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Abstract

This paper reports on the development and use of the Developmental Sentence Scoring for Japanese (DSSJ), a new morpho-syntactical measure for Japanese constructed after the model of the English Developmental Sentence Scoring model (Lee, 1974). Using this measure, we calculated DSSJ scores for 84 children divided into six age groups between 2;8 and 5;2 on the basis of 100-sentence samples collected from free-play child-adult conversations. The analysis showed a high correlation of the DSSJ overall score with the Mean Length of Utterance. The analysis of the DSSJ subarea scores revealed large variations between these subarea scores for children with similar overall DSSJ scores. When investigating the high-scoring children (over 1 *SD* over group average), most children scored high in three to five subareas, but the combination of scores for these subareas varied from child to child. It is concluded that DSSJ is a valuable tool especially for the language acquisition research. The overall DSSJ score reliably reflects the overall morpho-syntactic development of Japanese children, and the subarea scores provide specific information on individual acquisition patterns.

Keywords

language assessment, morpho-syntax, Developmental Sentence Scoring for Japanese, Mean Length of Utterance

Introduction

Assessment tools for language development are not available for all languages. Even Japanese, which has a relatively long history of linguistic research, suffers from a shortage of linguistic measures for clinical and research use (Miyata, Nisisawa & Otomo, 2005; Miyata, Otomo, Nisisawa, 2007). One way of improving this unsatisfactory situation is through the adaptation of approved English assessment tools. For obvious reasons, this is more straightforwardly performed in the area of vocabulary acquisition than for morphology or syntax. In fact, vocabulary measures, such as the Peabody Picture Vocabulary Test (Dunn & Dunn, 1981) or the MacArthur Communicative Development Inventories (Fenson, Dale, Reznick, Thal, Bates et al., 1993) have been adapted to a large number of languages including Japanese. Dale (2011) reports an impressive number of 60 languages, but still this represents only 1% of all languages.

In the field of grammar development, the Mean Length of Utterance (MLU; Brown, 1973) is probably the most widely adapted tool. This has to do with the fact that the definitions of MLU can be easily modified to work with other languages. Counting the number of morphemes per sentence is possible also for languages whose grammatical acquisition process is still unexplored. For Japanese, the MLU measure has been in use since the 1990s (Miyata, 1999, 2008; Ogura, Naka, Yamashita, Murase, & Mahieu, 1997; Watamaki, 1993, 1994, 1999). Although MLU has not yet been

standardized for Japanese, its usage is currently predominant for Japanese language development research purposes.

While MLU provides a simple and relatively efficient means of measuring grammar development, it is not clear to what degree sentence length reflects grammatical complexity (Crystal, 1974). This is particularly true for a highly elliptical null-argument language like Japanese. The Developmental Sentence Score (DSS; Lee, 1974) measures grammatical development more directly than MLU by scoring the use of selected morphological and syntactical items within sentences. Furthermore, DSS provides more detailed information on the morpho-syntactical development of a child. Sub-scores for individual grammatical areas allow a more detailed assessment and provides valuable information for language therapy (Hughes, Fey, & Long, 1992).

The Developmental Sentence Score (DSS)

DSS was developed in the early 1970's as a paper and pencil procedure. It consists of two parts. In the first part, called DST (Developmental Sentence Types), 100 consecutively spoken sentences are divided into "pre-sentences" and "sentences". Sentences include both subject and predicate, while pre-sentences are incomplete because either the subject or predicate have been omitted. Identical sentences are excluded, even when they are not direct repetitions and/or occur at different locations in the transcript. When more than 50 complete sentences are found in the transcript, it is

possible then to proceed with the computations of the DSS (Developmental Sentence Structures).

In the DSS analysis, each sentence is checked for selected grammatical items listed in a DSS table. The table covers 8 grammatical subareas ("indefinite pronouns and noun modifiers", "personal pronouns", "main verbs", "secondary verbs", "negatives", "conjunctions", "interrogative reversals", and "WH-questions"). According to the level of grammatical complexity, each item used receives between 1 and 8 points corresponding to eight developmental levels. For example, in the area of "conjunctions", the lowest scoring conjunction is the coordinating *and* with 3 points, the adversative conjunctions *but* and *if* are granted 5 points, while the conjunctive use of question words (e.g.: *I know where you are*.) scores highest with 8 points, according to their increasing syntactic and cognitive difficulty (Lee, 1974, p. 155-156).

Each sentence is checked for the grammatical items listed in the DSS table. For example, if the child utters a sentence like *Who broke my chair*, she will obtain 2 points for the Wh-question word *who*, 2 points for the main verb form *broke*, 1 point for the personal pronoun *my*, and 1 additional "sentence point" for the complete sentence "meeting all adult standards" (Lee, 1974, p. 157), making a total score of 6 points for this sentence (p. 179). This procedure is repeated for 50 sentences. The scores of all sentences are added and divided by the number of sentences to find an average score per sentence. Tis average score per sentence constitutes the DSS overall score. Further, it is

possible to compute the individual scores for each grammatical subarea.

The possibility to extract detailed scores for grammatical subareas, makes DSS an attractive diagnostic tool for assessment, as well as the evaluation of therapeutic intervention. Hughes, Fey, and Long (1992) studied the development of 21 children with language delay. They compared 10 children receiving language therapy to 11 children without therapeutic treatment. Samples of 50 sentences were collected before and after 5 months of treatment. Higher DSS scores clearly reflected the effect of the intervention for the group who received language therapeutic treatment.

A number of studies found a dissociation of MLU and DSS for several clinical populations. Rondal and DeFays (1978) found that children with Down syndrome in MLU stage III (2.50 - 3.00) had a lower DSS score than MLU-matched typically developing children. Mortimer and Rvachew (2010) examined the development of toddlers with speech sound disorders and found that these children had problems with verb morphology. Even in the case of such a toddler with a typical MLU, they scored lower on DSS than typically developing children.

Several studies compared the scores of the Index of Productive Syntax (IPSyn; Scarborough, 1990) with DSSJ and MLU. IPSyn is a grammatical measure similar to DSS, but using a different scoring method. While DSS produces an accumulative score based on each occurrence of a given grammatical form, IPSyn only scores the first and the second occurrence of a form. Oetting, Cantrell, and Horohov (1999) studied the

influence of dialect variation on MLU, DSS, and IPSyn scores of children with Specific Language Impairment (SLI) in comparison with age-matched as well as MLU-matched typically developing children in the age range of four to six (N = 31). They found that DSS, but not IPSyn, was sensitive to the morphological limitations due to language impairment. Dialect variation had no influence on any of the measures. However, Holdgrafer (1995), who compared DSS and IPSyn of samples from 19 typically developing and 10 language delayed children between 3;7 and 5;0, found IPSyn more sensitive to language impairment than DSS. Both studies found a strong correlation between DSS and IPSyn scores for typically developing children. Rice, Redmond, and Hoffman (2006) found MLU as useful as DSS and IPSyn for the assessment of SLI children. Their study compared MLU with DSS and IPSyn for 124 SLI and MLU- and age-matched typically developing children. The SLI and MLU-matched children developed in a similar way, and no mismatch of MLU and DSS was observed for the SLI children. DSS and MLU were highly correlated for both groups.

Some studies included also older non-typically developing children. Finestack and Abbeduto (2010) compared narrative samples from highly verbally expressive adolescents with Down syndrome, Fragile X syndrome, and mental-age matched typically developing children on DSS and Oral and Written Language Scales (OWLS). The participants with Fragile X syndrome scored higher on DSS than the Down syndrome group. These higher scores were caused by a higher frequency of

grammatical items rather than qualitative differences. This corresponds to the study of Reed, Griffith, and Rasmussen (1998) who examined 8- to 17- year-old typically developing children and adolescents. They found a substantial difference between the 8-year-olds and the older children for the DSS overall score and all subareas except secondary verbs. The higher scores for older children were mostly due to an increased frequency of use. This suggests that DSS can be applied to a wider age range than MLU, which is commonly used to evaluate children only up to age three or four.

When extending the age limit of DSS, the method of elicitation appears to play a role. Especially open-ended questions and narratives seem to be effective in eliciting morpho-syntactically complex utterances. Fields and Ashmore (1980) specifically investigated the influence of data elicitation on the morpho-syntactical complexity captured by DSS, MLU, and inflectional scoring for ten language delayed and ten typically developing children between 4;6 and 6;6. They found that open-ended questions yielded higher DSS scores than picture tasks and also higher than data obtained from unstructured wireless telemetry recordings. Finestack and Abbeduto (2010) sampled narratives from their adolescent participants with Down syndrome and Fragile X syndrome. In fact, narratives or structured interviews with open-ended questions might be more effective than free-play situations for eliciting morpho-syntactically complex samples from older children. Kemper, Rice, and Chen (1995) analyzed narratives from 62 children five to ten years of age and found a rapid

developmental increase of MLU and DSS up to an age of six, followed by a slowdown until approximately eight years of age.

A second important factor is sample size. Johnson and Tomblin (1975) compared the reliability of DSS based on 50-sentence speech samples of 50 children aged 4;8 to 5;2. The original speech samples were cut into 5-sentence slices and recombined to sample sizes varying between 10 and 250 sentences. As expected, the reliability was growing with sample size, but was still relatively low for 50 sentences ($r = .75$) and 100 sentences ($r = .86$). Only with 150 sentences a reliability of $r = .90$ was reached. This method of combining samples from different children, however, is based on the assumption that the children of an age group obtain a similar DSS score, which is not necessarily the case. We think that an intra-individual comparison of different sample sizes is necessary for the investigation of sample size effects. Even so, this study suggests that the commonly recommended sample size of 50 sentences for DSS might be too low to yield reliable results.

Although a number of studies indicate an interesting relationship between DSSJ and MLU, as well as IPSyn, there has not yet been any systematic comparison of profiles for typically developing children and children with different types of disorders. Also, the sampling method and the minimal sample size issue should be further investigated, in order to obtain reliable cross-sectional results and to determine the upper age limit for typically developing children.

Constructing a Developmental Sentence Score for Japanese (DSSJ)

Overall, DSS appears to be an attractive measure of morpho-syntactic development. DSS covers a relatively wide age range and delivers detailed information on development within separate grammatical areas, which makes it a promising tool for the research and the assessment of typically and atypically developing children. We therefore decided to construct a morpho-syntactic index for Japanese based on the model of the English DSS. When adapting DSS to Japanese we faced the following problems.

Selection of items and stage assignment. Japanese morpho-syntactical structure is very different from English. This means that DSS items and their scoring cannot be directly transferred from English to Japanese. Even for items existing in both languages, the timing of acquisition can be different because of sociolinguistic factors (e.g.: personal pronouns). Rather than looking for equivalents of the original English items, we selected grammatical items based on close observation of the development of eight Japanese children aged two to five.

In order to reflect the general acquisition process of typically developing Japanese children, we decided to only include items that were acquired in the same order for the eight children who had been investigated longitudinally (Miyata et al., 2006, 2009; Appendix A). The selected items were grouped in the following nine subareas: 1) verb last inflection, 2) verb middle inflection, 3) copula inflection, 4)

conjunctions and conjunctive particles, 5) noun phrase structure and compounds, 6) case, topic, focus and quotative particles, 7) adverbs, 8) sentence modality markers and formal nouns, and 9) final particles.

The selected items were grouped into five developmental stages. For example, for verb final inflection, present tense (*taberu* eat-PRES 'he eats'), past tense (e.g.: *tabeta* eat-PAST 'he ate') and colloquial imperative (*tabete!* eat-IMP:te 'eat!') were grouped into stage 1, while the hortative (*tabeyoo* eat-HORT 'let's eat') was classified as a stage 2 item. For case particles, the nominative *ga* and locative *ni* were grouped into stage 1, while the accusative particle *o* was acquired later and therefore grouped into stage 3. The items were grouped under consideration of the acquisitional timing across all grammatical areas. The resulting DSSJ Stage Table is provided in Appendix B.

Sentence point. The DSS score includes a "sentence point" added for complete sentences "meeting all adult standards" (Lee, 1974, p. 157) as a criterion reflecting growing grammatical competence. The sentence point cannot easily be transferred to Japanese. Because of the optionality of arguments and case particles, only a few utterances of young Japanese children would be considered ungrammatical, especially in the early stages. Only when the child starts to use more complicated constructions will inflection or case particle errors increase and non-adult standard utterances appear. Ironically, the application of the sentence point system would therefore result in a reverse effect: younger children are more likely to gain sentence-points than older

children. Because of this, we decided to forego the "sentence point" in the Japanese version of DSS.

Pre-sentences and sentences. Similarly, the distinction between "pre-sentences" and "sentences" proved difficult in Japanese. Lee (1974, p. 82) defines sentences as utterances where "subject and verb are both spoken", whereas pre-sentences are "utterances which contain only a partial subject-verb grammatical structure". It is obvious that this distinction is not applicable to a null-argument language. In Japanese the portion of sentences without any overt subject and/or object is high (Guerriero, Oshima-Takane, and Kuriyama, 2006; Hirakawa, Oshima, and Ito, 2009; Kuno, 1973; Martin, 1975), and sentences consisting only of verb or adjective are "conceived of as complete and are grammatical" (Tsujimura, 2007, p. 255). The DSSJ therefore disregards the distinction of pre-sentence and sentence and analyzes the complete sample of 100 sentences.

How reliable is this resulting Japanese version of DSS? In order to test DSSJ, we analyzed cross-sectional speech samples from children between 2;8 and 5;2. On the basis of these samples, we investigated the following questions. 1) Does DSSJ accurately evaluate the grammatical development of Japanese children? 2) How strong is the correlation of DSSJ with MLU? 3) Do children who score high on DSSJ also display high MLU scores, and vice versa? 4) Do children with high overall scores also score highly in the same DSSJ subareas, or do individual differences exist? 5) Which

subarea scores increase most during development? 6) Can DSSJ be computed with less than 100 sentences?

Method

Sample. The cross-sectional samples used for this study consisted of dyadic adult-child interactions of 84 children (31 boys and 53 girls) acquiring Japanese as their native language. The observations included six age groups ranging from 2;8 to 5;2, each group consisting of 14 children (Table 1).

We used cross-sectional data deriving from a variety of studies. Fifty-three recordings were collected especially for this study in kindergartens in the Chubu area (Prefectures Aichi, Mie, and Gifu; Children 2, 8-14, 21-28, 41, 42, 55-84) and in the Tokyo area (Children 15-19). The samples were video-recorded using an external microphone for better sound quality. Additionally a digital voice recorder was placed near the children. After a warming up book-reading session, the trained interviewers engaged each child in dough-play and elicited about 120 utterances. The elicitation usually required twenty minutes of interaction.

Another twenty-four samples were taken from a larger sample collected by Jessika Tsubakita at several kindergartens in the cities of Kyoto and Uji (Child 29-40, 43-54). For our study we extracted 100 child sentences from 20-minute mother-child sessions using play-dough. These sessions took place in a room separate from other

students in the kindergarten. Children who uttered less than 100 fully comprehensible sentences and one child with very unclear pronunciation were excluded from this study. The following samples were randomly taken from longer free-play mother-child interactions at home (father-child interaction in the case of the Ishii Corpus). Children 1, 4, and 5 belong to a longitudinal data set collected in Tokyo and Saitama area by one of the co-authors, Keiko Itoh, and Child 57 belongs to a data set of six mother-child conversations provided by the co-author Kiyoshi Otomo. The Ishii-data (Child 20; Jun) is taken from the longitudinal data of the Ishii Corpus (Ishii, 2004), and Child 3 (Njd), 6 (Tom), and 7 (Als) are early recordings (2;8) from the MiiPro Corpus (Miyata & Nisisawa, 2009, 2010; Nisisawa & Miyata, 2009), available through CHILDES from http://childes.talkbank.org (MacWhinney, 2000).

Table 1. Specification of the data samples

Age Group	Mean Age (*SD*)	# of Children (m/f)
2;8	2;8.10 (5.9 days)	14 (5/ 9)
3;2	3;2.17 (6.3 days)	14 (4/10)
3;8	3;8.12 (7.0 days)	14 (5/ 9)
4;2	4;2.21 (8.0 days)	14 (6/ 8)
4;8	4;8.09 (7.6 days)	14 (5/ 9)
5;2	5;2.11 (9.1 days)	14 (6/ 8)
Total		84 (31/53)

Transcription and scoring. All samples were transcribed in Japanese and Latin script (Miyata, Muraki, and Morikawa, 2004) using the Wakachi2002 v.3.0 format proposed by Miyata (2006) and provided with morphological tags in JMOR03 format (Miyata & Naka, 2006). We selected 100 fully comprehensible consecutive utterances. Complete and immediate imitations, self-repetitions, rote-learned phrases like song texts, nursery rhymes, and commercials were excluded. Furthermore, identical utterances were excluded, even if occurring at different locations in the transcript.

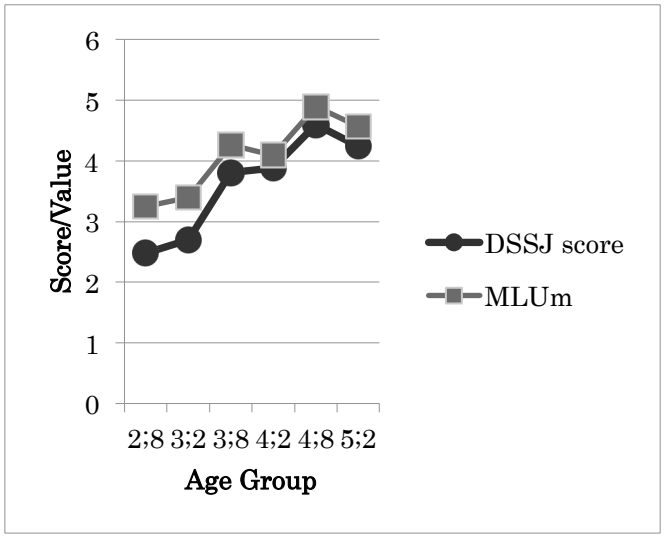
From these "cleaned" transcripts, we ran the MLU and the DSS commands of the CLAN program (MacWhinney, 2000). For MLUm (Mean Length of Utterance in Morphemes) we used the following command based on the definitions outlined in Miyata (2012): mlu +t%mor +b+ -sco* -sonoma* +d1 +t*CHI @. For DSS we compiled a specific Japanese library file (dssrulesjp.cut) that is now included in the Japanese MOR package distributed by CHILDES. For DSS we used the following CLAN command: dss +ddssrulesjp.cut +lj +b*CHI +e @.

Results

Question 1: Does DSSJ capture the grammatical development of Japanese children? First we compared the DSSJ results of the six age groups. The average DSSJ overall score increased steadily from 2.47 (*SD* 0.90) at 2;8 to nearly twice as much at 4;8 (*M* 4.59, *SD* 1.16). The average for the oldest age group (5;2) was 4.25 (*SD* 1.02).

This average was slightly lower than for the six-month younger children (Table 2). Nevertheless, the correlation of the children's average DSSJ score with age in months was high (r = .94, t (5) = 5.66, p < 0.005). The correlation of all children's DSSJ score with age in months was low (r = .56, t (83) = -41.20, p < 0.0001, two-tailed), but slightly higher than the correlation of MLUm with age (r = .50).

Question 2: How strong is the correlation with MLU? The curves for both measures run nearly parallel to each other (Figure 1), and the correlation of all children's DSSJ scores with MLUm was high (r = .95, t (83) = -10.05, p < 0.0001, two-tailed). Also the average DSSJ scores for each of the six age groups correlated extremely highly with the average MLUm (ρ = .94, t (5) = 5.66, p < 0.005; Table 2).



Figur 1. Mean DSSJ overall scores in comparison to MLUm of the six age groups

Table 2. Mean DSSJ and MLUm scores of the six age groups

Age Group	DSSJ Overall Score		MLUm Score
(n = 14)	*M* (*SD*)	Min.-Max.	*M* (*SD*)
2;8	2.47 (0.90)	0.90-3.98	3.25 (0.73)
3;2	2.70 (0.76)	1.68-4.24	3.39 (0.62)
3;8	3.81 (1.54)	2.09-7.86	4.26 (1.28)
4;2	3.88 (0.73)	2.60-5.10	4.11 (0.46)
4;8	4.59 (1.16)	2.98-6.65	4.89 (1.16)
5;2	4.25 (1.02)	2.59-6.20	4.56 (0.92)

This was also the case for the 5;2 year-olds who scored lower than the group 6 months younger: their average score was lower for both DSSJ and for MLUm. Also within each age group, including the lower performing 5;2 year-olds, we found strong correlations between DSSJ and MLUm ranging from $r = .85$ to .92 ($p < .0001$).

Question 3: Do children who score high on DSSJ also display high MLU scores, and vice versa? Next we focused on the 17 exceptional children who scored more than 1 *SD* higher than the mean of their age group on either DSSJ or MLUm. We found that all these exceptional children scored also higher than average for the other measure. Twelve out of 17 (71%) scored 1 *SD* or higher on both measures. The highest scoring child of all 84 children (Child 42, age 3;8) reached considerably high levels of MLUm (7.71) and DSSJ (7.93) alike. The only other child coming close to her performance was the 5;2 year-old Child 77. He attained the highest score in his age

group (DSSJ 6.29, MLUm 6.65), and he scored similar to Child 42 in all subareas.

Question 4: Do high-scoring children score higher on the same DSSJ subareas, or do individual differences exist? The children scoring higher than 1 *SD* than the mean DSSJ displayed various patterns concerning the subareas. Only Child 42, who attained the highest DSSJ score of all children, scored higher than average in all but one subarea (adjective inflection). Two children scored higher on six areas, but most children scored higher on only three to five areas (11 out of 14 children). These subareas varied according to the individual child; the children scored highly in various but different subareas.

For the seven younger children between 2;8 and 3;8 there was a tendency to score especially high on finite verb inflection (71% of the high-scoring children scored higher than 1 *SD* on VL), conjunctions and case particles (71% on both CONJ and CASFQ). Most older children between 4;2 and 5;2 scored higher on conjunctions (CONJ, 78%) and noun phrases including compounds (NP, 56%). This reflects the developmental tendency to progress from simple sentences with finite verbs and particles to complex sentence constructions using conjunctions and complex noun phrases. Other particular subareas with high scores are verb inflection, copula inflection and final particles; over 40% of the children scored highly in these areas.

Question 5: Which subareas increase most during development? In order to get an impression about which areas of development contribute most to changes in the DSSJ score, we investigated the average increase within subareas over time (Table 3). The scores for verb final inflection (VL) turned out to be especially high from the beginning (avg. 64.5 points), and they increased 160% further to over 100 points in the oldest age groups. Verb middle inflection (VM), copula (COP), case and other particles (CASFQ), and sentence modalizers (SMOD) showed a similar increase of about 160%. For noun phrase structure (NP) and conjunctions (CONJ) we found an even stronger increase (about 300% and 450%, resp.). On the other hand, the scores for adjective inflections did not increase until age 5;2. Japanese adjectives inflect for tense like verbs, and in fact many endings are identical to the corresponding verb inflections. Nevertheless, adjective usage was relatively rare in our samples. Most of the adjectives were in present tense form, although negation and past tense had already appeared sporadically in the lowest age group. It is possible that these higher scoring adjective inflections become more frequent after age five. Overall, scores in all areas, except adjective inflection, continued to increase until age five.

Question 6: Can DSSJ be computed with less than 100 sentences? While the figures above are based on 100-sentence samples, the original DSS is based on 50 sentences. We therefore want to explore the reliability of 50-sentence samples for DSSJ.

Table 3. Mean DSSJ subarea scores for the six age groups (*SD* in brackets)

Area	2;8	3;2	3;8	4;2	4;8	5;2
VM*	22.4 (10.7)	26.5 (11.1)	33.1 (21.8)	35.5 (12.4)	45.9 (16.9)	35.7 (10.3)
VL	64.5 (19.7)	70.8 (17.0)	91.0 (28.9)	93.3 (18.7)	107.1 (25.0)	99.3 (24.6)
ADJ	12.4 (5.2)	10.7 (6.5)	15.8 (12.6)	15.8 (8.4)	13.6 (8.3)	12.1 (5.7)
COP	24.5 (15.5)	22.9 (9.8)	29.4 (23.7)	49.6 (23.4)	50.2 (22.3)	43.9 (14.3)
CNJ	9.7 (13.3)	8.8 (7.8)	36.2 (32.0)	23.1 (14.2)	42.3 (33.4)	33.6 (19.4)
NP	21.4 (12.7)	33.6 (13.4)	44.0 (15.7)	49.7 (25.2)	63.7 (28.1)	56.1 (22.8)
CASFQ	27.8 (13.2)	34.9 (10.2)	46.2 (21.5)	45.6 (16.5)	51.9 (26.2)	46.9 (16.7)
ADV	17.4 (8.0)	19.6 (18.6)	27.7 (16.6)	24.7 (15.9)	23.2 (14.1)	34.7 (20.2)
SMOD	14.2 (14.7)	13.6 (14.9)	14.1 (18.5)	12.8 (8.7)	21.9 (20.3)	22.0 (9.9)
FINP	33.1 (18.1)	28.2 (14.2)	43.6 (21.8)	37.6 (20.1)	39.6 (17.2)	40.1 (16.1)
Sum	247.3 (89.8)	269.7 (75.6)	381.1 (154.3)	387.7 (73.4)	459.4 (116.4)	424.5 (101.6)

*Abbreviations of the areas: VM middle verb inflection, VL last verb inflection, ADJ adjective inflection, COP copula inflection, CNJ conjunctive particles and conjunctions, NP noun phrase structure and compounds, CASFQ case, topic, focus and quotative particles, ADV adverbs, SMOD sentence modalizers, FML formal nouns, FINP final particles.

We split all samples into a first and a second half of 50 sentences each, and compared both halves to each other in order to examine the intra-individual reliability. The correlation between all first and second halves was low ($r = .51$, $t\ (83) = 5.33$, $p < 0.0001$, two-tailed). The correlation of the scores of all 50-sentence samples to the

corresponding DSSJ score for 100 sentences was relatively high (r = .86, t (167) = 21.57, p < 0.0001, two-tailed). The correlation of the 50-sentence samples with MLUm (based on the corresponding 100-sentence sample) was relatively high (r = .81, t (167) = 18.40, p < 0.0001, two-tailed), but not as high as the correlation we had found for the full 100-sentence sample (r = .95; see above, Question 2). The correlation with age in months was low (r = .48, t (167) = 7.01, p < 0.0001, two-tailed).

Discussion

DSSJ overall scores

Overall, we found a steady increase of the DSSJ overall score as age increased for the six age groups between 2;8 and 5;2, and a strong correlation with average DSSJ scores and age. However, the oldest age group (5;2) scored slightly lower than the 4;8 year-olds. As we can assume that children's morpho-syntax improves over the years, we conclude that DSSJ reflects this development, at least for the age span of three to five.

We found a strong correlation between DSSJ and MLUm. This corresponds to previous research on the English DSS which had shown a strong correlation to MLU, at least for typically developing children, while children with language disorders regularly scored lower on DSS than on MLU (Mortimer & Rvachew, 2010; Oetting, Cantrell, and Horohov, 1999; Rice, Redmond, and Hoffman, 2006; Rondal & DeFays, 1978). Indeed, we found a very strong correlation for the Japanese DSSJ and MLU m (r = .94 for the

group scores and r = .95 for the individual children). This was also true for the children scoring high on DSSJ (1 *SD* higher than average): they all scored higher than average on MLU as well.

The strong correlations show that there was no dissociation of DSSJ and MLUm in the older age groups. This suggests that DSSJ as well as MLUm might be valuable even after age four or MLU 4.0, resp., the upper reliability limit that has been suggested for the English MLU (Brown, 1973; Scarborough, Wyckoff, and Davidson, 1986; Klee & Fitzgerald, 1985, Bloom and Lahey, 1978; Bernstein & Tiegerman-Farber, 1997). Other researchers found MLU to be reliable up to age five (Miller & Chapman, 1981) or even six (Chabon, Kent-Udolf, and Egolf, 1982), and found correlations between MLU and other grammatical measures for these age groups (Kemper, Rice and Chen, 1995). This upper limit does not mean that MLU scores do not continue to increase after age six, but we would expect a larger degree of variation within the samples of individual children and thus a lower reliability. There are less studies investigating the upper age or score limit for DSS, but it appears that DSS is applicable for an age range longer than that for MLU. Reed, Griffith, and Rasmussen (1998) found that eleven year-olds scored higher on DSS than eight year-olds for most grammatical items mostly because the items were used more frequently. On this basis we might expect a higher age limit for the Japanese DSSJ as well.

The evidence mentioned above suggests that the lack of increase of the DSSJ

score which we found for the five year-olds compared with the younger 4;8 group is not necessarily due to an upper limit of applicability of DSSJ. The MLU scores for the older group were similarly low and strongly correlated to the DSSJ overall scores. The slightly lower average for the older group could also not be attributed to a single low-performing child but rather reflected an overall tendency of this age group. Ten out of fourteen children of the older group scored lower than the average 4;8 child. Also, in most subareas, the average scores for the 5;2 year-old children were slightly below the scores of the 4;8 year-olds, although the difference was not significant.

Furthermore, the case of the two highest scoring children (DSSJ 7.93, MLU 7.71, and DSSJ 6.29, MLU 6.65, respectively) speaks against any leveling off of DSSJ at age five or DSSJ 4.0. These figures show that complex morpho-syntactic structures are recognized by DSSJ and MLUm alike, at least up to a level of DSSJ 7.0.

If we disregard the possibility of DSSJ leveling off at this early level, what prevented our 5;2 year-olds to perform better than our 4;8 year-olds? The reasons for the comparably low DSSJ and MLU results remain unclear. It is possible that our elicitation method of free-play child-adult interaction is less effective for this age group.

In our study, free-play with play-dough was used to stimulate child-adult conversations. This same style of play was used for all children, no matter the age group, to ensure comparability of data for each age group. Play-dough is a preferred toy of kindergarten children, and most children over three years old like to play with it because

of its formability, colorfulness, and creative usage.

Nevertheless, using play-dough during child-adult conversation might not be the ideal speech elicitation method for older children. In our study the five-year old children tended to be less communicative than the four-year olds. When fascinated by a topic, the older children produced detailed explanations using complex sentence structures, but there were a number of situations where they answered only monosyllabically when prompted by the interviewer. This is in line with our experience with longitudinal observation. Children over four years old, especially boys, were less intrigued by the prospect of playing with their mother, and rather preferred to play outside with their friends. It is also possible that older children are more inhibited in conversations with adults than are younger ones. Japanese children of this age live in a world that is only partially shared by adults, and they increasingly become aware that adults are not only less knowledgeable about Pokémon, Purikyua and Gokaiger, but also consider this information as irrelevant. As a result they become more reluctant to talk about their interests with adults. For older children, therefore, free conversation might be less effective for elicitation of complex speech.

Although requiring more effort from both children and investigator, narratives might be a better option for older children. Kemper, Rice, and Chen (1995) analyzed narratives of children aged five to ten, and found an increasing MLU up to age seven. Similarly, a preliminary analysis of Japanese narratives elicited from three to

eleven-year old children (Inaba, in preparation) suggests that also in the case of Japanese children, MLU scores continue to increase up to at least age six. While the three-year olds found it difficult to retell the story even with much support from the investigator, most children over five years old retold the story willingly and more skillfully, even though it was obvious that they struggled with the complicated story line (Inaba, personal communication).

Further investigation of the elicitation method used, especially with respect to the older age groups, is necessary, but it is possible that for more accurate results, a switch from free conversation to a more suitable task like narration is necessary for children over five years of age.

DSSJ Subareas

While we found a steady increase in the overall score of DSSJ for all ages, the scores of the single subareas increased to a differing degree

. The scores for verb inflection were high even in the youngest age group and continued to increase as the age increased. Likewise, noun phrase structure and compounds, conjunctions, and case particles also showed substantial increases as the age increased. However, other subareas like adjective inflection, adverbs and sentence modalizers, increased to a lesser degree.

In addition, individual children showed differential performance across subareas.

When we investigated the subarea scores of the high-scoring children (more than 1 SD over the average of their age group), individually they displayed very different patterns. Only one child scored higher than average in all subareas but one. Most of the other children scored highly on three to five subareas, but these subareas varied according to the individual child reflecting his or her specific speech style. As a result there are different ways to reach a high DSSJ overall score. This recalls the study by Rollins, Snow, and Willett (1996) who found significantly different rates of morpheme use within a group of children of the same age and MLU for English. They concluded that MLU is a global measure behind which differences of morpho-syntactical developmental style might hide. The same can be said of the DSSJ overall score.

Overall, we can see tendencies that are different for the younger children than for the older ones. Most younger high-scoring children up to 3;8 scored higher than average on finite verb inflection, conjunctions and case particles, while the older children's high scores were concentrated on conjunctions, complex noun phrases and compounds. Therefore, many high-scoring children appeared to be advanced especially in the areas of basic syntax and sentence conjunction, although the individual pattern differed from child to child.

Sample size

The research on the English DSS as well as on MLU suggests that the sample

size plays an important role in the reliability of the results and suggests that the recommended size of 50 sentences for DSS might be too small (Johnson & Tomblin, 1975). We therefore compared DSSJ scores based on 100 sentences to samples of 50 sentences, analyzing the first and the second halves of the sample separately. Although we found relatively strong correlations of these half-sized samples with MLUm, it turned out that the correlation between the corresponding halves was low (r = .51), and we conclude that DSSJ needs more than 50 utterances to yield a reliable result. This is possibly related to a relatively high portion of sentences consisting of only one morpheme. As mentioned above, we had to disregard the notion of pre-sentences as opposed to complete sentences because Japanese is a null-argument language, and as such, sentences consisting only of a verb are as complete as sentences that include both subject and verb. As a result, our samples include sentences consisting of only one morpheme, for example a simple noun. These simple sentences, which are quite commonly used even by children in the older age groups, display no morpho-syntactic knowledge and therefore don't contribute to the increase of the DSSJ overall score.

It is possible that this portion of one-morpheme sentences makes a higher number of sentences necessary for DSSJ compared with the English DSS. In fact, it is not clear whether 100 sentences give a sufficient sample size. Future research should investigate the reliability of samples larger than 100 sentences in combination with different elicitation methods. For the time being we assume that a sample size of 50 utterances is

not sufficient for the Japanese DSSJ.

Conclusions

Overall we conclude that the DSSJ overall score reliably reflects the morpho-syntactic development of Japanese children. As we found a strong correlation between DSSJ and MLUm for all age groups including the five year-olds, the question arises why one would "bother" to calculate DSSJ if one can obtain the same result with the less complicated MLUm. If both measures are similarly sensitive to the morpho-syntactic development, what is the advantage of DSSJ? Compared with MLU, DSSJ scores grammatical items directly, and besides the overall score, more detailed results for the different grammatical subareas can be obtained. While taking a 100-sentence sample for DSSJ might require time and effort considered too excessive to be practical in clinical assessment, the more detailed analysis provided by DSSJ will be beneficial for research on the characteristics of different types of children including children with language disorders.

The current study examined the newly developed morpho-syntactical measures DSSJ in comparison to MLU. Based on speech data from 84 Japanese-speaking children between 3;2 and 5;2, we could show that DSSJ is a reliable measure at least up to age 4;8. The DSSJ scores of the oldest age group (5;2) did not increase in comparison to the group which is six months younger, but the correlation with MLU was equally high. The reason for this lower performance of the oldest group is not clear. It is

possible that our method of data elicitation (free-play child-adult conversation) was less effective for the oldest children, and that narratives might yield better results for older children. An examination of the sample size (50 vs. 100 sentences) revealed a low temporal reliability for 50-sentence samples for all age groups, which indicates that DSSJ should be used with samples larger than 50 sentences. Research concerning the elicitation method and the optimal sample size is needed.

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Appendix A. List of morpho-syntactical items used in DSSJ

adj	verbal adjective	*oishii* 'tasty'
ACC	accusative (particle)	*hon o katta*. 'I bought the book.'
adn	adnominal	*ironna* 'various'
adv	adverb	*chotto* 'a bit'
-ADV	adverbial	*oishiku* 'tastily'
-ALT	alternative	*tabetari* 'eating and…'
-CAUS-	causative	*tabesaseru* 'make eat'
-COMPL-	completive	*tabechau* 'eat up'
:conc	concate (contraction)	*tabecha* (= *tabete wa*) 'eat'
-COND:ba	conditional	*tabereba* 'if [he] were to eat'
-COND:tara	conditional	*tabetara* 'if [he] were to eat'
conj	conjunction	*soshite* 'and then'
-CONN	connective	*oishikute* 'tasty and...'; *tabete* 'eat and...'
ptl:conj	conjunction	*kara* 'because'
cop	copula	*da* '[it] is'
dem	demonstrative	*kore* 'this'
-DESID-	desiderative	*tabetai* 'want to eat'
FIN	final particle	*iku yo*. 'I'll go.'
FOC	focus particle	*anata dake* 'only you'
GEN	genitive (particle)	*papa no kutsu*. 'Dad's shoes'
-INTENT	intentive	*tabeyoo* 'let's eat'

-IMP	imperative	*tabero*! 'Eat!'
-IMP&POL	polite imperative	*tabe nasai! 'Eat!'*
-IMP:te	colloquial imperative	*tabete! 'Eat!'*
AN	adjectival noun	*kiree (na) 'beautiful'*
-NEG-	negation	*tabenai 'doesn't eat'*
NOM	nominative (particle)	*boku ga tabeta. 'I ate it.'*
NP	noun phrase	*oishii gohan 'tasty meal'*
-OBL	oblique	*tabenakya 'must eat'*
-PASS-	passive	*taberareru 'is eaten'*
-PAST	past	*tabeta 'ate'*
-POL-	polite	*tabemasu 'eat'*
-POT-	potential	*taberareru 'can eat'*
-PRES	present	*taberu 'eat'; oishii 'tasty'*
GER	gerund	*tabe ni iku 'go out for a meal'*
snr	sentence-nominalizer	*taberu no yameta 'he stopped eating'*
sub	subsidiary verb	*[katte] kita 'he bought it'*
TOP	topic (particle)	*boku wa konai. 'I won't come'*
VN	verbal noun	*sampo suru 'stroll'*
VP	verb phrase	*boku wa konai. 'I won't come'*

Appendix B. DSSJ Table

Area*	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
VL	PAST PRES IMP:*te*	HORT CONN	COND:*tara*	CONN&*wa* GER NEG&IMP:*de*	IMP NEG&OBL
VM	COMPL NEG *te-i-*	DESID POT POL *te-ku-* *te-ik-*	*te-mi-* *te-ar-* *te-ok-* *te-age-*	PASS	*te-moraw-* *te-kure-*
ADJ	A-PRES		A-NEG- A-ADV	A-PAST	
COP	*da* (*no da* excl.)		*de* *janai*	*na* *ni* *datta* AN *da* AN *na* AN *ni*	*ja*
CNJ		*kara* (causal)	*kara* (temporal) *to* *kedo*	*shi* *noni*	
				datte *ja*	*demo*

				sorede	
				dakara	
NP		N *no* (N)	N *to* (N)		AN *na* N
		A N	Adn N		V SNR
			V N		(*no da* excl.)
	N+N				PROP+N
					N+V
					V+V
CASFQ	*ga* (case)	*to* (case)	*o* (case)		*made* (case)
	ni (case)	*de* (case)	*kara* (case)		
	wa (topic)				
	mo (focus)		*dake* (focus)		*kurai* (focus)
					shika (focus)
		tte (quotative)	*to* (quotative)		
ADV		*motto*	*mada*	*ippai*	*yappari*
		moo	*chotto*	*nanka*	*sakki*
		mata	*ippai*	*sugu*	
SMOD			*desu*	*mitai (ni)*	*yoo (ni)*
				deshoo	*jan*
FML				*koto*	*hoo (ga)*

FINP	*yo*	*kanaa*	*no+yo*	*yo+ne*
	no	*mon*		*kke*
	ne	*ka*		
		naa		

*Abbreviations of the areas: VM middle verb inflection, VL last verb inflection, ADJ adjective inflection, COP copula inflection, CNJ conjunctive particles and conjunctions, NP noun phrase structure and compounds, CASFQ case, topic, focus and quotative particles, ADV adverbs, SMOD sentence modalizers, FML formal nouns, FINP final particles.