DLI and non-DLI children to make the appropriate grammatical corrections on each subsection. However, there are also several subsections with only a few items; thus, we will be restricted to reporting only tendencies in the form of group means.

The first grammatical category that we examined was Case-marking. There was a total of 18 stimulus sentences, which contained either NPs which were unmarked for

[9] The two-tailed independent measures *t*-tests on the test of grammaticality judgement were run only on the incorrect stimuli. One should not collapse both incorrect and correct stimuli in the same statistical test. Thus 'overall performance' for this test does not signify performance on the test in its entirety.

Case in obligatory contexts or NPs which were marked with an inappropriate Case marker. Two-tailed independent-measures *t*-tests were performed. The results reveal significant difference between the performance of the DLI and non-DLI children: $t(14) = 5.18$, $p = .0003$. The DLI children seemed unable to appropriately judge the stimuli with ungrammatical Case marker substitutions and performed slightly better than chance at appropriately judging the stimuli with Case marker omissions in obligatory contexts. It also seemed that Nominative, Accusative and Dative Case were most problematic for the DLI children. The DLI children made very few attempts to correct these sentences. The means percent correct of the two groups are presented in Table 9

Table 9. GJ of Case Particle Omissions & Substitutions: Mean % Correct

	DLI	Non-DLI
Case omiss. (6)	61	100
Corrections	50	100
Case Subst. (12)	38	91
Corrections	27	88

The second examination that we performed was that of passive constructions. There were 6 stimulus sentences in this subsection: 2 in which the passive morpheme *-rare-* was omitted in contexts where only a passive interpretation was possible and 4 in which the passive morpheme was present but either the underlying subject (Agent) was inadvertently marked with Accusative or Nominative, instead of Dative Case or the derived Subject (Patient) was inadvertently marked with Accusative or Dative, instead of Nominative Case. The results reveal that the DLI children experienced great difficulty with the passive construction. More specifically, they seemed unable to manipulate both the verbal passive morphology and the Case particles: they often accepted as grammatical those sentences without the appropriate passive morpheme and those without the appropriate Case particles. Table 10 presents the means percent correct of both groups for both types of illicit passive constructions.

Table 10. GJ of Illicit Passive Constructions: Mean % Correct

	DLI	Non-DLI
PASS omiss. (2)	55	100
Corrections	50	100
Case subst. (4)	35	94
Corrections	29	94

Our third analysis was of causative constructions. It was performed in the same manner as were the passive constructions, since the two constructions have similar properties: they both require the manipulation of verbal morphology and Case markers. There were again 2 stimulus sentences without the causative morpheme *-(s)ase-* in contexts where only a causative reading was possible and 4 stimulus sentences with the causative morpheme but without the appropriate Case particles: the Agent of the transitive base verb was inappropriately marked with Nominative or Accusative instead of Dative Case. The results indicate that the performance of the DLI children with these constructions closely resembled their performance on the passive constructions: they again judged both sets of ungrammatical stimuli as grammatical. Their means percent correct are provided below in Table 11.

Table 11. GJ of Illicit Causative Constructions: Mean % Correct

	DLI	Non-DLI
CAUS omiss. (2)	31	88
Corrections	50	81
Case subst. (4)	30	85
Corrections	24	78

The fourth grammatical category that we examined was 'GIVE' & 'RECEIVE' complex verbs. These V-V complex constructions also require Case particle manipulation. Briefly, the verbs 'GIVE' & 'RECEIVE' affixed to base verbs show the direction of benefit which is created by the result of the event expressed by the base verb. The V-V complexes that are formed with 'GIVE' *-ageru* require three arguments: an Agent marked with Nominative Case, a Theme marked with Accusative Case, and a Beneficiary (Goal) marked with Dative Case. The V-V complexes that are formed with 'RECEIVE' *-morau* also require three arguments: a Benefeciary marked with Nominative Case, a Theme marked with Accusative Case and a Source marked with Dative Case. There was a total of 4 stimulus sentences whose arguments were mismarked for Case. The results reveal that the DLI individuals experienced great difficulty with these constructions. The DLI children judged many of these illicitly Case-marked sentences as grammatical. The results are summarized below.

Table 12. GJ of Illicit 'Give' & 'Receive' Constructions: Mean % Correct

	DLI	Non-DLI
Give V-V (2)	22	92
Corrections	10	81
Receive V-V (2)	22	95
Corrections	10	85

The fifth analysis we performed was that of transitive (lexical causative) and intransitive (inchoative) verb pairs. Unlike English, the majority of these pairs are morphologically related in Japanese (e.g., *tok-as-u* 'melt (TRANS)' vs. *tok-e-ru* 'melt (INTR)'). There were 4 stimulus sentences: 2 with transitive verbs substituted for intransitive verbs and 2 with intransitive verbs substituted for transitive verbs. The results reveal that although the DLI children had some difficulty with these constructions, they performed much better on this category than on the last four grammatical categories. They could also make the appropriate corrections on many illicit stimuli. Table 13 presents the means percent correct of both groups.

Table 13. GJ of Illicit Transitive & Intransitive Verb Forms: Mean % Correct

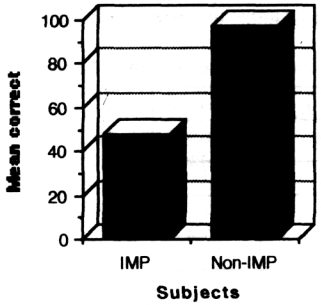
	DLI	Non-DLI
Illicit transitives (2)	77	100
Corrections	72	100
Illicit intransitives (2)	79	100
Corrections	70	100

To summarize, the results of the test of grammaticality judgement reveal that the DLI individuals experienced great difficulty with the manipulation of verbal morphology as exempified by their performance with morpho-syntactic constructions such as the passive, the causative, 'GIVE' & 'RECEIVE' V-V which interface with morphological Case marking on NPs while they had much less difficulty with constructions in which manipulation was possible by memory, such as with the transitive & the intransitive verbs. Therefore, the DLI children, unlike the non-DLI children, were unable to make both the appropriate judgement and correction for stimuli containing ungrammatical morpho-syntactic constructions, whereas they were able to make both the appropriate judgement and correction for those stimuli containing lexically derived verbs. The DLI children also experienced some difficulty providing appropriate judgements on sentences which involved illicit adjectives and morphological negation. (See Fukuda & Fukuda 1994 for more details).

3.5.3 Tense-Marking Production

The overall performance of the DLI individuals on the test of tense-marking production was significantly different from that of the non-DLI individuals: $t(14)=4.32$, $p=.001$. The means percent correct of the two groups of subjects on the test in its entirety (DLI: 48, non-DLI: 98) are presented in Figure 3.

Figure 3. Tense-marking Production: Overall performance



Significant difference in the overall performance between the DLI and the Non-DLI individuals on the test in its entirety is indicative of the inability of the DLI individuals to manipulate tense-marking; however, we must further examine the performance of both groups of subjects on the different types of stimuli in order to determine which forms caused them most difficulty. Since there were only 10 stimulus sentences we will again simply be able to report tendencies in the form of group means.

The first set of stimulus sentences that we examined were those which required present-tense regular verb forms. There were 2 of these constructions; thus, the findings will be preliminary at best. The first sentence of each stimulus contained the target verb, which was inflected for the past tense, and the second sentence, which began with the temporal adverb *mainichi*, 'every day', prompted for a present-tense form.[10] The results reveal that the DLI children were unable to consistently produce an appropriately tense-marked form. They simply tended to reproduce the inflected

[10] Since Japanese verbs cannot surface as base stems, it was necessary to always inflect the target verb in the first sentence for tense. The time change in the second sentence was, however, always 'saliently' marked with a lexical item in sentence-initial position.

target verb even though they had been able to produce the appropriate forms on the pretest. Table 14 presents these preliminary findings.

Table 14. Production of Present-Tense Regular Verb Forms: Mean % Correct

	DLI	Non-DLI
Present regular (2)	50	100

The second set of stimulus sentences that were the subject of our analysis were those that required past-tense regular verb forms. There were 4 of these constructions: the target verb in the first sentence was inflected for the present tense, and the second sentence, which began with the temporal adverb *kinou*, 'yesterday', prompted for a past-tense form. The results were identical to those on the stimuli which prompted for a present-tense form. The DLI children were again unable to systematically produce the appropriately tense-marked form. The means percent correct for both groups of subjects are presented in Table 15.

Table 15. Production of Present-Tense Regular Verb Forms: Mean % Correct

	DLI	Non-DLI
Past regular (4)	51	100

The next set of constructions were those that required a present progressive aspectual verb form. There were two of such constructions: the target verbs of the first sentences were inflected for the present and the second sentences began with the temporal adverb *ima mo choudo*, 'right now', prompting for a present progressive form. The results reveal that the DLI children were unable to produce an appropriately marked aspectual form. The impaired subjects seemed to experience more difficulty with these stimuli than with all the others. They tended to supply a present-tense form. These preliminary findings are presented in Table 16.

Table 16. Production of Present Progressive Verb Forms: Mean % Correct

	DLI	Non-DLI
Present Prog. (2)	38	100

The stimuli requiring past-tense forms of adjectival phrases were the focus of our last analysis of this test. Unfortunately, our data set was again limited to 2 constructions. In one stimulus, the first sentence contained an adjectival noun in sentence-final position, inflected for the present; the second sentence prompted for its past-tense form. The target of the other stimulus was a adjective with the same format. The results reveal that the DLI children were unable to inflect these adjectival forms for the past tense. The group means are presented in Table 17.

Table 17. Production of Present-Tense Adjectival Forms: Mean % Correct

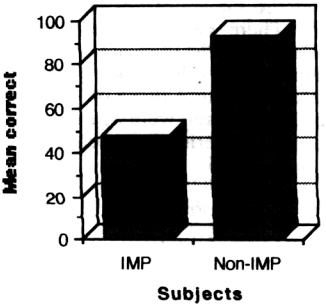
	DLI	Non-DLI
Past Adj. form (2)	32	100

To summarize the results of the test of Tense Production reveal that the DLI children were unable to consistently produce the appropriately marked verb or adjectival form. The features of both TENSE and ASPECT seemed to be equally problematic.

3.5.4 Grammaticality Judgement—Tense

The overall performance of the DLI children on the test of grammaticality judgement for tense was significantly different from that of the non-DLI children: $t(14)=3.99$, $p=.001$. The means percent correct of the two groups of subjects on the incorrect stimuli of the test (DLI: 46; non-DLI: 93) are presented in Figure 4.

Figure 4. GJ—Tense: Overall performance



As on the general test of grammaticality judgement, a significant difference in overall performance was found between the DLI and the non-DLI children. This is indicative of their inability to identify ungrammatical constructions; however, we must examine the performance of both groups on the various stimuli independently in order to determine which constructions seem to cause them more difficulty. We also will compare the abilities of the two groups to make appropriate grammatical corrections on the various types of stimuli. Finally, due to the limited number of stimuli, we will be only reporting tendencies in the form of group means.

The first analysis was of the performance of both groups of subjects with illicit sentences which were lexically marked for past with a temporal adverb, but whose verbs were inflected for present. They required past-tense regular verb forms to be made licit. The results reveal that the DLI children experienced difficulty making both the appropriate judgement and a correction. They were more likely, however, to make the appropriate judgement than the appropriate correction. Several of the DLI children who found the sentences to be illicit couldn't identify the source of the ungrammaticality. The means percent correct of the two groups are presented in Table 18.

Table 18. GJ of Illicit Past-Tense Constructions: Mean % Correct

	DLI	Non-DLI
Illicit past tense (2)	69	100
Corrections	31	91

Illicit sentences, which were lexically marked for the present progressive aspectual form with a temporal adverb, but whose verbs were inflected for the present were our second subject of analysis. There was a total of 3 such stimuli. The results reveal that the DLI children experienced some difficulty with these constructions, however, the difference between the DLI and the non-DLI children was less significant than the previous category. The children were able to often make the appropriate judgement and the appropriate correction. Table 19 presents the means percent correct.

Table 19. GJ of Illicit Present Progressive Verb Forms: Mean % Correct

	DLI	Non-DLI
Illicit pres. prog. (3)	67	88
Corrections	60	79

The last analysis that we conducted was that of the performance of both groups of subjects with illicit sentences which contained adjectives with inflectional morphemes of verbal adjectives. Not only were the inflectional morphemes of one adjectival phrase substituted for those of another, but there also were instances in which the adjectival phrases were doubly marked for past tense; once with their own inflectional ending and once with those of the opposite type. There were 4 of such stimuli: 2 examples of illicitly formed adjectives and 2 of adjectival nouns. The results reveal that illicitly constructed adjectival nouns were much easier for the DLI children to identify than adjectives, contrary to what we had found on the general test of grammaticality judgement where both illicit structures had been equally difficult. Perhaps we can attribute this discrepancy in the results to the occurrence of the doubly marked forms in this test. The DLI children seem to be able to identify the ungrammaticality of such illicit structures more readily. The results are summarized in Table 20.

Table 20. GJ of Illicit Adjectives & Adjectival Nouns: Mean % Correct

	DLI	Non-DLI
Illicit adjectives (2)	35	100
Corrections	22	89
Illicit adj. noun (2)	69	100
Corrections	57	87

To summarize, the results of the test of GJ for tense reveal that the DLI children were not only unable to systematically produce an appropriately tense-marked verb or adjective, but they were also unable to systematically make the appropriate judgement of illicitly tense-marked verbal and adjectival constructions. Both the production and the acceptance of illicitly tense-marked constructions suggest that the impairment is at the level of the underlying grammar, not at the level of performance, since both modalities seem to be equally affected. If only production had been affected, one could not have ruled out the possibility of auditory/ articulatory or short-term memory deficits. Tests of GJ, however, tap underlying linguistic competence; thus, if the DLI children are able to judge illicit constructions as grammatical, one can be more certain that at the root of the deficit is underlying competence, not performance.

In conclusion, the results of this entire section reveal significant differences in the overall performance between the DLI and the non-DLI children on the tests of SC, GJ, Tense-Marking Production, and GJ-Tense. Such results were important in that they served as a confirmation of our prediction of a difference in performance between the two populations and a justification for further investigation; however, in order to provide a principled linguistic account of the language impairment, it was necessary to examine the performance of the two groups of subjects on the various subsections of these tests. We could only present tendencies, since the tests, being

tools of assessment of linguistic deficits of the disorder, were not amenable to statistical analysis. Nevertheless, our results of significant difference paired with our reported tendencies of difference in performance between the two populations suggest that Japanese DLI individuals experienced difficulty with many of the same morphological properties that the English DLI individuals did. The features of TENSE and ASPECT appear to be as problematic for the Japanese impaired subjects as they are for the English, as was illustrated by their performance on these features in the tests of SC, GJ-Tense, and Tense-Marking Production. Such findings, therefore, not only meet all of our predictions, but they also illustrate that the manifestations of DLI observed in English, are not language-specific. They also have far greater implications; the data from the Japanese subjects indicate that DLI speakers experience great difficulty with those constructions that are morpho-syntactic, such as the passive, the causative, and 'GIVE' and 'RECEIVE' V-V complexes, and much less difficulty with those constructions that are purely syntactic, such as reflexives, possessives, and word-order.

4.0 Discussion

The results from several different tests of this preliminary study of DLI in Japanese converge to support both the linguistic hypothesis that the deficits characteristic of this disorder can be attributed to an impairment in the underlying grammar since its manifestations in Japanese resemble those in English, and the genetic hypothesis that at least some cases of DLI are genetic in origin. Clearly, it cannot be the case that the manifestations in English and Japanese resemble one another because the structure of English is similar to the structure of Japanese. These two languages, as we have seen, are linguistically quite different on surface. In addition, since three of the 8 Japanese DLI children that were selected according to the criteria for DLI and not for of family history, had both mothers and siblings that were also language-impaired, one can conclude that there may be a genetic component that contributes to the disorder, as appears to be the case for English. The results from both the English and Japanese populations are provided in the Appendix.

The results could clearly be accounted for by the hypothesis that neither Japanese nor English DLI speakers can construct abstract implicit morphological rules in their underlying grammars. Their performance on tasks which required manipulation of morphological features was often no better than chance. Clearly, more data are required in order to not only examine the implications of this hypothesis, but, more importantly, to provide a more detailed linguistic account of the disorder in Japanese. Nevertheless, the evidence that we do have indicates that the disorder does have cross-linguistic significance that merits further investigation.

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Appendix: Comparison of English and Japanese Results

SYNTACTIC COMPREHENSION	
Plurals mean of English language-impaired: mean of Japanese language-impaired:	 100 100
Passives mean of English language-impaired: mean of Japanese language-impaired:	 40 42
Reflexives mean of English language-impaired: mean of Japanese language-impaired:	 93 92
Possessives mean of English language-impaired: mean of Japanese language-impaired:	 96 100
GRAMMATICALITY JUDGEMENT	
Judgement of morphological feature errors mean of English language-impaired: mean of Japanese language-impaired:	 57 43
Corrections of the ungrammatical sentences mean of English language-impaired: mean of Japanese language-impaired:	 37 35
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