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A Psychometric Study of the ASL Receptive Skills Test When Administered to Deaf 3-, 4-, and 5-Year-Old Children

Abstract

A new test, the ASL Receptive Skills Test (ALS-RST), adapted from the BSL Receptive Skills Test (BSL-RST), was administered to 160 deaf children, ages 3–5, as part of the Early Education Longitudinal Study conducted by the Science of Learning Center on Visual Language and Visual Learning. An analysis of the test's psychometric properties was conducted. The results support the use of the ASL-RST for measuring ASL grammatical knowledge for developing signers at this young age level. The overall reliability of the test across all age groups was .96. An ANOVA revealed significant differences among sample age groups, as well as significant differences among groups of children differentiated by whether their families reported regularly using sign in the home. An analysis of items grouped by the grammatical feature that determined the structure of the ASL-RST showed systematic gains by age and systematic differentiation by the degree of grammatical complexity represented by the items. These grammatical differences in score performance are discussed from a developmental perspective in light of the current research literature on ASL acquisition.

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THE DEVELOPMENT OF reliable and valid sign language assessment tools is essential in order to monitor the progress of children acquiring sign language for a variety of purposes. For example, one specific and critically important research question for young deaf children pertains to the efficacy of bilingual ASL-English deaf education programming, as well as the impact of growing up in bilingual ASL-English families on later academic achievement. It is particularly important, for this purpose, to pursue the development of measures of ASL that are suitable for administering to preschool-aged deaf children. It will be impossible to effectively study the effects of dual language acquisition on child development without adequate measures of both languages (ASL and English). Although researchers and test developers have generated some checklists and experimental tests related to ASL assessment, until now a standardized measure of ASL has not been available (Paludnieveciene et al. 2012; Singleton and Supalla 2011).

Standardized tests have been developed for other signed languages, British Sign Language (BSL), for example, and these can serve as models in this area. Recent efforts to modify a test of receptive skill in BSL—the Assessing British Sign Language Development: Receptive Skills Test (BSL-RST; Herman, Holmes, and Woll 1999)—for use with other signed languages have been promising in spite of a range of linguistic, cultural, and psychometric challenges (Haug and Mann 2008).

In this article we report on the psychometric properties of an ASL adaptation of the BSL-RST, called the American Sign Language Receptive Skills Test (ASL-RST; Enns et al. 2013), when administered to preschool-aged deaf children. Test data using the ASL-RST with an American sample of deaf preschoolers aged 3, 4, and 5 participating in the Early Education Longitudinal Study conducted by the National Science Foundation–funded Science of Learning Center on Visual Language and Visual Learning (VL2) at Gallaudet University are analyzed, and selected psychometric properties of the adapted test are discussed.

Background

Establishing a first-language foundation in a natural signed language is the key premise of all bilingual deaf education programs. Without an established first language the success of bilingual programs is compromised (Knight and Swanwick 2002; Mahshie 1995; Prinz and Strong 1998). Bilingual programs emphasize first-language acquisition in signed language because these languages are considered the most natural and accessible languages for deaf children (Johnson, Liddell and Erting 1989; Klima and Bellugi 1979). The primary objective of bilingual deaf education programs is to facilitate the normal acquisition of language, cognition, and social structures through an accessible first language and then build the skills needed for academic learning and literacy upon this foundation. Therefore, if deaf students enter school without an established language base, developing their signed language skills must be the focus of education before proceeding with other curricular areas. For this reason, the need for reliable and valid assessments of preschool children's signed language proficiency is essential in furthering the educational objectives of bilingual programs for deaf students.

Determining preschool children's level of signed language proficiency as they begin formal schooling is essential for early childhood educators. Knowing a child's level of ASL skill is critical for placement, monitoring of the child's progress, identification of individual strengths and weaknesses, and the reporting of accurate information to parents about a child's development. Clearly, the need for reliable and valid sign language assessments of preschool-aged deaf children is great.

There are legitimate reasons for the paucity of signed language acquisition tests. It is a challenge to identify developmental problems in the acquisition of minority languages, whether they are signed or spoken (Johnston 2004). Frequently, norms for these populations do not exist because of a lack of controlled elicited data from representative samples of native users of natural signed languages (Schembri et. al. 2002). The number of studies of signing deaf children's language development is limited, and, in the studies that do exist, the number of participants is small. This is because only a minority of deaf children (less than 10 percent; Mitchell and Karchmer 2004) can be considered native signers; that is, they have had a normal experience of language acquisition from exposure to deaf parents who sign. Despite these limitations, a variety of signed-language assessment measures have been developed (summarized by Tobias Haug on his website, www.signlang-assessment.info), including tests for assessing competence in ASL.

Language researchers have defined some key developmental milestones and acquisition patterns in the ASL development of young deaf children (French 1999; Lillo-Martin 1999; Newport and Meier 1985; Schick 2003). Considerable information is also available on the linguistic features of ASL and their relative grammatical complexity, and this can help us understand the sequence of acquisition (Neidle et al. 2001; Valli and Lucas 2010). Although the connection between ASL acquisition research and the development of practical assessment tools needs to be extended, several tests have already been developed and continue to be honed.

Several of these measures are appropriate for school-aged children and focus on the relationship between ASL and English literacy skills. These include the American Sign Language Assessment Instrument (ASLAI) (Hoffmeister 1994, 2000) and the Test of ASL (TASL) (Strong and Prinz 1997, 2000). Although both of these measures have been used for research purposes and pilot-tested with students aged 8–15 years, neither one is commercially available (Haug 2005). The ASL Proficiency Assessment (ASL-PA) (Maller et al. 1999) is a screening tool developed to determine the level of ASL skills of deaf children born to hearing parents who are not expert signers. The initial testing using the ASL-PA involved eighty deaf children aged 6–12 years, and although some psychometric testing for reliability and validity has been conducted, the measure has not been standardized with large sample norms.

To assess ASL skills at the preschool level, the MacArthur Communicative Development Inventory for ASL (ASL-CDI) (Anderson and Reilly 2002) measures early vocabulary development in infants aged 8–36 months and utilizes parental or caregiver reports. The assessment is based on the English version of the CDI (Fenson et al. 1993). Although the ASL-CDI has been shown to be reliable and valid and is commercially available, it is limited to assessing productive lexical development at the early (8–36 months) preschool level.

Designed for use with children from birth to 5 years, a new checklist that combines content and strategies from earlier checklists is currently under development (also within the VL2 Center.) This tool, the Deaf and Hard of Hearing Children's Visual Communication and Sign Language Milestones checklist (created by Simms, Baker, and Clark; norms and descriptive information are provided in this volume) is designed and normed to provide age equivalencies for a large number of observable ASL capabilities. The checklist utilizes a rating-scale format that allows teachers and other caregivers to determine whether children (with deaf or hearing parents) are achieving appropriate levels of language development compared to norms developed with ratings of native signers at different developmental levels.

Each of the measures of ASL currently under development has strengths and weaknesses, particularly with regard to validity, availability, and purpose of assessment. An assessment tool that can be easily, reliably, and efficiently administered and scored by teachers and be used to monitor progress and provide guidelines for instruction is clearly required. This need led to the development of the ASL-RST. As noted, the ASL-RST is an adaptation of the BSL-RST, the first standardized test of any signed language in the world that has been normed on a population and tested for reliability (Johnston 2004). For this reason, researchers from several different countries have chosen to modify it for use with other signed languages. The advantage of adapting an existing test rather than developing an original one is that important considerations and decisions have already been evaluated. For example, the BSL-RST is based on what is known about signed language acquisition and highlights grammatical features identified in the research as important indicators of proficiency, such as verb morphology and use of space (Herman, Holmes, and Woll 1999). In addition, clear guidelines for the assessment format (e.g., pictures, video, number of items) have also been validated. (For a detailed description of the test adaptation process, please refer to Enns and Herman 2011).

The ASL-RST

The goal of the ASL-RST (Enns et al. 2013) is to assess understanding of syntactic and morphological aspects of ASL in children aged 3–12 years. The test includes both a vocabulary check and a video-based receptive test. The vocabulary check, which is a simple picture-naming task of twenty items, is used to confirm knowledge of the test vocabulary and to identify any sign variations children may have that differ from those used in the test. If necessary, the test administrator shows the child the test sign and ensures that the child can accept this version. If the child does not know (i.e., is unable to name or recognize) more than five of the vocabulary items, the test is discontinued at this point.

The receptive test includes three practice items, followed by forty-two test items organized in order of difficulty and presented by video (DVD format). Test items assess children's knowledge of ASL grammatical structures, including the following:

a. *Number/Distribution* (including spatial arrangements of objects, e.g., a row of parked cars)
b. *Negation* (including head shake with signs and negative signs, e.g., NOT, NEVER, NOTHING)
c. *Noun/Verb Distinctions* (including similar signs with different movements to distinguish between object and action, e.g., single movement/hold for SIT vs. small, repeated movement for CHAIR)
d. *Spatial Verbs* (including the use of classifiers to depict location, e.g., a car behind a house, and classifiers depicting action, e.g., a bicycle going over a hill)
e. *Size/Shape Specifiers* (including classifiers to show the attributes of people and objects, e.g., thin stripes on a shirt)
f. *Handling Classifiers* (including classifiers to indicate how objects are held, e.g., eating a sandwich)
g. *Role Shift* (where the speaker embodies two characters marked by shoulder shift and eye gaze, e.g., a mother giving an apple, and shifting to a child accepting the apple)
h. *Conditional Clauses* (including the use of raised eyebrows and ASL SUPPOSE to mark the first clause and indicate that the second event/clause is dependent on the first)

Administering the test involves the child watching the video of a deaf adult explaining the test procedure and then presenting each test item. There are fade-outs between items to allow the child time to respond. From an array of four pictures that appear on the video following each signed item, the child responds by pointing to the appropriate picture (drawing) represented by the signed item. For children who require a longer response time, the video can be paused. Testing time varies from twelve minutes to twenty minutes, depending on children's response times.

In the published version of the ASL-RST, scoring includes both a quantitative raw score (number of items passed) that is converted to a standard score and a qualitative error analysis to describe the pattern of grammatical errors made. The normative data are based on 206 children tested in Canada and the United States. All of the children were deaf, had been exposed to ASL by the age of 3 years, and had a nonverbal IQ of at least 70.

In the VL2 Early Education Longitudinal Study (EELS) project discussed here, a few minor modifications were made to the testing and scoring procedures. Not all of the children tested as a part of EELS had been exposed to ASL by age 3, as the study was designed to track the language and literacy development of deaf children from a range of backgrounds and experiences. Indeed, we wanted to determine whether children who had not been exposed to ASL (or who had had minimal exposure) would be able to make correct responses based simply on the iconic nature of some of the video-recorded items. (Evidence that children from nonsigning families were unable to respond correctly to ASL-RST items was considered to help strengthen the validity of the tool as a measure of growing language skill.) Our purpose was to determine whether true exposure to and emerging knowledge of the grammatical properties of ASL were required for correct item responses.

Also, we established a termination rule for test administration. Testing was terminated once a child had failed to get two items correct out of seven successive items. This was deemed appropriate, given the young age of the children and the fact that the items were arranged in order of difficulty, based on previous developmental work with the test. Test termination after repeated failures also reduced the effect of guessing on the obtained raw scores. Additionally, the ASL-RST was part of a battery of tests that required approximately two hours to administer. Thus the termination rule optimized the use of testing time, particularly for the youngest participants.

Finally, we recorded only raw scores (not standard scores). At the time of the testing, normative scaled-score conversions were not available. (In fact, data from the EELS project contributed to the normative database used to develop the raw-score to scaled-score conversions.)

Ultimately, our goal in the EELS study is to use the scores on the ASL-RST collected on the same cohorts of students each year over a three-year period to describe the growth of deaf children's language skills in different home and school contexts. In addition, we intend to study the relationship between ASL skills and emergent literacy skills within these different environments, including those that are bilingual ASL-English. In order to feel confident in using this instrument as a valid and reliable measure of receptive ASL skill, we used the test data collected in the first wave of the EELS project to evaluate the instrument's psychometric properties, which were specifically determined for this younger population. Previous publications of psychometric information for both the BSL-RST and the ASL-RST do not single out younger students as a unique cohort of study in the determination of the test's psychometric properties. We analyzed properties of the test for each of the ages (i.e., 3, 4, and 5) represented in the sample.

Method

The ASL-RST (Enns et al. 2013) was included in the battery of tests administered to a national sample of 3, 4, and 5-year-old deaf children as part of the VL2 Early Education Longitudinal Study (EELS). The EELS project was designed to track, over a three-year period, the emergence of language, cognitive, and literacy skills among preschool and early elementary-aged deaf children in a national study that also included extensive survey data from parents, teachers, and administrators. During the 2012–2013 school year, EELS completed its third year of data collection on the same three age cohorts of students (who are now 5, 6, and 7 years old.) Ultimately, we will use the EELS longitudinal dataset to test hypotheses about the interactions among language use, demographic characteristics, reading comprehension, and various home and school strategies for enhancing early literacy development in deaf children.

The ASL-RST was selected as a measure of ASL-skill development in the EELS direct assessment battery because it was designed for use with emerging young signers, was based on the BSL-RST, which had demonstrated strong psychometric properties among children aged 4 and older, and was easy to administer and score. In the EELS, trained assessors who were clinical psychology PhD students at Gallaudet University conducted all of the assessments. These activities were carried out under the close supervision of a senior professor of clinical psychology who also has a private practice that includes conducting neuropsychological assessments of deaf children. All of the scoring protocols were verified by the supervisor and double-entered independently into the EELS database to verify the data entry.

Characteristics of the EELS Sample

Within EELS, data were collected from a total of 251 children in Wave 1. However, due to the complex design of the study, not all of the data were collected on all of the children. For the current analysis of the properties of the ASL-SRT, we have extracted the data from the 160 children in the EELS dataset to whom the test was administered. Among the total number of EELS respondents, a considerable number of questionnaires were collected from the parents of children we were unable to assess. (Likewise, we assessed a number of children whose parents did not return the parent surveys.)

The EELS dataset includes deaf children whose reported hearing loss was in the severe-to-profound category. They come from a wide variety of family and school backgrounds. The types of schools included in the survey were public and private preschools, as well as early childhood programs. Schools were located in twenty-three states in various-sized communities; 13 percent of the schools were in very large cities, 23 percent in large cities, 8 percent in medium-sized cities, 15 percent in suburbs, 17 percent in small cities or towns of fewer than fifty thousand people, 21 percent in rural areas, and 2 percent on an Native American reservation. The schools had relatively high levels of federal funding (i.e., 73 percent of schools were receiving federal aid).

A demographic analysis of the 160 children who took the ASL-SRT as part of the EELS project reveals a highly diverse group of children:

Age at the time of testing: 3-year-olds: 21%; 4-year-olds: 35%; 5-year-olds: 44%
Sex: male: 55%

Race: white: 88% (including 8% who reported the use of Spanish at home)
Cochlear implant use: 29%
Home communication: speech only: 9%; sign language only: 41%; speech and sign: 50%
Parents' hearing status: neither parent deaf: 51%; one or both parents deaf: 49%
SES: family eligible for free or reduced-fee lunch: 50%
Mother's highest level of education: less than bachelor's degree: 49%; bachelor's degree: 23%; graduate degree: 28%

These percentages do not reflect those of the larger population of deaf children in the United States. Nonetheless, the diversity in the sample (particularly with respect to the relatively even numbers of children from "deaf of deaf" and "deaf of hearing" homes) is considered beneficial for our current purposes since it allows for a finer-grained analysis of population subgroups and a greater degree of generalizability across different segments of the population.

Results

Mean Performance Levels by Age

Figure 1 shows the mean raw-score performance on the ASL-SRT for each of the three ages studied. Although these means are far below chance-level performance, based on the total number of forty-two items, keep in mind that the assessment team terminated the test administration when a child failed to answer two items correctly out of any seven-item sequence. In evaluating the test items, it is important to consider the total number of items each child responded to. Table 1 shows, for each age, the mean and range of the ordinal position of the most difficult item answered correctly. For 3-year-olds, the mean item position of the most difficult item answered correctly was only 5.52. (On average, 3-year-old children answered only five or six items until they were no longer able to answer any items correctly, and thus the test was terminated a few items later.) *None* of the 3-year-olds got beyond Item 22 on the test. Thus the mean raw-score performance of 2.485 was not surprising (and above chance level), given the difficulty of the test for children at age 3.

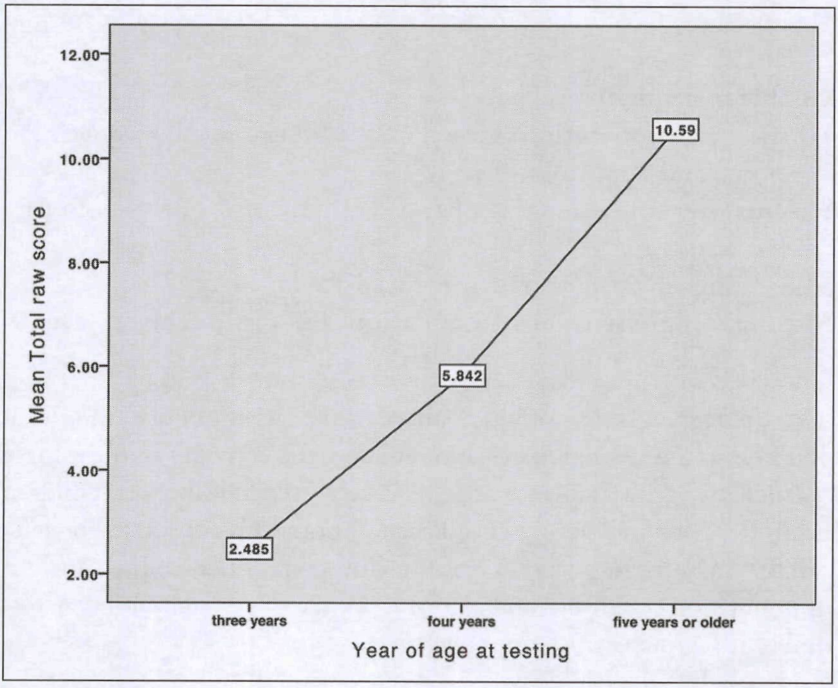

Figure 1. Mean number of items correct on ASL-RST by age.

In contrast, the mean item positions of the most difficult item answered correctly for 4- and 5-year-olds were 10.63 and 16.29, respectively, and *none* of the 4-year-olds went beyond item 35. It is very clear from these data that children "grow" into this test between the ages of 3 and 5 and that the test may have limited usefulness for 3-year-olds, especially beyond the twentieth item.

Table 1. Mean, Minimum, and Maximum Level of Difficulty of the Item Positions for the Most Difficult Items Answered Correctly, by Age.

Age	*N*	Mean item position of the most difficult item answered correctly	Minimum item position of the most difficult item answered correctly	Maximum item position of the most difficult item answered correctly
Three	27	5.52	1	22
Four	48	10.63	1	35
Five	67	16.29	1	42

Impact of Parental Deaf Status and Use of ASL in the Home

Using data from the EELS family background questionnaire, we grouped the EELS participants as follows: (1) children with one or both deaf parents regularly using ASL at home (DOD-s); (2) children with both hearing or hard of hearing parents who regularly use ASL at home (DOH-s); and (3) children with both hearing or hard of hearing parents who do not regularly use ASL at home (DOH-ns). The purpose of forming these groups was to examine the ASL-RST performance of groups of children whom we expect will have different levels of exposure to ASL at home and are therefore expected to demonstrate different levels of performance on the ASL-RST.

The analysis of these group differences is presented in figure 2. A two-way ANOVA revealed significant main effects for both age

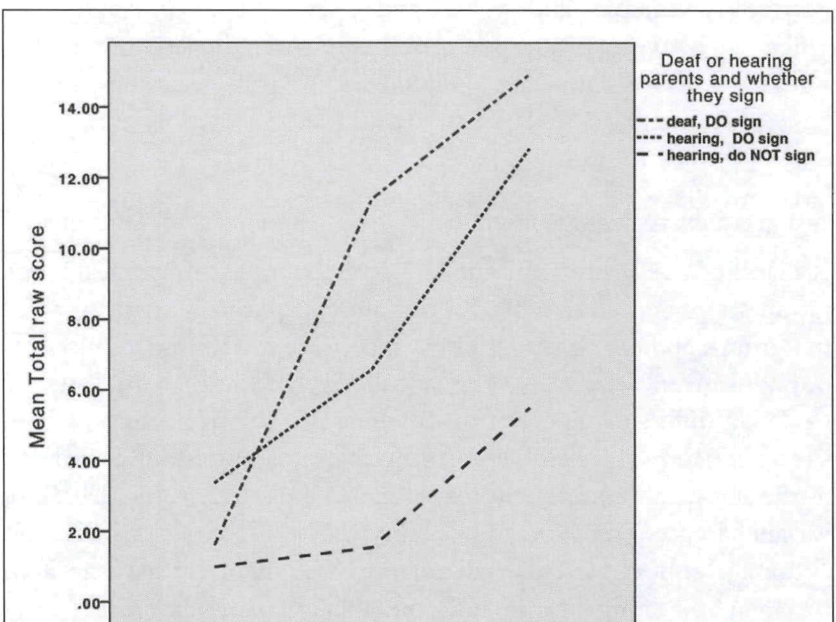

FIGURE 2. Mean performance on the ASL-RST by age for each of three groups of students defined by parental deaf status and the regular use of ASL in the home.

($F_{(2,80)} = 7.462$, $p < .01$) and parental deaf/communication status ($F_{(2,80)} = 3.493$, $p < .05$). The interaction between the two independent variables was not significant ($F_{(4,80)} = .742$, ns). Post hoc comparisons, using the Bonferoni method for controlling Type I errors revealed significant differences between the DOH-ns group and the DOD-s group (the DOD-s group performed significantly better) but no significant comparisons for either of these groups and the DOH-s group. (The less conservative LSD method reveals significant differences between the DOH-ns group and *both* the deaf and the hearing signing groups but no significant difference between the DOH-s and the DOD-s groups.) That is, in general, signing at home, whether by deaf or hearing parents, appears to be more significant than the deaf or hearing status of the parent in the prediction of ASL receptive skill performance as measured by the ASL-RST. With respect to age, the post hoc Bonferoni comparisons revealed significant differences between 3-year-olds and *both* 4- and 5-year olds but no significant difference between 4- and 5-year olds. (However, the less conservative LSD test revealed significant differences among all age-group pairwise comparisons.) The ASL-RST shows a clear sensitivity to age differences between the ages of 3 and 4.

Test and Subscale Reliabilities

Reliability coefficients for the full EELS sample and for each age group are presented in table 2. They are exceptionally high for all of the groups, indicating strong internal consistency among items composing a given total score. The calculations of these coefficients are based on different item sets for different age cohorts, resulting from the termination rules followed during the test administration and due to the statistical requirement that all items must have some degree of variance in the estimation of reliability. Obviously items on which an entire age cohort got either all correct or all incorrect have no item variance and cannot be included in the calculation of Cronbach's alpha measure of internal consistency.

Table 3 presents the reliability coefficients, average p values, and average percentage correct for each of the subscales defining the grammatical "blueprint" for the ASL-RST using the grammatical

TABLE 2. Reliability Coefficients of ASL Receptive Skills Test.

	Cronbach's alpha	Number of items[1]	Number of test takers
All ages as a group	.96	41	167[2]
3-year-olds	.84	18	33
4-year-olds	.96	34	57
5-year-olds	.96	41	71

1. The total number of items differs for each age due to the termination rules established for the test administration. The "number of items" indicated the number of items that were answered correctly by at least one participant within the respective age group. Reliability analysis requires variability among item performance for all items included in a given test.
2. DOB information was missing for six individuals who are included in the total reliability statistics but not included in the age-by-age analysis.

categories described earlier. Quite obviously, the ASL-RST is not designed as a diagnostic test that provides reliable profiles of a student's grammatical knowledge. Nonetheless, information about student performance on subsets of items defined by these categories may be quite useful for teachers in evaluating individual students and developing language exercises designed around particular grammatical features. To this end, we provide this information.

As table 3 shows, reliability decreases in grammatical domains that have fewer items in the test and in those that are more difficult.

TABLE 3. Reliability and Item Summary Data for ASL-RST Subscales.

ASL-RST Subscales	*N* Items	Cronbach's Alpha	Average p values	Average raw score	Average raw score proportion
Number and distribution	7	.82	.12	2.42	.35
Noun-verb	4	.79	.17	1.33	.33
Negation	9	.86	.21	1.91	.21
Size and shape classifiers	4	.47	.2	.79	.2
Spatial verbs	8	.66	.18	1.43	.18
Role shifting	2	.15	.11	.22	.11
Handling Classifier	3	.74	.08	.25	.06
Conditional	2	.31	.06	.13	.06

The easier domains (e.g., number, distribution, negation) and those with more items (seven and nine, respectively) show strong reliability, whereas difficult domains (conditionals and role shifting, each with only two items) show very weak reliability. The low levels of reliability in some of the domains may be related to the levels of difficulty for this group since we might expect a child who is developing a skill (rather than older children who have mastered it) to be inconsistent in recognizing the structure and using it to make a correct response.

Subscale Performance by Age

Figure 3 shows the mean percentage correct for each of the grammatical domains by age. Clear developmental trajectories are evident for each. Furthermore, there is a clear ordering of domains over time according to their difficulty. Negation, size, and shape classifiers, as well as number and distribution, have steeper slopes and show greater mastery over time than do the other domains as children reach the age of 5. However, the more grammatically complex domains of role shifting, handling of classifiers, and conditionals remain very difficult

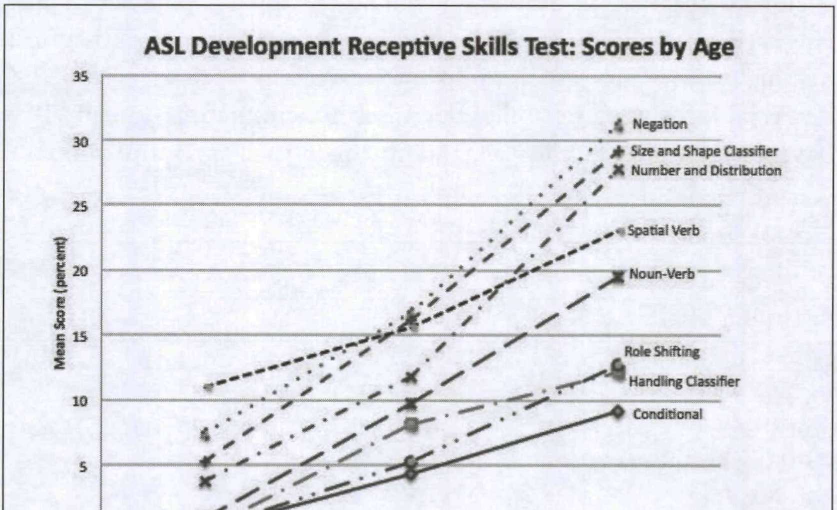

Figure 3. Mean percentage correct on different grammar domains in the ASL-RST by age.

all of these age groups. These findings may contribute to our growing knowledge of the developmental ages at which children become capable of understanding increasingly complex ASL grammatical structures.

Discussion

Our findings shed some light on assessment practices with young, signing deaf children and add to the understanding of the acquisition of receptive ASL skills. The results show that the ASL-RST is an effective measure of young children's understanding of ASL grammar. Although it is not intended to be a diagnostic tool, it does indicate the child's overall level of comprehension relative to normative data and can identify potential areas of concern, where further assessment and intervention may be needed.

The findings confirm those of previous studies of the importance of parental input in language acquisition (Hoffmeister 2000; Kuntze 2004; Mayberry 2007). The children of deaf parents had significantly higher scores than those with hearing parents who did not use ASL or any other type of signing. However, the children with hearing parents who did use ASL also performed significantly better than the children whose hearing parents did not sign. This emphasizes the impact that early exposure to ASL can have on language learning, which in turn influences other developmental and academic areas. It also suggests that even if parents are just beginning to learn ASL, their input makes a difference in their child's ASL acquisition.

Our findings also provide insight into the acquisition patterns of various grammatical structures in ASL. These results, however, must be interpreted with caution as the number of test items for all grammatical structures was not consistent and indeed for some structures was very low (two items in some cases).

The pattern of acquisition of spatial verbs, as demonstrated by the mean percentage correct throughout the three age groups, is interesting. Although the percentage of correct responses increases with age, the trajectory differs from that in other grammar domains (see figure 3). The results show that for 3-year-olds, spatial verbs were the grammatical domain with the highest percentage of correct responses; for 4-year-olds, it was still one of the top domains, together with negation and size and shape specifiers; however, with 5-year-olds, the category of spatial verbs falls to the middle of the group and is exceeded by the mean percentage correct for negation, size and shape specifiers, and number/distribution. This reflects several things. First, as previous research indicates, some forms of spatial verbs are acquired at an early age (Casey 2000; Lillo-Martin et al. 1985). Second, due to the broad range of complexity within this grammatical domain, spatial verbs are still developing well beyond age 5 (Kantor 1980; Schick 1990; Supalla 1982). This pattern may also be influenced by the fact that the number of test items is highest for spatial verbs (sixteen items in total). This allows for a greater demonstration of growth in the acquisition of this structure, whereas the children may have "topped out" on the grammatical structures that were assessed with fewer items (e.g., size and shape specifiers [four items]; nouns/verbs [four items]; and number/distribution [seven items]).

Some other patterns are also worth mentioning. For example, the results from this study confirm previous findings that ASL grammatical structures for negatives and number/distribution are acquired earlier (Hoffmeister 1978; Meier 1982) and that structures like conditionals and role shift develop later (Emmorey 2002; Morgan 2002; Reilly, McIntire, and Bellugi 1990; Schick 2010; Winston 1995). One surprise was the relatively flat trajectory for the acquisition of handling classifiers since these are typically believed to develop earlier (Kegl 1978; Lindert 2001; Slobin et al. 2000). A possible explanation for this finding is related to the test construction. Two of the test items measuring handling classifiers also assess spatial verbs since the two structures are embedded in the same sentence. It is not possible to determine whether children's errors on these items are due to a lack of understanding of the handling classifier or of the spatial verb constructions. For this reason, more detailed analysis of the error patterns (the child's selection of distracter items) or possibly further diagnostic testing would be required to accurately determine the area of difficulty. In future test revision and development, the separation of grammatical structures within each test item should be considered.

This study revealed that the youngest children, the 3-year-olds, were not able to respond correctly to many items; thus the test was often discontinued due to numerous errors. It may be that the task, which is somewhat decontextualized (i.e., linking a signed sentence to a picture, all on video), was not appropriate for their developmental level. However, many of the 3-year-olds were able to name or identify the pictures cards as part of the vocabulary pretest, so the concept of linking signs to pictures was not completely unfamiliar to them. Also, grouping all of the children in this age group together may not reflect the tremendous growth that occurs in language acquisition during this period. There may be considerable differences between what 3.0-year-olds and what children who are at least 3.5 years old are able to understand. Future research should expand test items to include a greater number of earlier-developing grammatical structures and possibly provide alternative test-presentation formats (such as live vs. video-recorded) to assess more accurately the early acquisitions of this youngest group of children.

Overall, the findings confirm the importance of early exposure to ASL. Even at these early ages the difference in ASL acquisition with children exposed to ASL is evident and can be measured. Preschool children's language development is critical to later language learning, social interaction, and academic achievement. The ASL-RST is an effective measure for assessing young children's acquisition of ASL. Its test task is simple enough for preschool children to understand, and the results clearly support and reflect the developmental sequence of ASL acquisition as established by previous research.

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