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■原 著

Exploring the Developmental Sentence Score for Japanese (DSSJ): A Comparison of DSSJ and MLU in Spoken Language Samples from Typically Developing Children and Children with Delayed Development[*1]

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ABSTRACT: This article discusses tests using the Developmental Sentence Score for Japanese (DSSJ), a new language measure of grammar development. Twenty language samples from three children with mental retardation (MR); three children with pervasive developmental disorders (PDD) with a development age between 2;6 and 4;3, and five typically developing children between 2;0 and 3;6. DSSJ scores were compared to the (developmental) age, as well as to the Mean Length of Utterance in Morphemes (MLUm). The correlations between DSSJ and MLUm were highly significant for both groups, while the correlations between the two measures and (developmental) age proved significant only for the typically developing children. PDD and MR children did not differ in terms of MLUm and DSSJ results. The typically developing children, however, showed a greater diversity after DSSJ 300, which points to the necessity of an extension of DSSJ items for the higher age range. The overall results suggest that DSSJ is a valuable measure of language development. The somewhat weaker correlation between the linguistic measures and developmental age shows that language development is not fully congruent with mental development. Developmental age alone then is not a sufficient predictor in the case of non-typical language development.

Key Words: DSSJ, MLU, linguistic measure, mental retardation, pervasive developmental disorders

1. INTRODUCTION

1.1 WHY DO WE NEED A NEW LANGUAGE MEASURE FOR JAPANESE?

For an appropriate assessment of language development we need informative, reliable linguistic measures. To capture the whole language competence of a child, a broad spectrum from phonetics to grammar and vocabulary to situative-appropriate communication has to be covered by the assessment tools. Such a comprehensive task cannot be performed by a single language test.

What is the situation for Japanese? Currently a number of language measures are available. Vocabulary size can be measured by the "Picture Vocabulary Test" (PVT; Ueno, Nadeo, Iinaga, 1991), and also by the Japanese version of the "MacArthur Communicative Development Inventory" (MCDI; Ogura, Watamaki, 2004; Watamaki, Ogura, 2004) based on caretaker report, which focuses especially on early vocabulary acquisition. A broader spectrum of language abilities is covered by the Japanese version of the "Illinois Test of Psycholinguistic Abilities" (ITPA; Ueno, Ochi, Hattori, 1993) and the newly developed "LC Scale" (Language Communication Developmental Scale; Otomo, Hayashi, Hashimoto, et al., 2005). But there is still a general need for specific measures for the syntactic and morpological development.

1.2 LIMITATIONS OF MLU

Grammar development in expressive language can be captured basically by two methods: testing of specific constructions in an experimental situation, and extracting grammatical structures found in spontaneous speech in a free conversation. The only grammar-specific measure available for Japanese, MLU (Mean Length of Utterance; Brown, 1973; Miyata, 1999; Ogura, Yamashita, Murase, 1994; Watamaki, 1993, 1994), opts for the latter method, using small samples of spontaneous language. Although not

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yet standardized for Japanese, MLU is a promising measure for early language development. MLU makes use of the fact that children's utterances become longer in the course of the development. To calculate MLU, 100 consecutive utterances (excluding repetitions, imitations, and rote expressions) are selected, and the number of morphemes in each utterance is determined (*e.g.: ichigo/o/zembu/tabe/ta/yo* 'he has eaten up all the strawberries' contains 6 morphemes). The average utterance length constitutes the MLU value.

For English MLU is already a widespread measure of language development, and in research a basic and conventional language measure, but it is not yet very popular for Japanese. Although MLU is applicable to Japanese (Miyata, 1999; Ogura, Yamashita, Murase, 1994; Watamaki, 1993, 1994), and automatic computation is available as a program based on MS EXCEL (Watamaki, 1993) or on the CLAN program of the Child Language Data Exchange System CHILDES (MacWhinney, 2000; Miyata, 1999, 2003; Ogura, Yamashita, Murase,1994), it is seldom used in the clinical context, and also, comparatively speaking, rarely in research. One reason for the low use of MLU is that there is no generally accepted methodology for estimating the length of utterance. Existing proposals differ considerably in the definition of the morphemes and words to be counted. For example, tabeteru may be counted as composed of 3 morphemes (*tabe-te-[i]ru*) or 2 morphemes (*tabe-teru*). Unlike English, MLU for Japanese has not yet been standardized.

An additional problem with MLU in general is that its validity is restricted to early acquisition. For English, it has been shown that after MLU 3.0 to 3.5, which is on average reached around age three, MLU results become less reliable (Chabon, Kent-Udolf, Egolf, 1982; Conant, 1987; Klee, Fitzgerald, 1985). For this reason, MLU is generally not applied to older children. Similar tendencies have been found for Japanese (Miyata, 1999). Furthermore, MLU measures grammatical development only indirectly (Crystal, 1974), by simply counting the number of morphemes, but does not differentiate between utterances of identical length but a different degree of complexity. This feature of MLU might be one reason for the low reliability for advanced language development.

1.3 DEVELOPMENT OF DSSJ

With an awareness of a shortage of reliable assessment tools for Japanese grammar development, we have started to develop a new measure called the "Developmental Sentence Score for Japanese" (DSSJ) which tries to capture differences in grammatical complexity (Miyata, Hirakawa, Kanagy, et al., 2003; Miyata, Hirakawa, Kanagy, et al. 2006; Otomo, 2004; Sirai, 2001). This new measure is based on the English "Developmental Sentence Score" (DSS; Lee, 1974). DSS analyses 50-100 consecutive utterances, rating grammatical phenomena in 8 areas (Indefinite Pronouns or Noun Modifiers, Personal Pronouns, Main Verbs, Secondary Verbs, Negatives, Conjunctions, Interrogative Reversals, WH-Questions). Identical, incomplete or incomprehensible sentences are excluded. Words or morphemes which are acquired early are assigned lower points whereas those which tend to be learned later receive higher points. For example, the personal pronouns *I* or *you* would receive 1 point, while *them* would score 3 points (Lee, 1974:134f.) and *oneself*, 7 points. A sentence like '*I eat chocolate*' would receive 1 point for each of the areas Personal Pronouns and Main Verbs, and an additional Sentence Point for being an adult-like sentence, making a total of 3 points. Especially attractive in DSS is the possibility of yielding separate scores for each grammatical area in order to see whether a child's development is balanced or not.

However, since Japanese has a completely different language structure from English, DSS cannot be simply translated. Therefore, we began with an analysis of the grammatical development of 7 children acquiring Japanese. All children had been observed for 2 years or longer on a weekly basis. We were looking for grammatical items typical of different stages of development, and found indeed that many grammatical items were acquired in the same order across children. Moreover, items that were acquired at approximately the same time by early developers, also appeared together in the acquisition of late developers. On the other hand, we also found items, which were acquired early by some children, but later by others, regardless of the overall speed of their development. Differences in the input (language use of the caretaker) may be the reason for these differences in development.

Based on the items acquired by all the children in the same order, and by excluding items showing individual disparity, we developed a prototype of the Developmental Sentence Score for Japanese (DSSJ; Miyata, Hirakawa, Kanagy, et al. 2006; Otomo, 2004). The selected items were classified into 10 areas:

1) Verb Inflection divided into Middle Inflection and (e.g. *tabe-**rare**-ta* 'was eaten') and Last Inflection (e.g. *tabe-**ta*** 'ate')
2) Adjective Inflection (e.g. *oishi-**katta*** 'was tasty')
3) Adjectival Noun and Copula Inflection (e.g. *kiree **datta*** 'was beautiful')
4) Negation (e.g. *dame* 'forbidden'; shika … nai 'only')
5) Sentence Conjunction (e.g. *oishii **kara** tabete* 'eat [it] because it's tasty')

6) Noun Phrases (e.g. *oishikatta gohan* 'tasty meal')
7) Case and Topic Particles (e.g. *Mama* ***wa*** *ichigo* ***ga*** *ii* 'Mommy wants the strawberries')
8) Deixis (e.g. *koko* 'here')
9) Question Words (e.g. *nande* 'why')
10) Final Particles (e.g. *iku* ***yo*** 'I am going')

The individual items were designated points according to the timing of their acquisition by the seven children observed: while items acquired early scored low, later acquisitions could score up to 5 points. For example, a sentence like *kore tabete*! "Eat this!" would receive 1 point for the imperative form *-te*, and 1 point for the deictic *kore*, for a total of 2 points, while a sentence like *ii no katte moratta yo* "[He] bought me something nice." would receive a total of 11 points (1 point for adjective inflection PRESENT (PRES) *-i*; 3 points for Noun Phrase (NP) construction adjective *ii* with sentence nominalizing particle *no*; 5 points for the verb middle inflection *-te morau-*; 1 point for PAST *-ta*; and 1 point for the final particle *yo*; compare **Table 1**).

As the sample size of 50 utterances used in the English DSS appears to be too low for a highly elliptic language such as Japanese, we currently use samples of 120 utterances. The sample size will be subject to further investigation.

2. GOALS OF THIS INVESTIGATION

Our first goal is to investigate the relations among age, MLU, and DSSJ, respectively. As a first step towards standardization, we will compare the MLU and DSSJ values, respectively, with age for typically developing (TD) children. Our particular interest is to test the DSSJ prototype against a number of new language samples, and the validity of DSSJ will be examined against age and the Mean Length of Utterance in Morphemes (MLUm) values. Our second goal is to investigate the language development of children with developmental disorders and to see how it is reflected in the MLUm and DSSJ results. We will therefore compare the results of (a)TD children, (b)children with mental retardation (MR), and (c)children with pervasive developmental disorders (PDD). While the developmental pathways are not identical between children with MR and those with PDD, we examined as preliminary analysis whether or not these groups fit the patterns exhibited by TD children to estimate the applicability of DSSJ measures to the speech of these two clinical populations.

3. METHOD

3.1 THE DATA

Participants in our study (**Tables 2, 3**) included five TD children between 2;0 and 3;6, three children with MR, and three children with PDD with a developmental age[註1] between 2;6 and 4;3. The TD children had experienced no sensory, motor, or intellectual problems in their course of development, and the families had no concerns about the children's language development.

For the TD children we analyzed between one and three language samples of 120 consecutive child utterances (utterances including unclear parts, repetitions, imitations, rote expressions and song texts were excluded). We analyzed 2 language samples from 2;0 and 3;0 for Tar (Kokuritsu Kokugo Kenkyujo, 1981-1983), 3 samples from 2; 2, 3;1 and 3;6 for Njd (Nisisawa, unpublished data), 3 samples from 2;6, 3;0 and 3;6 for Als (Nisisawa, unpublished data), and Jun (Ishii, 2004), respectively, and 1 sample from 3;5 for Tom (Nisisawa, unpubished data).

For the three children with MR (MR1, MR2, MR3) and three children with PDD (PDD1, PDD2, PDD3), we analyzed language samples at one (for MR3, PDD1-3) or two time points (for MR1 and MR2). As it was difficult to obtain 120 consecutive utterances for some PDD and MR children, we combined utterances from different sessions (indicated as "+" in **Table 3**) in order to obtain a sample of at least 89 utterances. When more than one DA value was available because several developmental tests had been performed, we chose the DA from the test which had been conducted close to the session analyzed.

3.2 MLU AND DSSJ COMPUTATION

All data was transcribed in Japanese CHILDES format JCHAT (MacWhinney, 2000; Miyata, Muraki, Morikawa, 2004; Oshima-Takane, MacWhinney, Sirai, et al., 1998) following Wakachi 2002 v.2.1 (Miyata, 2003), and provided with morpheme tags using the CHILDES-based automatic segmentation program JMOR03 (Miyata, Naka, 2006).

MLUm was computed on the basis of these morpheme tags. The following utterance types were excluded: a)rote forms like songs, counting, and TV commercial lines; b) exact repetitions of the preceding utterance; c)utterances including unclear parts; d)uncompleted utterances; extra-syntactical items such as e)communicators, and f) onomatopoeias. Any appearing morpheme, regardless of the degree of mastery by the child, was included into the computation of MLUm (Miyata, 1999).

DSSJ was computed on the basis of the morpheme tags described above. The computation was performed by a preliminary version of the CHILDES-based Japanese DSS program (Miyata, Hirakawa, Kanagy, et. al., 2006). For sake of comparability, all DSSJ scores were recalculated to 100 utterances.

註1 In this study, 'developmental age' refers to age indices obtained with standardized tests of development, intelligence, or language.

Table 1 Preliminary DSSJ Score Table
(based on Miyata, Hirakawa, Kanagy, et al., p.80-83, 2006)

Area \ Score	1	2	3	4	5
Verb Inflection middle	COMPL *tabechau* 'eat up' NEG *tabenai* 'doesn't eat'	DESID *tabetai* 'want to eat' *-te kuru* [CONN come] *motte kuru* 'bring here'	*-te miru* [CONN see] *itte miru* 'try to go' -te aru [CONN have] *kaite aru* 'is written'	*-te ageru* [CONN give] *itte ageru* 'I'll go for you' *-te kureru* [CONN give] *motte kureru* 'you hold it for me'	PASS *taberareru* 'was eaten' *-te morau* [CONN get] *tabete morau* 'I get it eaten'
final	PAST *tabeta* 'ate' PRES *taberu* 'eat(s)' IMP:te *tabete!* 'eat!'	INTENT *tabeyoo* 'let's eat' CONN *tabete* 'eat and..'		CONN&wa *tabecha dame* 'you may not eat it' NEG&OBL *tabenakya* 'I have to eat it' IMP:nasai *tabe nasai!* 'eat!'	
Adjective Inflection	ADJ-PRES oishii 'is tasty'		ADJ-PAST oishikatta 'was tasty' ADJ-NEG *oishikunai* 'is not tasty'	ADJ-ADV oishiku 'tastily'	ADJ-CONN oishikute 'tasty and..'
Adj. Noun and Copula Inflection	COP-PRES *da* 'is'		COP-POL-PRES desu 'is'	COP-PAST *datta* 'was' COP-POL-INTENT *deshoo* 'will be' COP-PRES:na *kutsu na no* 'it's a shoe' COP-ADV *ringo ni naru* 'becomes an apple' AN+COP-PRES *kiree da* 'is beautiful'	AN+COP-PAST *kiree datta* 'was beautiful'

Table 1 (continued)

				AN+COP-ADV *kiree ni suru* 'make beautiful' AN+COP-PRES:na *kiree na* '*beautiful*'	AN+COP-PRES:na N *kiree na hito* beautiful person'
Negation	*nai* 'not exist' *gohan nai*. 'there is no food' *iya* 'not like' *gohan iya* 'I don't like food	*dame* 'forbidden' *kutsu dame*. 'don't touch the shoe'		*shika*..NEG 'only' *kutsu shika nai*. 'has only shoes'	
Sentence Conjunction **sentence connecting**		S-COND:*tara* S 'if..then' *tottara dame* 'it's not good if you take it' S+*kara*+S 'because' *chiisai kara dame* 'it's not good because it's small'	S+*to*+S 'if/when..then' *inai to dame* 'it's not good if I am not here' V-CONN+*kara*+S 'after' *tabete kara iku* 'we'll go after we have eaten' V-COND:*ba*+S 'if..then' S+*kedo*+S 'but' S+*noni*+S 'nonetheless'	S+*node*+S 'because' S+*nara*+S 'if'	
sentence initial			*ja* 'so' *dakara* 'therefore' *demo* 'but' *datte* 'because' *sorede* 'then'	*soshite* 'then' *soshitara* 'then' *sorekara* 'then'	
Noun Phrases		N *no* (N) *Papa no kutsu* 'Papa's shoes' Adj+N *akai kutsu* 'red shoe'	V+N *katta kutsu* 'the shoes we bought' N *to* N 'and' *kutsu to kutsushita* 'shoes and socks'	V/Adn +SNR 'the one that' *chigau no totte!* 'take the one that is different'	AN *na* N *kiree na hito* a beautiful person'

Table 1 (continued)

Area \ Score	1	2	3	4	5
			Adn+N *ironna kutsu* a lot of different shoes' Adj+SNR 'the..one' *akai no totte* 'take the red one'		
Case and Topic Particles	*wa* TOP *kutsu wa nai.* 'there are no shoes' *mo* TOP 'too' *kutsu mo nai.* 'the are also no shoes' *ga* NOM *kutsu ga ochita.* 'the shoes have fallen down'	*ni* LOC 'to' *shita ni iku.* 'go down' *de* LOC 'in' *shita de taberu.* 'eat downstairs'	*kara* LOC 'from' *hako kara dasu.* 'take out of the box' *o* ACC *hako o dasu* 'take the box out'		
Deixis	*kore* 'this one' *koko* 'here' *kotchi* 'here' *atchi* 'over there'	*sore* 'that one' *kono* N 'this N' *konna* N 'this kind of N'		*asoko* 'over there' *soko* 'there' *ano* N 'that N over there'	
Question words		*nani* 'what' *doko* 'where'	*dore* 'which one' *dotchi* 'which one'	*nande/dooshite* 'why' *dare* 'who' *doo* 'how'	
Final Particles	*yo* (assertive) *iku yo.* 'I am going' *no* (question) *oishii no?* 'is it tasty?' *ne* (reconfirming) *oishii ne.* 'it's tasty, isn't it'	*kanaa* (doubt) *doko kanaa?* 'I wonder where it is' *mon* (assertive) *iku mon.* 'I'll go anyway' *ka* (question) *oishii ka?* 'is it tasty?'	*yo ne* (reconfirm) *oishii yo ne.* 'it's really tasty, isn't it' *no yo* (affirm) *oishii no yo.* 'it's tasty, I tell you'	*no kanaa* (doubt) *dare na no kanaa.* 'I wonder who it is'	

Table 2. Description of language samples examined in this study (typically developing children)

Child	No. of Utterances	Age (y;m)		
Tar	120 each	2;0	3;0	
Njd	120 each	2;2	3;1	3;6
Als	120 each	2;6	3;0	3;6
Jun	120 each	2;6	3;0	3;6
Tom	120 each			3;5

4. RESULTS

4.1 TD CHILDREN

4.1.1 Age versus MLU

The TD children aged between 2;0 and 3;6, showed MLUm values between 1.3 and 4.4. Like previous studies of Japanese MLU, we found a strong correlation to age (**Fig.1**). We estimated statistical significance by treating multiple data obtained from a single child as independent data: A Pearson product-moment correlation coefficient was found to be highly significant between age and MLUm (r=0.804; p=0.0002).

4.1.2 Age versus DSSJ

Next we looked at the DSSJ results of the TD children. We found a linear increase in the DSSJ score, with a stronger variety in the higher age range (**Fig. 2**). The two early samples (Tar at 2;0 and Njd at 2;2) scored very low, that is, under 100 points. The two samples at 2;6 (Als and Jun) scored 150-200 points. The five samples around 3;0 (Tar, Tom, Jun, Als, Njd) scored between 200 and 400 point, while the samples over 3;6 scored over 270 points (Mic, Als, Jun, Tom). The correlation coefficient was significant (r=0.758; p=0.0010) between age and DSSJ.

4.2 CHILDREN WITH DEVELOPMENTAL DISORDERS

4.2.1 Age versus MLU

Non-typical children showed a tendency similar to that of TD children. The sample with the lowest DA (first sample of MR2 DA 2;6) also displayed a low MLUm around 2.1, and children with a DA of 3;7-3;11 reached a high MLUm of 3.9-4.6 (**Fig. 3**). However, for the children judged between DA 2;8 and 3;3, we found mixed results. While two children (MR3 and second sample of MR2) scored rather low (MLUm 1.9-2.3), two others (PDD3 and first sample of MR1) scored high on MLUm (3.6 and 4.2, respectively). The correlation coefficient was nonsignificant (r=0.520; p=0.197), but this may partly be due to the small sample size.

While the three children with PDD scored well within the MLUm range displayed by the TD children, two of the three children with MR (MR2 and MR3) scored relatively low in comparison to their developmental age (**Fig. 1, 3**). While the TD children ranged between 2.9 and 4.4 points at about 3;0 (average 3.3 points), MR2 reached an overall score of 2.3 at DA 3;0, and MR3 1.9 at DA 3;3.

4.2.2 Age versus DSSJ

The DSSJ results for non-typical children were comparable, although they showed a slight delay. The five samples between DA 2;6 and 3;3 (PDD3, MR1, MR2, MR3) scored in the range of 100-290 points. The three samples

Table 3. Description of language samples examined in this study (non-typical children)

Child	No. of Utt.	Chronological Age (y;m)	Developmental Age *
MR1	90	5;7	2;9 (ShinK at CA 5;1), 3;0 (ITPA at CA 5;9)
	86+36	6;1+6;4**	3;7 (ITPA at CA 6;5)
MR2	95	8;5	2;6 (TB at CA 8;6), 2;7 (ShinK at CA 8;7)
	87+33	9;3+9;6	3;0 (TB at CA 9;5)
MR3	82+38	4;5+4;8	3;3 (ITPA at CA 4;6), 3;2 (ShinK at CA 4;8)
PDD1	42+18+24	5;1+5;2+5;3	3;11 (ITPA at CA 5;1)
PDD2	89	5;3+5;4+5;5	3;7 (ShinK at CA 5;2), 4;3 (TB at CA 5;7)
PDD3	120	3;4	2;8 (LC at CA 3;8)

* ShinK = *Shimban Keishiki Hattatsu Kensa* (1983); Developmental Age for all Areas;
TB = Mental Age as indicated by *Tanaka-Binet Chino Kensa* (1987);
ITPA = Psycholinguistic age as indicated by *ITPA Gengo Gakushu Noryoku Shindan*;
LC= LC age as indicated by *LC Scale*.

** The "+" mark indicates combined data samples from 2 or 3 separate sessions.

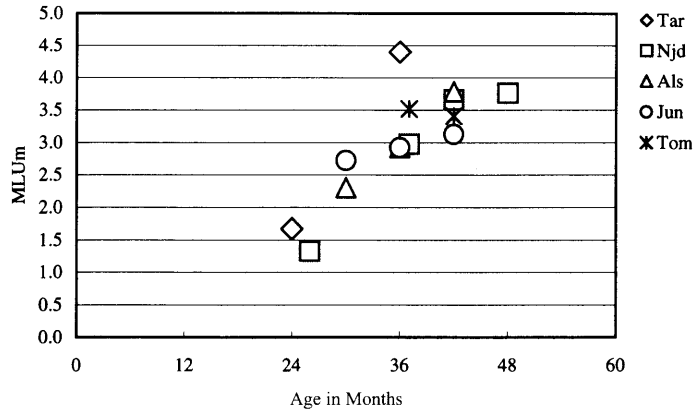

Fig. 1 MLUm related to chronological age in months (CA) for typically developing children

Fig. 2 DSSJ overall score related to chronological age in months (CA) for typically developing children

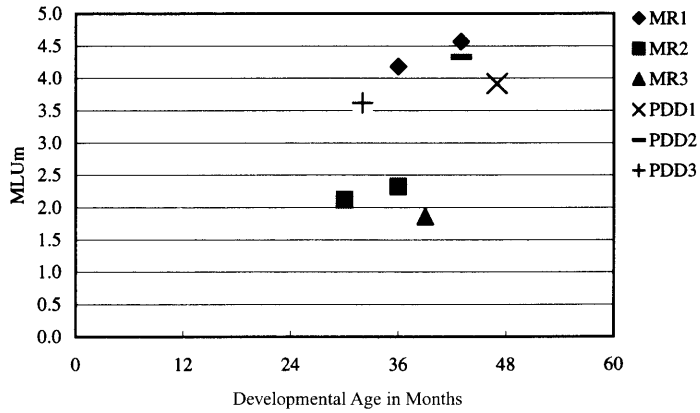

Fig. 3 MLUm related to developmental age in months (DA) for PDD and MR children

between DA 5;3 and 5;7 (PDD1, PDD2, MR1) scored between 320 and 390 points (**Fig. 4**). The correlation coefficient was not significant (r=0.636; p=0.0932) between the developmental age and DSSJ. As was the case with MLU, this may be due to the small sample size.

As with the case with MLUm, the three children with PDD appeared to score within the range of the TD children, whereas MR2 and MR3 scored relatively low for their developmental age (**Fig. 2, 4**). While the TD children ranged between 200 and 400 points at about 3;0, MR2 reached an overall score of 161 points at DA 3;0, and MR3, 115 points at DA 3;3. Furthermore, their was no increase from an earlier sample of MR2 at DA 2;6, where the child had reached 163 points (**Fig. 4**).

4.3 MLU VERSUS DSSJ

We then compared the DSSJ overall scores with the MLUm values (**Fig 5**). For the TD children, we found that those with an MLUm under 2.0, also yielded a low DSSJ (under 100 points), while those with an MLUm 2.3-2.7 yielded 150-190 points. With an MLUm around 3.0 the DSSJ score rose to 200-315, and for samples with an MLUm over 3.4 the DSSJ score reached 270-395 points. The non-typical children showed an even stronger linear correlation. The three samples with low MLUm values (1.9-2.3) also showed a low DSSJ of 115-165 points, while samples with an MLUm of 3.6-4.2 had a DSSJ score of 240-325 points, and those with an MLUm of 4.3-4.6 reached a DSSJ score of 360-390. Correlations between MLUm and DSSJ were highly significant both for the TD children (r=0.848; p<0.0001) and for the non-typical children (r=0.956; p<0.0001).

5. DISCUSSION

As expected from previous research (Miyata, 1999; Ogura, Yamashita, Murase, 1994), MLUm showed a strong correlation with age for the five TD children. Although individual differences in the speed of development could be seen (especially Tar's values were higher than those of the other four children), MLUm showed a steady rise along the

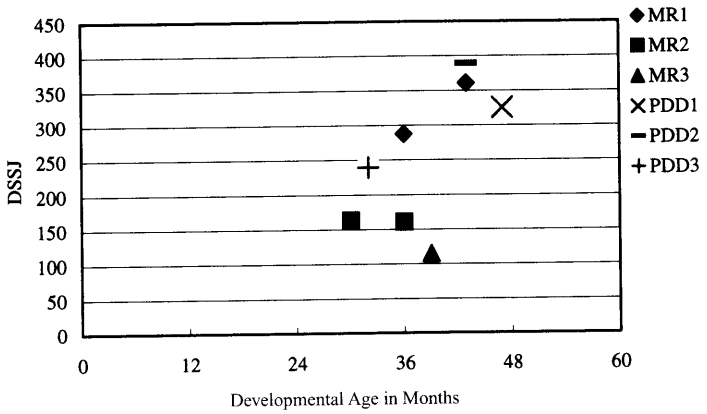

Fig. 4 DSSJ overall score related to developmental age in months (DA) for PDD and MR children

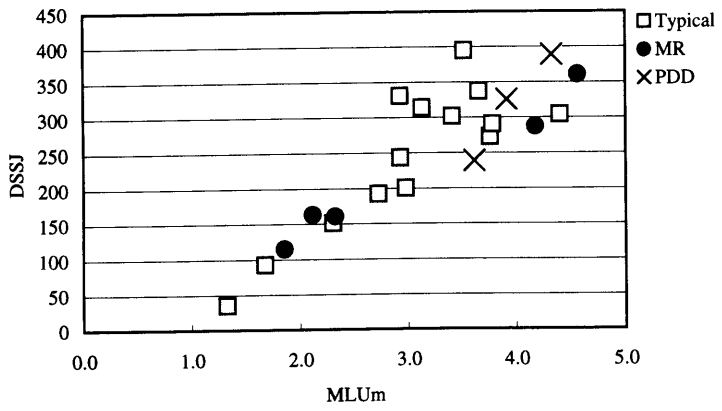

Fig. 5 DSSJ overall score related to MLUm for typically developing, MR and PDD children

age continuum. While at 2;0 the MLUm value ranged around 1.5, it continually rose to 2.5 at 2;6, to 3.3 at 3;0, and finally to an average of 3.5 at 3;6 (**Fig. 1**). These results correspond to the results of the three children between 1;6 and 3;0 reported in Miyata (1999). In that study, at age 2:0, one child (Aki) reached MLUm 1.2, while Ryo and Tai reached MLUm 1.5. At 2;6 Aki reached MLUm 2.5 (Ryo 2.9, Tai 3.5), and at 3;0 he reached MLUm 3.5 (Ryo 3.5, Tai 4.2).

In the case of the three MR and the three PDD children the correlation between the MLUm and developmental age was not significant with relatively large individual differences. The child judged DA 2;6 displayed a low MLUm of 2.1, while the children judged DA 3;7 and more displayed a rather high MLU over 3.9. The children between 2;6 and 3;3 showed mixed results. If we now compare their MLUm to the values reached by TD children of the present study, it turns out that the MLUm for four of the children (MR1, PDD1-3) was in the range expected from their developmental age, while one child (MR3), in particular, scored considerably lower in comparison to his developmental age (DA 3;3, MLU 1.9).

As with the case with MLUm, the relation between DSSJ and chronological and developmental age, respectively, turned out to be significant for typical children, but not for the children with MR and PDD. Whether individual variations, as demonstrated by the low DSSJ score of MR3 relative to the range of TD children is typical for this clinical population or whether the lack of correlations reflects the small sample size, needs to be investigated with a larger number of children.

When relating the MLUm to the DSSJ results, we obtained very strong correlations both for the TD children and for the non-typical children, with even MR3 fitting the linear relationship between MLUm and DSSJ scores. If we take a close look at the data of TD children, however, a tendency towards more diversity appears after MLUm 3.0 and DSSJ 300; that is, some children score higher on DSSJ than might be expected from their MLUm value (e.g.: Jun at 3;0 with MLUm 2.9 and DSSJ 331; Tom at 3;1 with MLUm 3.5 and DSSJ 395). For the PDD and MR children, the correlation between MLUm and DSSJ was even stronger than for the typical children, and also continued in the higher ranges of MLUm and DSSJ (**Fig. 5**).

Although the number of cases examined is still too low to be able to draw any final conclusions, DSSJ appears to be a valuable measure of language development for TD children, as well as for PDD and MR children. The strong correlation of DSSJ with MLUm shows that DSSJ promises to be a rather reliable indicator of language development. The diversity observed beyond MLUm 3.0 and DSSJ 300 in the case of the TD children may be related to the reliability problems with MLU over 3.5 mentioned earlier, which concerns the fact that children start to connect words and sentences with conjunctions such as *'and'* at around this time. Obviously DSSJ may also show a greater diversity after age 3;6. As already stated in Miyata, Otomo, Nisisawa (2005), words and morphemes acquired by older children increase in diversity, and the range of items which receive DSSJ scores has to be extended in order to be able to reliably capture the advanced language development of 4- and 5-year-olds. It is also possible, however, that the less clear relationships between MLUm and DSSJ beyond MLUm 3.0 and DSSJ 300 suggest that these two indices assess different aspects of language. If this is the case, DSSJ can be regared a more promising measure of language development.

The high correlation between the two linguistic measures MLUm and DSSJ in comparison with the weaker correlation between each measure and developmental age shows that even standardized tests do not precisely capture the the developmental level of expressive language. In other words, developmental age alone is not a sufficient predictor of the expressive language of non-typical children. Theorizing relationships between MLU, which indicates the length of morpheme combinations, and DSSJ, which reflects both semantic and grammatical complexities of the output, will further strengthen the significance of these procedures as clinical tools.

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新たな言語発達指標としてのDSSJの開発：
健常児と発達障害児の自発話サンプルに基づいたDSSJとMLUの比較

宮田Susanne　大伴　潔　西澤弘行

1．はじめに

言語発達の評価にあたっては，語彙や文法，語用など複数の言語領域に関する発達情報を統合する必要がある．しかし，日本語では「絵画語い発達検査」や「日本語マッカーサー乳幼児言語発達質問紙」などの語彙能力の評価や，より広い言語学習能力を対象とする「ITPA言語学習能力診断検査」，語彙・文法等の理解・表出面とコミュニケーションを包括的に評価する「LCスケール」などがあるものの，表出言語の統語スキルに焦点を当てた評価方法はまだ開発されていない．

表出言語を評価する方法として，自発話における語連鎖の長さを数値化する平均発話長（MLU: Mean Length of Utterance）が提案されており，日本語への適用も試されている．これは100の自発話サンプルのそれぞれについて「いちご／を／ぜんぶ／たべ／た／よ」のように文を形態素に分割し，100発話の平均値を文の複雑さの指標とするものである．英語についてはMLU値から標準的な年齢を推定する標準化が行われているが，日本語では「形態素」としてカウントする単位が研究者間で異なることなどから標準化に至っておらず，臨床場面でもMLU分析はほとんど用いられていないのが現状である．また，言語を問わずMLUが課題とする点として，「～して，～して…」などと接続詞や接続助詞で文節が連鎖する発達段階になると，MLUの妥当性が低下することが知られている．したがって，英語では3歳以降についてはMLUの適用は控えることが望ましいとされている．

このような背景から，われわれはDSSJ（Developmental Sentence Score for Japanese）の開発を行ってきた．これは50－100の自発話に含まれる語彙の意味的・統語的複雑さに基づき発話の複雑さの指標値を求めるDSS（Developmental Sentence Score）の分析方法を日本語に適用したものである．ただし，英語と全く異なる言語体系である日本語にDSSを適用できないため，毎週の自発話を2年以上にわたって記録した7名の幼児の縦断データを詳細に分析し，発達指標となりうる言語領域の抽出を行った．点数化の対象となった10領域は以下の通りである：1）動詞活用形態素（語尾形態素「たべ／**た**」；中間形態素「たべ／**られ**／た」），2）形容詞活用形態素（「おいし／**かった**」），3）形容動詞活用形態素「きれい／**だった**」，4）否定形（「だめ」「しか…ない」），5）接続詞・接続助詞（「おいしい／**から**／たべて」，6）名詞句（「おいしかった／ごはん」），7）格助詞・係助詞（「ママ／**は**／イチゴ／**が**／いい」），8）指示詞（「ここ」），9）疑問詞（「なんで」），10）終助詞（「いく／**よ**」）．これらの言語領域の中で，発達スピードの個人差にかかわらず比較的一貫した順序で獲得される語彙・形態素の抽出を行い，初期に獲得されるものは1点，獲得が遅い語彙・形態素ほど高い点数（最高5点）を付与した（**Table 1**）．この点数化を自発話に適用することで発話の統語的複雑さの指標を得た．例えば「これたべて！」では，「これ」（1），語尾形態素「（たべ）て」（1）で合計2点が与えられ，「いいの買ってもらったよ」では，形容詞「いい」の現在形（1），名詞句「いいの」（3），中間形態素「かっ／**てもらっ**／た」（5），語尾形態素「**た**」（1），終助詞「よ」（1）で合計11点となる．

2．目　的

本研究の第1の目的は，形態素単位のMLU（MLUm），DSSJと年齢（発達年齢）との関連について明らかにすることである．また，DSSJを健常児の自発話に適用し，DSSJの妥当性をMLU値と比較することによって明らかにすることを目指した．さらに，MLUmとDSSJを発達障害児の自発話に適用してこれらの指標の汎用性を明らかにすることを第2の目的とした．

3．方　法

対象児は，2;0から3;6の5名の健常児と，発達年齢が2;6から4;3の間にある3名の知的障害（MR）児および広汎性発達障害（PDD）児である（**Table 2, 3**）．発話分析では不明瞭な発話や繰り返し，相手の模倣などを除く自発話を対象とした．健常児については100発話を対象とし，発達障害児については，連続する自発話を得ることが困難であったため，複数のセッションを合わせて84以上の発話をひとつのサンプルとして分析した．すべての発話はパソコン上でCHILDESフォーマッ

トで分かち書きされ，自動の形態素タグ付けプログラムで形態素に分けられた．MLU，DSSJともにCHILDESにもとづくプログラムで解析された．

4．結　果

健常児群については，MLUmとDSSJ値の各々と年齢との間に有意な相関が認められ，年齢が高いほどこれらの指標値が上昇することが示された（**Fig. 1, 2**）．一方，発達障害児群については有意な相関は認められなかったものの，健常児群同様に発達年齢が高いほど群全体としてはMLUmおよびDSSJ値が増加する傾向がみられた（**Fig. 3, 4**）．対象児を個別に検討すると，PDD児は3名とも発達年齢に照らして両指標とも健常児の範囲内にあると考えられたが，1名のMR児（MR3）は特に発達年齢に比して低いスコアが示された．

MLUmとDSSJとの間には，健常児群，発達障害児群を問わず，有意な高い相関が認められ（**Fig. 5**），これら2つの表出言語指標の間には強い関連があることが明らかになった．

5．考　察

健常児におけるMLUmと年齢との関連については，過去の研究の結果と一致して高い相関が認められた．発達障害児においても同様の傾向はみられたものの，個人差も認められた．本研究で新たに検討されたDSSJについては特に健常児で年齢との関連が明らかであったことや，MLUとDSSJとの間に健常児と発達障害ともに高い相関が得られたことは，DSSJが言語発達評価の指標として妥当であるだけでなく，発達障害児にも十分適用可能であることを示している．発達障害児で発達年齢とMLUmやDSSJとの間に有意な相関が認められなかったことは少ないサンプル数の影響とも考えられるため，MR児とPDD児との間に質的な差があるのかを含め今後検討が必要である．また，DSSJ値300以上については，健常児であってもMLUmとの関連が弱まる傾向がみられ，形態素の連鎖の程度（MLU）と，意味的・統語的複雑さをも反映した指標（DSSJ）が発達的にどのように関連するかを今後4－5歳まで年齢範囲を広げて検討することが課題である．