

Research Article

A Comparison of Natural Language Samples Collected From Minimally and Low-Verbal Children and Adolescents With Autism by Parents and Examiners

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Purpose: We aimed to compare the speech of parents and examiners as they elicited language samples from minimally and low-verbal (MLV) children and adolescents with autism spectrum disorder (ASD), while following the same semi-structured elicitation protocol, Eliciting Language Samples for Analysis—Adolescents (ELSA-A). We also compared the speech elicited from the MLV children/adolescents by their parents at home and by trained examiners in the lab and assessed the feasibility of parents collecting language samples at home.

Method: Thirty-three (five female, 28 male) MLV children and adolescents with ASD between the ages of 6;6 and 19;7 (years;months) participated. All participants were administered standardized assessments, and a trained examiner collected an ELSA-A language sample from them in the lab. The parents of 22 of the children/adolescents collected an ELSA-A sample at home. All language samples were transcribed following standard procedures, and measures of expressive language were extracted to assess the quantity of speech, its syntactic complexity, and lexical diversity. At the end of the study, parents filled

out a feedback survey about their experiences collecting ELSA-A.

Results: On average, parents produced twice as much speech as trained examiners during ELSA-A. However, their speech did not differ in syntactic complexity or lexical diversity. When with their parents, the MLV children/adolescents also produced twice as much speech than with trained examiners. In addition, their samples were more lexically diverse. Overall, parents elicited longer language samples but administered fewer of the ELSA-A activities. Nevertheless, the majority of parents rated the experience of collecting language samples at home favorably.

Conclusions: When parents collect language samples at home, their older MLV children/adolescents with ASD produce more speech and engage in more back-and-forth verbal interactions than when with trained examiners. Because parent-elicited language samples allow for a richer assessment of children's expressive language abilities, future studies should focus on identifying ways to encourage parents to collect data at home.

Assessing the verbal abilities of minimally and low-verbal (MLV) children and adolescents with autism spectrum disorder (ASD) presents a significant challenge and often requires major adjustments and adaptations to traditional assessment methods (Kasari et al., 2013). Natural language samples (NLS), widely used in language acquisition research (MacWhinney, 2007), have

been proposed as an optimal approach for assessing the expressive language for individuals at this neglected end of the spectrum (Barokova & Tager-Flusberg, 2018; Tager-Flusberg & Kasari, 2013; Tager-Flusberg et al., 2009). Yet, there is no systematic investigation of how to tailor traditional NLS sampling methods to older MLV speakers in a way that would elicit speech most representative of their true ability. One important avenue for investigation is the role of conversational partner. By virtue of familiarity, parents might be better than unfamiliar adult examiners at collecting language samples from their children. The role of familiarity could have important implications in the assessment of MLV individuals with ASD, whose behavioral challenges, combined with social withdrawal and difficulty

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communicating (Lord, 2010), might make them more hesitant to interact with a stranger in the lab. Yet, no study has asked parents to elicit speech from their older MLV children and adolescents. This study aims to assess the feasibility of parents collecting NLS in their homes, to compare their speech to that of trained examiners collecting NLS in the lab, and to compare the speech parents and examiners elicit from older MLV children and adolescents with ASD, while following the same elicitation protocol.

Only one study to date has empirically tested the claim that parents might be better than examiners at eliciting speech from children with ASD (Kover et al., 2014). Kover et al. (2014) compared the speech of preschoolers with ASD when playing with their parents and when playing with a trained examiner. Both quantitative and qualitative differences in children's speech were found contingent on conversational partner. Preschoolers produced more utterances (total number of utterances) and made more requests when with their parents but used more complex syntax (operationalized as mean length of utterance [MLU]) when with examiners. Because this study did not compare the language of the parents and examiner, it is not known whether the differences in the children's language reflect differences in their conversational partners. It is also not known whether the same findings would be obtained with older MLV children and adolescents.

Exploring differences in language between parents and examiners is an important avenue for investigation in light of conflicting findings of the association between child and adult language in ASD (e.g., Barokova & Tager-Flusberg, 2019; Fusaroli et al., 2019; Kover et al., 2012). When parents collect the language sample, several studies have reported positive concurrent correlations between child and adult language variables (see Nadig & Bang, 2016, for a review). For example, Fusaroli et al. (2019) found that, for children with ASD, their MLU, word token, and word types were significantly associated with that of their parents. These positive associations were attributed to parents being responsive to and tailoring their language to their child's language ability. In contrast, when examiners collected a language sample, negative correlations were found between child and adult variables (Kover et al., 2012). In this study, participants were middle schoolers and adolescents with fragile X syndrome and Down syndrome and language-matched typically developing controls, and during conversations, the examiners' MLU was negatively correlated with the participants' MLU. These negative associations were attributed to examiners adjusting their language by providing more verbal prompts to those children who were less likely to engage and have more limited language. The same explanation has been used to account for similar findings from children with language impairment (DeThorne & Channell, 2007). It is possible that a similar pattern of results could be found for MLV children and adolescents with ASD. However, regardless of the nature of the associations between adult and child language, a key question remains about which conversational partner (parent vs. examiner) can elicit speech that best represents the child's true language ability not influenced by assessment factors and high cognitive and social demands. This study aims to address this

question to help inform what the most optimal language assessment methods are for MLV children and adolescents.

The role of conversational partners in the collection of language samples from older MLV children and adolescents with ASD is a research avenue worth exploring, but there are some practical considerations that need to be addressed. All the studies that have recruited parents to collect an NLS from their young children with ASD have used free-play with toys as the context for obtaining the language sample (e.g., Bang & Nadig, 2015; Fusaroli et al., 2019; Swensen, 2007). While the lack of structure in this context equates to no additional training for the parents, there is less control over how parents might guide or construe the interaction with their child during play, making it difficult to compare the NLS across children. To date, parents have not been asked to collect samples from older children and adolescents with ASD, particularly those with severe language deficits, for whom a more structured elicitation protocol rather than free-play with toys might be more developmentally appropriate and provide greater control over the elicitation context. In this study, we used the Eliciting Language Samples for Analysis–Adolescents (ELSA-A) protocol (Barokova et al., 2020) to explore how well parents of older MLV children and adolescents with ASD could provide a language sample. Since ELSA-A has already been validated for use in the lab by trained examiners with this population, it is a good candidate to assess the feasibility of parents collecting language samples at home.

This study has three main aims:

- **Aim 1:** *To compare the expressive language of parents and examiners while collecting NLS using ELSA-A from MLV children and adolescents with ASD.* Based on past research (Kover et al., 2012), we hypothesize that examiners might speak more during ELSA-A than parents because they will provide more verbal prompts to the MLV children and adolescents.
- **Aim 2:** *To compare the expressive language of MLV children and adolescents with ASD during ELSA-A elicited by their parents and by trained examiners.* Based on past research (Kover et al., 2014), we predict that children and adolescents with ASD are going to produce more speech with their parents at home than with examiners in the lab.
- **Aim 3:** *To assess the feasibility of parents collecting a semi-structured language sample in their homes by examining how many parents comply, their administration fidelity, and how they rate the experience of NLS collection.*

Method

Participants

Thirty-three (five female, 28 male) children and adolescents with ASD between the ages of 6;6 and 19;7 (years; months) were included in this study. They were a subsample of participants enrolled in a larger study designed to

develop and evaluate expressive language outcome measures for use in a variety of research settings, including clinical trials and treatment and intervention studies (Barokova et al., 2020). From the larger study, those participants who were minimally to low verbal, operationalized as the administration of the Autism Diagnostic Observation Schedule–Second Edition (ADOS-2) Module 1 or 2 or the adapted ADOS (A-ADOS) Module 1 or 2 (Bal et al., 2019; Lord et al., 2012), and who lived at home were included in this study. The primary language of all participants was English.

Procedure

Institutional review board approval was obtained prior to participant enrollment. The initial study visit was carried out at either our research lab or at the participants' school, which had a space setup that was comparable to the one in the research lab. During this visit, the participants were administered a battery of standardized assessments, after which a trained examiner collected a language sample from them following the ELSA-A elicitation protocol (for details about ELSA-A, see <https://sites.bu.edu/elsa/>). Before collecting an ELSA-A sample, each examiner went through training, which included reviewing the instruction manual and video, practicing administering the protocol with adults, and receiving feedback. The ELSA-A samples collected by examiners were audio-recorded for the purposes of transcription. Parents also completed a demographic form, the Social Communication Questionnaire (SCQ; Rutter et al., 2003) and the Vineland Adaptive Behavior Scales–Second Edition (VABS-2; Sparrow et al., 2005). Participants' demographic information and standardized assessment scores are presented in Table 1 and Table 2, correspondingly.

Within 1–2 weeks of this first visit, researchers visited all participants' homes, provided parents with a kit that included the materials necessary to collect ELSA-A at home, and walked them through the administration manual and the instructional video (see <https://sites.bu.edu/elsa/> for details). After the home visit, one of the parents was asked to collect ELSA-A from their child. The samples collected at home were audio-recorded with a voice recording app (Voice Recorder HD) on a smartphone worn by the parent in an armband. The audio recordings were later shared on a secure Dropbox. At the end of the larger study, parents were asked to fill out a feedback survey about their experiences collecting ELSA-A at home and other aspects of the study.

Standardized Assessments

Diagnosis. Participants' diagnoses were confirmed with the administration of the ADOS-2 or the A-ADOS (Bal et al., 2019; Lord et al., 2012). The ADOS is a semi-structured behavioral assessment of autism symptoms. It involves a series of activities allowing for the observation of core autism symptoms, like deficits in social communication and restricted and repetitive behaviors. Different modules are administered based on participants' chronological age and language ability. In our study, participants between

Table 1. Demographic information for the 33 participants.

Characteristic	Total N	n
Gender	33	
Female		5
Male		28
Race	32	
White		21
Black, African American		3
Asian		2
Hispanic, Latino, or Spanish origin		1
Multiple races		5
Ethnicity	32	
Non-Hispanic		26
Hispanic		5
Prefer not to respond		1
Caregiver Education	33	
High school degree or GED		3
Vocational or trade degree after high school		2
Associates or 2-year degree		9
Bachelor's degree or equivalent		8
Master's degree or equivalent		7
Professional degree (MD, PhD, JD)		4
Caregiver income	33	
Prefer not to answer		8
< \$20,000		2
\$20,000–\$49,999		5
\$50,000–\$99,999		5
\$100,000–\$149,999		5
Over \$150,000		8

Note. GED = General Educational Development.

6 and 12 years were administered ADOS-2 Modules 1 and 2, appropriate for younger children with few words to phrase speech (Lord et al., 2012), and participants 12 years old and older were administered A-ADOS Modules 1 and 2, appropriate for older minimally verbal adolescents and adults (Bal et al., 2019). From the ADOS-2 and the A-ADOS,

Table 2. Standardized assessment scores for the 33 participants.

Characteristic	Assessment score			
	N	M	SD	Range
Age in months	33	146.79	45.56	78–235
ADOS-2 or A-ADOS				
Module 1	25			
Module 2	8			
Calibrated Severity score	33	7.82	1.61	3–10
Leiter-R				
Nonverbal IQ	33	63.94	21.77	30–102
SCQ				
Reciprocal Social Interaction score	33	6.12	2.63	2–10
Communication score	33	3.87	2.68	0–9
VABS-2				
Socialization standard score	33	51.45	13.79	31–83
Communication standard score	33	50.30	13.87	30–83

Note. ADOS-2 = Autism Diagnostic Observation Schedule–Second Edition; A-ADOS = Adapted Autism Diagnostic Observation Schedule; Leiter-R = Leiter International Performance Scale–Revised; SCQ = Social Communication Questionnaire; VABS-2 = Vineland Adaptive Behavior Scales–Second Edition.

Calibrated Severity scores (Hus et al., 2014; Hus & Lord, 2014) of 1–10 were computed, with 10 indicating the *highest symptom severity*.

Nonverbal IQ. Participants' nonverbal IQ was assessed with the Leiter International Performance Scale–Revised (Roid & Miller, 1997). The test provides a composite nonverbal IQ score based on performance on four subscales: Figure Ground, Form Completion, Classification and Analogies, and Sequential Order. Each subscale involves solving different puzzles and finding pieces that fit a sequence. The test is especially suitable for individuals with ASD who are minimally and low-verbal because its administration and the expected responses do not involve any verbal prompts or responses.

ELSA-A. ELSA-A is a language elicitation protocol specifically designed to collect language samples from older children and adolescents across a wide range of age and language ability. It consists of eight activities that are developmentally appropriate, engaging, and easy to administer. The activities are categorized based on two elicitation contexts: semi-structured play (ELSA-A games) and narration (Pixar movie shorts). The ELSA-A games include putting leaves on a paper tree (leaf falling activity); pretending to plant an acorn with a shovel (planting an acorn activity); playing hide and seek with paper animals hidden around the room (discovering animals activity); helping toy animals who are hurt, thirsty, and/or hungry (helping animals activity); making a S'more with crackers, chocolate, and marshmallows (S'mores activity); drawing and coloring (crafts activity); and playing a bean bag toss game (bean bag toss activity). The ELSA-A Pixar movie shorts activity consisted of the participants watching a short Pixar movie and then narrating the plot and/or labeling the characters. In addition, administrators are encouraged to engage the child/adolescent in a conversation (back-and-forth verbal interaction) about their interests while transitioning between activities. Detailed information about the ELSA-A protocol, including administration instructions, activity descriptions, and a list of materials, can be found on our website: <https://sites.bu.edu/elsa/>; <https://sites.bu.edu/elsa/elsa-2/manual/>.

Parent Questionnaires

Demographics. Parents filled out a demographic questionnaire, which asked information about their relationship to the child, highest level of education, and family income, as well as about the child's race and ethnicity, diagnosis, medical history, and language skills.

Communication. Participants' social communication was assessed with two parent questionnaires: the SCQ (Rutter et al., 2003) and the VABS-2 (Sparrow et al., 2005). The questionnaires were administered in their entirety, but we only used the SCQ reciprocal social interaction (computed by combining responses from Questions 9, 10, 19, 26, 27, 28, 29, 30, 31, 32, 33, 36, 37, 39, and 40) and communication domain (computed by combining responses from Questions 2, 3, 4, 5, 6, 20, 21, 22, 23, 24, 25, 34, and 35) scores and the VABS socialization and communication standard scores for the present analyses.

ELSA-A feedback survey. Parents were given a survey soliciting their feedback about the experience of collecting ELSA-A at home and about other aspects of the larger study. They rated on 5-point Likert-scale statements about the logistics of collecting the sample, the helpfulness of the instructions, and the effectiveness of the protocol in eliciting language from their child (see Appendix). Each item on the Likert scale was anchored from *strongly disagree*, which we converted to 1, to *strongly agree*, which we converted to 5, for the purposes of analyses. On this scale, a 3 denotes *neither agreement or disagreement*.

Coding

ELSA-A measures. Using the audio recordings, the length of all ELSA-A samples in minutes was obtained, and administration fidelity was scored: 1 point was given for each ELSA-A activity that was attempted. Since we used the audio recordings of the parent- and examiner-elicited ELSA-As, an activity attempt was operationalized as the administrator talking about the materials associated with the activity. We computed an administration fidelity score out of 8 for both examiners and parents. Even though this measure of fidelity is very general, it captures whether the administrator engaged the participant with the ELSA-A activities. Considering the variability in participants' characteristics (symptom severity, nonverbal IQ, and communication), using a more focused measure of fidelity (e.g., using a specific number or kind of verbal prompts) would not have been feasible, and it would have imposed too much structure on a protocol that aims to be naturalistic and semi-structured.

ELSA-A transcription and measures. All ELSA-A samples, parent- and examiner-collected, were transcribed for speech following standard transcription procedures using Systematic Analysis of Language Transcripts (SALT) format (Miller et al., 2011). Speech vocalizations were defined as utterances that have a syllable structure and contain a vowel and a consonant of the English language. Speech vocalizations that were phrases or full sentences were broken down into communication units (Miller et al., 2011). Imitated utterances and utterances not directed at a conversational partner were also transcribed. A sequential transcription procedure was followed: Each language sample was transcribed by a trained transcriber and then checked by a second transcriber; disagreements were resolved through consensus.

The transcribed ELSA-A samples were analyzed with SALT software (SALT-12; Miller & Iglesias, 2012). Key measures across language domains were obtained for both participants and their conversational partners (examiners/parents; see Table 3). Frequency of utterances per minute (FreqUtt), frequency of words per minute (FreqW), and number of conversational turns per minute (CT; a CT is defined as one or more consecutive utterances by the same speaker; Miller et al., 2011) were included as global measures of expressive language and social communication. FreqUtt and CT, as obtained from ELSA-A, are appropriate for

Table 3. Expressive language measures derived from Eliciting Language Samples for Analysis–Adolescents transcripts.

Measure (abbreviation)	Construct or language domain	Adult	Child/adolescent
Frequency of utterances per minute (FreqUtt)	Quantity of language	Yes	Yes
Frequency of words per minute (FreqW)	Quantity of language	Yes	Yes
Conversational turns per minute (CT)	Social communication	Yes	Yes
Mean length of utterance in words (MLUw)	Syntactic complexity	Yes	No
Number of different words per minute (NDW)	Lexical diversity	Yes	Yes

MLV children and adolescents with ASD, have already been validated with this population, and serve as a broad measure of expressive language (Barokova et al., 2020). MLU in words (MLUw), as a measure of syntax, and number of different words per minute (NDW), as a measure of lexical diversity, were obtained from SALT. In the language development literature, it is generally recommended to have a minimum of 50–100 complete, intelligible utterances to obtain reliable MLUw and NDW (e.g., Miller, 1981; Templin, 1957). Since the speech of most of our MLV child/adolescent participants was so limited, this criterion could not be followed. For this reason, child/adolescent measure of syntax (MLUw) was not computed, and analyses involving NDW as a measure of lexical diversity should be interpreted with caution.

Results

Out of the 33 parents of MLV children and adolescents enrolled in this study, 22 (19 mothers and three fathers) collected language samples in their homes and submitted them to the investigators. All analyses for Aims 1 and 2 were carried out on the data from these 22 participants.

In the following analyses, all variables have been checked for normality. Nonparametric tests were performed where appropriate, and correction for multiple comparisons was applied.

Aim 1: To Compare the Expressive Language of Parents and Examiners While Collecting NLS Using ELSA-A From MLV Children and Adolescents With ASD

To compare parent and examiner language, we ran paired-samples *t* tests (or Wilcoxon signed-rank tests where appropriate) on all expressive language measures (FreqUtt, FreqW, CT, MLU, NDW; see Table 4). Parents' FreqUtt was significantly higher than that of examiners. The same was true for parents' FreqW and CT. Overall, parents produced more speech more frequently than examiners. No significant differences were found between parent and examiner MLUw and NDW. The parents' and examiners' language did not differ in terms of syntactic complexity and lexical diversity.

Aim 2: To Compare the Expressive Language of MLV Children and Adolescents With ASD During ELSA-A Elicited by Their Parents and by Trained Examiners

To test for differences in child/adolescent speech contingent on conversational partner, we ran paired-samples *t* tests (or Wilcoxon signed-rank tests where appropriate) comparing children's FreqUtt, FreqW, CT, and NDW from the parent ELSA-A with those from the examiner ELSA-A (see Table 5). Participants' FreqUtt with their parents was significantly higher than with examiners. The same was true for FreqW and CT. On average, children/adolescents produced twice as much speech with their parents than with examiners. Participants also had significantly higher NDW when with their parents than when with examiners, so children/adolescents exhibited greater lexical diversity with their parents than with examiners.

To assess the consistency of participants' language across conversational partners, we computed correlations between their language measures derived from the parent-elicited ELSA-A with those from examiner-elicited ELSA-A. These correlations were all statistically significant: FreqUtt, $r_s(20) = .848, p < .001$; FreqW, $r_s(20) = .885, p < .001$; CT, $r_s(20) = .708, p < .001$; and NDW, $r_s(20) = .880, p < .001$.

Table 4. Comparison of parent and examiner expressive language during Eliciting Language Samples for Analysis–Adolescents.

Measure	Parent		Examiner		Significance test p
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
FreqUtt	17.92	6.42	10.40	2.61	$t(21) = -4.602$ $p < .001$
FreqW	63.20	22.55	39.08	9.86	$Z = -4.140$ $p = .001$
CT	4.35	3.33	2.35	2.00	$t(21) = -4.002$ $p = .001$
MLUw	3.66	.51	3.77	.35	$t(21) = 1.628$ $p = .118$
NDW	11.84	3.67	10.17	2.01	$t(21) = -1.859$ $p = .077$

Note. FreqUtt = frequency of utterances per minute; FreqW = frequency of words per minute; CT = conversational turns per minute; MLUw = mean length of utterance in words; NDW = number of different words per minute.

Table 5. Comparison of child/adolescent expressive language during Eliciting Language Samples for Analysis–Adolescents across conversational partner (parent vs. examiner).

Measure	Parent		Examiner		Significance test <i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
FreqUtt	6.11	4.77	3.26	3.26	$Z = -3.458$ $p < .001$
FreqW	12.00	12.88	6.46	8.39	$Z = -3.389$ $p < .001$
CT	4.42	3.34	2.35	2.02	$t(21) = -4.090$ $p < .001$
NDW	4.02	3.87	2.45	2.90	$Z = -3.389$ $p < .001$

Note. FreqUtt = frequency of utterances per minute; FreqW = frequency of words per minute; CT = conversational turns per minute; NDW = number of different words per minute.

Aim 3: To Assess the Feasibility of Parents Collecting a Semi-Structured Language Sample in Their Homes by Examining How Many Parents Comply, Their Administration Fidelity, and How They Rate the Experience of NLS Collection

Out of the 33 parents of MLV children and adolescents enrolled in this study, 22 of them, representing two thirds of the participant sample, collected an ELSA-A sample in their home and submitted it to the investigators. We checked for differences in participant characteristics depending on whether or not the parent contributed a language sample by running independent-samples *t* tests (or Mann–Whitney *U* tests where appropriate) to compare participant-based factors of age, ADOS Calibrated Severity score, Leiter International Performance Scale–Revised Nonverbal IQ score, SCQ score, and VABS Socialization and Communication scores (see Table 6). Participants whose parents collected an ELSA-A sample did not differ from those whose parents did not, on any of the tested variables.

We ran Wilcoxon signed-rank tests comparing fidelity of parent administration to that of trained examiners in order to assess how well parents ($N = 22$) were able to administer the ELSA-A at home. On average, parents ($M = 5.73$, $SD = 2.78$) administered significantly fewer ELSA-A activities than trained examiners ($M = 7.09$, $SD = 1.19$, $Z = -2.138$, $p < .05$). Table 7 presents how many parents and examiners administered each ELSA-A activity. The toy animals activity was administered by the highest number of adults (19 parents and 21 examiners). The S’mores activity was administered by the fewest number of adults (16 parents and 15 examiners). The crafts and Pixar movie shorts sections were administered by the fewest number of parents (15 and 10, correspondingly).

We compared the overall length of ELSA-A sample in minutes across conversational partners. On average, parents ($M = 28.99$, $SD = 13.63$) collected significantly longer ELSA-A samples than examiners ($M = 21.19$, $SD = 4.34$, $Z = -2.289$, $p < .05$). We then compared how much time parents spent on each ELSA-A activity in comparison to trained examiners. Because the total length of ELSA-A differed, we computed the proportion of time spent on each activity out of total ELSA-A length. There were no statistically significant differences in the proportion of time spent on each activity between parents and examiners, suggesting that parents took proportionally the same amount of time per activity as examiners.

To evaluate parents’ experiences with ELSA-A, we analyzed their responses on the feedback survey (see Appendix). Out of the 33 parents of MLV children and adolescents enrolled in the study, 31 filled out the feedback survey, which included questions about ELSA-A and other aspects of the larger study. Of these 31, 21 had collected ELSA-A at home and 10 had not. Following best practices for analyzing Likert scales, we conducted qualitative analyses of parent responses for each subgroup (ELSA-A collected vs. no ELSA-A collected) and for all parents (Harpe, 2015). The parents who did not submit an ELSA-A sample still received instruction about it and interacted with the materials when researchers visited them at home. Thus, the

Table 6. Standardized assessment comparison of participants whose parents collected Eliciting Language Samples for Analysis–Adolescents (ELSA-A) samples at home to those whose parents did not collect ELSA-A samples at home.

Measure	ELSA-A <i>n</i> = 22		No ELSA-A <i>n</i> = 11	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age (in months)	150.18	52.35	140.00	28.45
ADOS-2 or A-ADOS CSS	8.13	1.39	7.18	1.89
Leiter-R Nonverbal IQ	63.95	21.96	63.91	22.46
SCQ Reciprocal Social Interaction standard score	5.63	2.50	7.09	2.74
SCQ Communication standard score	4.09	2.65	3.45	2.81
VABS-2 Socialization domain score	51.68	14.04	51.00	13.94
VABS-2 Communication domain score	49.91	13.87	51.10	14.50

Note. ADOS-2 or A-ADOS CSS = Autism Diagnostic Observation Schedule–Second Edition or Adapted Autism Diagnostic Observation Schedule Calibrated Severity score; Leiter-R = Leiter International Performance Scale–Revised; SCQ = Social Communication Questionnaire; VABS-2 = Vineland Adaptive Behavior Scales–Second Edition.

Table 7. Frequency of Eliciting Language Samples for Analysis—Adolescents activity administration by conversational partner (parent and examiner).

Activity name	Parents (n = 22)	Examiners (n = 22)
Leaf falling	16	18
Planting acorns	17	19
Hide and seek	16	20
Toy animals	19	21
S'mores	16	15
Crafts	15	21
Beanbag toss	17	21
Pixar	10	21

comparison of parent responses across groups (ELSA-A collected vs. NO ELSA-A collected) could provide insight as to what determines whether a parent will complete data collection at home.

First, we computed the means, medians, and modes for every statement on the survey for each subgroup (see Table 8 for descriptive statistics on the statements). Based on visual inspection of these descriptive statistics, overall, most parents rated the experience of collecting ELSA-A favorably. In particular, 27 (out of 31) parents agreed or strongly agreed that “The instructions in the guide were easy to follow,” and the remaining four parents neither agreed nor disagreed. In addition, 24 parents agreed or strongly agreed that “The video instructions were helpful,” and seven neither agreed nor disagreed. No parents disagreed with either statement. For the “Setting up the materials for the games was easy” statement, 25 parents agreed or strongly agreed, and six parents neither agreed nor disagreed. Overall, most parents also felt comfortable performing the

games: seven strongly agreed, 16 agreed, seven neither agreed nor disagreed, and only one disagreed. In terms of how representative their child’s communication was during ELSA-A, most parents (24) agreed or strongly agreed that their child’s communication during the game was similar to their everyday communication, while three parents neither agreed or disagreed, one parent disagreed, and three parents strongly disagreed.

Some differences between parent subgroups emerged. Parents who did not collect ELSA-A at home provided lower ratings/disagreed more with the following statements, “Setting up the materials was easy,” “It was easy to find time to collect the language sample,” “Recording the session was easy,” and “Using Dropbox was easy,” than parents who collected ELSA-A at home and sent it (see frequency distributions of parent responses by subgroup in Table 9).

Discussion

Our study, which was designed to evaluate how well parents of MLV children and adolescents with ASD could obtain language samples using a structured protocol, has three main findings: (a) Parents produced significantly more speech and engaged in more back-and-forth interaction with their MLV children than the examiners did. (b) The participants with ASD produced twice as much speech, conversational turns, and number of different words with their parents at home than with trained examiners. (c) Parents who collected a language sample at home administered fewer elicitation activities than trained examiners but collected longer samples. Overall, all parents rated the experience of language sampling at home favorably, but parents who did not contribute an ELSA-A language sample reported

Table 8. Measures of central tendency of parents’ (ELSA-A and No ELSA-A) responses from the Parent Feedback Survey.

Statement	n = 21 (ELSA-A)			n = 10 (No ELSA-A)		
	M	Median	Mode	M	Median	Mode
1. The instructions in the guide were easy to follow.	4.19	4.00	4.00	4.20	4.00	4.00
2. The video instructions were helpful.	4.20	4.00	4.00	4.20	4.00	4.00
3. Setting up the materials for the games was easy.	4.24	4.00	4.00	3.80	4.00	3.00 ^a (4.00)
4. It was easy to engage my child in the games.	3.24	3.00	4.00	3.00	3.00	3.00
5. My child seemed to enjoy the games.	3.48	4.00	4.00	3.30	3.50	4.00
6. It was easy to find time to collect the language sample.	3.43	4.00	4.00	2.80	3.00	2.00 ^a (3.00, 4.00)
7. My child’s communication during the games is similar to what I see on a typical day.	3.38	4.00	4.00	4.10	4.00	4.00
8. It was easy to engage my child in the Pixar movies.	3.43	3.00	3.00	3.60	3.50	3.00
9. My child seemed to enjoy the Pixar movies.	3.71	4.00	4.00	3.70	3.50	3.00
10. Recording the session was easy.	3.86	4.00	5.00	2.30	2.00	2.00
11. Using Dropbox was easy.	3.76	4.00	4.00	3.00	3.00	3.00

Note. Mean, median, and mode for all ELSA-A–related statements from the Parent Feedback Survey, where 1 = *strongly disagree*, 2 = *disagree*, 3 = *neither agree nor disagree*, 4 = *agree*, 5 = *strongly agree*. ELSA-A = Eliciting Language Samples for Analysis—Adolescents.

^aMeans to lowest values; the lower value is presented, and the other values are included in parentheses.

Table 9. Frequency distributions of parent responses by subgroup (No ELSA-A vs. ELSA-A).

Statement	Ratings	ELSA-A <i>n</i> = 21	No ELSA-A <i>n</i> = 10
Setting up the materials for the games was easy.	Strongly disagree	0	0
	Disagree	0	0
	Neither agree nor disagree	2	4
	Agree	12	4
	Strongly agree	7	2
	*Missing	1	0
It was easy to find time to collect the language sample.	Strongly disagree	0	1
	Disagree	5	3
	Neither agree nor disagree	4	3
	Agree	10	3
	Strongly agree	2	0
	*Missing	0	0
Recording the session was easy.	Strongly disagree	0	1
	Disagree	4	6
	Neither agree nor disagree	3	2
	Agree	6	1
	Strongly agree	8	0
	*Missing	0	0
Using Dropbox was easy.	Strongly disagree	0	0
	Disagree	4	2
	Neither agree nor disagree	3	6
	Agree	8	2
	Strongly agree	6	0
	*Missing	0	0

Note. ELSA-A = Eliciting Language Samples for Analysis—Adolescents.

that they had some difficulty finding time to collect it, record it, and send it.

Parents who collected ELSA-A at home, on average, spoke more and engaged in almost twice as much back-and-forth verbal interaction with their children than examiners in the lab. Even though parents spoke more, parents and examiners used a similar NDW (10–11 words) and similar length of utterances (three to four words). This similarity in the quality of language is not surprising considering that the children and adolescents in this study had very limited verbal abilities. However, parents, on average, produced almost twice as many utterances per minute (17.92) and conversational turns (4.35) compared to examiners (FreqUtt: 10.40; CT: 2.35), while also collecting longer language samples. There are several possible explanations for why parents spoke more than examiners. Perhaps parents are better able to communicate with their child because they know what kinds of prompts their child is more likely to respond to and know what kinds of topics their child likes to discuss. Another explanation could be that the children/adolescents themselves feel more comfortable and initiate and/or respond more to their parents, which in turn reinforces parents to speak more. The deeply intertwined nature of the back-and-forth verbal exchanges between children/adolescents and their parents cannot be disentangled with our analyses.

Nevertheless, the most interesting finding in our study is that the MLV children and adolescents with ASD produced twice as many utterances, words, and conversational turns per minute with their parents at home than with examiners, thus suggesting that parents might be able to elicit

speech from their children most representative of their actual language ability. There are several possible explanations for this finding. One is that parents provided input that facilitated their child's communication. Another explanation could be that our participants felt more comfortable speaking with their parents or being at home. Since all parent samples were collected at home, we cannot disentangle the relative contributions of the parent as a conversational partner and the home as an NLS setting. In addition to feeling more comfortable at home, another reason for participants to speak more with their parents could be that the parent sample was always collected after the examiner sample, so the children were already familiar with the ELSA-A activities. Regardless of whether it was the parent, the home, familiarity with the materials, or a combination of these factors that lead to participants speaking more during the parent ELSA-A, this finding is of tremendous practical importance. It suggests that studies relying on examiner-collected NLS to assess the communication of MLV children and adolescents might significantly underestimate their expressive language not only in terms of how much/how likely they are to engage in verbal exchanges but also in terms of the diversity of their lexicon. Our participants, on average, used twice as many different words per minute with their parents than with examiners. Even though in absolute value, the FreqUtt with their parents is small (six utterances per minute), it could be quite meaningful in these individuals' everyday communication compared to the three utterances per minute used with examiners. Considering the magnitude of this difference (almost double), future studies should include

parents and a home setting in the assessment of their children's expressive language. This will ensure that the sampled speech is representative of children's actual language ability and is not influenced by the role of external factors like the conversational partner and the laboratory setting. Having a more valid representation of MLV children/adolescents' language abilities could ensure that treatments and interventions not only aim at developing new language abilities but also help children generalize the already existing ones. Furthermore, having parents collect NLS at home rather than during multiple lab visits could be more convenient for many families and researchers.

If parents collecting NLS at home is the key to better language assessment of the older MLV children and adolescents and perhaps all individuals with ASD, then what do we, as researchers, need to do to help, encourage, and support all parents to collect useable data at home? Even though the majority of parents found the ELSA-A instructions and instructional video helpful and felt comfortable performing the games, one third either did not collect a sample or collected one but failed to submit it. Based on our results, it was not the characteristics of the child, such as age or symptom severity, that differentiated between parents who submitted an ELSA-A sample and those who did not. Rather, it was setting up the materials, finding the time to collect the sample, recording it, and sharing it that parents who did not submit ELSA-A had difficulty with. Therefore, future studies should address these logistical aspects of data collection to encourage more parents to do it. For example, an interactive online platform that walks parents through the process of recording and submitting the language samples can be created rather than relying on different programs and applications for recording and submitting. In addition, examiners can coach the parents in setting up the materials in their homes and could schedule a specific time with them for data collection.

Another aspect of the feasibility of parents collecting language samples at home is the extent to which they follow the instructions/language elicitation protocol. In our study, parents administered fewer activities than trained examiners in the lab, and their language samples were significantly longer. Nevertheless, the majority of parents followed the structure of the elicitation protocol and spent proportionately the same amount of time per activity as examiners. Interestingly, the activity administered by the fewest number of parents, the making a S'more activity, is the activity administered by the fewest number of examiners, perhaps due to our participants' restricted diets and food allergies. Similarly, the activity administered by the highest number of parents, playing with toy animals, is one of the activities administered by most examiners, as well, suggesting that both adult groups considered this activity appropriate for engaging the participants and eliciting verbal communication. The playing with toy animals activity also comes early in the ELSA-A protocol, which could be another reason why it is administered by most of the adults. The activity administered by the fewest number of parents and the highest number of examiners is the Pixar movie shorts activity.

This is the only activity in the ELSA-A protocol that relies on narration as the elicitation context. Asking the child to narrate typically elicits more syntactically complex language (e.g., Kover & Abbeduto, 2010) and is appropriate for children with higher verbal abilities, so perhaps parents did not consider this activity to be one that would encourage their children to communicate and decided to omit it. Despite these differences in administration between parents and examiners, parents were the ones who elicited more speech from their children, suggesting that their unique knowledge about their children could make them better conversational partners for natural language sampling.

Although very informative, our study has a few limitations that should be addressed in future research. Because all of the parent ELSA-A samples were collected at home, we cannot determine the relative contributions of familiarity with the conversational partner/parent and with the home setting to children's language. Furthermore, all parent ELSA-A samples were collected after the examiner ELSA-A samples, so perhaps our participants spoke more at home because they were familiar with the activities, which, in turn, could have led to parents speaking more too. Another limitation is related to the computation of one of the language measures for our participants: Since they were all minimally to low verbal, their measure of lexical diversity, NDW, could not be based on 100 complete intelligible utterances as recommended in the literature (e.g., Miller, 1981). Therefore, it is unclear how reliable our finding is about children's more lexically diverse speech with parents. Nevertheless, considering that lexical diversity did not differ between parents and examiners, perhaps, using a higher number of different words with parents is indeed related to children's familiarity with the conversational partner and setting. Future studies should determine the reliability and validity of such measures, specifically for the MLV children and adolescents with autism. In addition, future studies should compare parent and examiner language in the pragmatic domain. Perhaps, parents use more open-ended questions or comment more, which is associated with their children's more lexically diverse speech. From a practical standpoint, more information should be gathered about parents' experiences of data collection at home to determine exactly what aspect of the process they have greatest difficulty with. One third of the parents in our study did not submit an ELSA-A sample but filled out the feedback survey, so it is unclear whether they collected the sample but did not record it and send it or whether they did not even attempt data collection. Once it is determined what aspects of data collection parents struggle with the most, these can be addressed to ensure that more parents collect data at home.

Future studies should not only focus on how to facilitate data collection at home but also examine the feasibility and usefulness of collecting parent ELSA-A samples from other clinical populations. It is essential to examine how the characteristics of parent-collected ELSA-A samples and the language measures derived from them vary by child characteristics, like age, language ability, symptom severity, and potentially diagnosis. Clinical populations for

whom parent-collected ELSA-A samples could be particularly useful include those who cannot be assessed with traditional assessment methods, like standardized tests and/or parent reports, individuals with ASD more broadly, and children with selective mutism among others.

To allow for comparison of findings across studies, specifically in the context of assessing change in language ability as a result of treatment or intervention, a consistent language elicitation protocol should be followed. The consistency of the protocol requires similar/equivalent elicitation context (activities), conversational partner, and setting. ELSA-A is an excellent candidate because it has already been validated for use with children and adolescents across a wide range of ages and language abilities (Barokova et al., 2020). Furthermore, as our findings suggest, parents can successfully follow the instructions of the protocol and collect ELSA-A at home. Not only that, but parents at home elicit almost twice as much speech from their MLV children and adolescents than trained examiners in the lab. Therefore, parents might be better at eliciting speech from their children that is representative of their actual language abilities. Future studies should capitalize on this and encourage parents to collect samples at home to assess their children's true language ability.

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Appendix

Parent Feedback Survey Questions About ELSA-A

Each statement was rated as one of the following options: “strongly disagree,” “disagree,” “neither agree nor disagree,” “agree,” or “strongly agree.”

ELSA-A: Games

The instructions in the guide were easy to follow.
The video instructions were helpful.
Setting up the materials for the games was easy.
I was comfortable performing the games.
It was easy to engage my child in the games.
My child seemed to enjoy the games.
It was easy to find time to collect the language sample.
My child’s communication during the game is similar to what I see on a typical day.

ELSA-A: Pixar Movie Shorts

The instructions in the guide were easy to follow.
The video instructions were helpful.
I was comfortable showing the Pixar movies and asking my child to describe it.
It was easy to engage my child in the Pixar movies.
My child seemed to enjoy the Pixar movies.
It was easy to find time to show the Pixar movies.
My child’s communication during the Pixar movies is similar to what I see on a typical day.
My child communicated more during the Pixar movies compared to the games.

ELSA-A: Recording and File Sharing

Recording the session was easy.
Using Dropbox was easy.
