



Nouns and Verbs in Parent Input in American Sign Language during Interaction among Deaf Dyads

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ABSTRACT

Parent input during interaction with young children varies across languages and contexts with regard to the relative number of words from different lexical categories, particularly nouns and verbs. Previous work has focused on spoken language input. Little is known about the lexical composition of parent input in American Sign Language (ASL). We investigated parent input in ASL in a sample of deaf mothers interacting with their young deaf children ($n = 7$) in a free play setting. Children ranged in age from 21 to 39 months ($M = 31$ months). A 20-minute portion of each interaction was transcribed and coded for a range of linguistic features in maternal input including utterance length, sign types and tokens, proportion of nouns and verbs, and functions of points. We found evidence for a significant verb bias in maternal input; mothers produced more verb tokens and unique verb types than any other word class. Verbs were produced more than twice as often as nouns (36% vs 17% of all tokens) and appeared in a higher proportion of utterances than nouns (57% vs. 31% of all utterances). Points were frequent in the input, often serving as pronouns replacing common or proper nouns. Maternal noun and verb tokens increased in frequency with child age and vocabulary. These findings provide an initial step in understanding the lexical properties of maternal input during free play interactions in ASL.

Introduction

The quality and quantity of parent language input significantly affect children's vocabulary development (e.g., Huttenlocher et al., 1991; Rowe, 2012). Additionally, parents' use of social and nonverbal cues with their young children is correlated with the size of children's vocabularies several years later (Cartmill et al., 2013). As such, examining parental input, and the way in which input varies across languages and modalities, can shed light on possible variation in child acquisition. Some features of parent input are known to show cross-linguistic and cross-modal similarities. For example, parents use a particular child-directed register in speech (Fernald et al., 1989) and sign (Pizer et al., 2011). Other features of input shows more cross-linguistic variation (Choi, 2000; Tardif et al., 1997). In particular, the lexical composition of parental input, and specifically the relative proportion of nouns and verbs, has been found to vary across languages.

To date, most research on parent input has focused on spoken language. In the current study, we begin to fill this gap by examining the sign composition of parent input in a group of deaf parents interacting with their young deaf children in American Sign Language (ASL). We focus on the relative proportion of nouns and verbs and examine the prevalence and function of points, which can be both attention-getting and pronominal in ASL. Data from sign languages such as ASL can help shed light on whether there are linguistic- and modality-based differences in the composition of linguistic input to young children.

Linguistic content of child-directed language

Cross-linguistic studies of spoken language have found variations in the proportion of nouns and verbs in parental input. English input has a noun bias, and in early reports, this was proposed as a near universal (Gentner, 1982). English-speaking caregivers use more nouns than verbs, place nouns in salient positions (e.g., at the end of an utterance), and have few morphological markers on nouns. This is now known to contrast with caregiver input in other languages (Sandhofer et al., 2000). Specifically, Mandarin-speaking caregivers use more verbs than nouns and place verbs in salient positions (Tardif et al., 1997). Korean-speaking caregivers use a more balanced proportion of nouns and verbs, although this varies based on the interactive context (Choi, 2000). Italian-speaking caregivers show yet a different bias, in that they use more verbs than nouns (Camaioni & Longobardi, 2001) and place verbs in more salient positions, but they ask more questions about objects and use more morphological markers on nouns than verbs (Tardif et al., 1997).

To what can we attribute these cross-linguistic differences? One obvious factor is the linguistic structure of the language. For example, Mandarin and Italian are both pro-drop languages. Differences in the location of morphological markers as well as word order differences also contribute. Finally, socio-cultural factors, such as the emphasis on object labels versus interactive routines, also likely play a role, as has been demonstrated for English and Japanese (Fernald & Morikawa, 1993).

Not surprisingly, the noun to verb ratio in children's input correlates with the noun to verb ratio in their early productions (Tardif, 1996; Tardif et al., 1999), although the exact nature of the relationship between input and early vocabulary composition is still a matter of debate (Goodman et al., 2008). Children learning Mandarin have been shown to produce more verbs than nouns in early vocabularies (Tardif, 1996). In Korean, children produce an equal number of nouns and verbs at the one-word stage (Choi & Gopnik, 1995). A study of children learning Tzotzil Mayan (De Leon, 1999) revealed that children use more verbs or action words than nouns or object labels in early speech. For Italian, there is evidence for a balance of referential and interactive words (Camaioni & Longobardi, 1995), although there is also evidence of a noun bias (Caselli et al., 1995).

To date, little is known about the linguistic content of ASL input with respect to the relative proportions of nouns and verbs. Studies of input in ASL are limited, and only recently have vocabulary and syntactic aspects of input been systematically examined (Goodwin et al., 2019). ASL provides an interesting case of input composition for several reasons. Linguistically, ASL is generally categorized as SVO (Liddell, 1980), although there is significant word order variation arising from spatial and aspectual inflection (Chen Pichler, 2011) which leads to utterances with non-canonical word order (Napoli & Sutton-Spence, 2014). For example, a verb that is marked for aspect or agreement can occur in an utterance-final position (Matsuoka, 1997). Further, a sentence in which the object is topicalized (and thus moves to the utterance-initial position) can also be verb final (Liddell, 1980). To the extent that young children focus on words at the end of an utterance, the presence of verbs in the utterance-final position may make them particularly salient for children exposed to ASL (Slobin, 1985).

Beyond these linguistic features, studying ASL input provides unique insight into how linguistic features and surrounding cultural norms may interact. The culture that children are raised in – the “developmental niche” composed of the physical and social setting, customs of child-rearing, and psychology of the caretakers – necessarily influences children's development by instilling a culturally specific understanding of the world (Super & Harkness, 1994). ASL is used by deaf individuals in North America, and so can be contrasted with findings from spoken English North American interactions, allowing for a comparison between groups with a common developmental niche but differing home languages. English-speaking North American caregivers tend to emphasize object labels in their interactions with young children (Fernald & Morikawa, 1993). A comparison with ASL users provides an opportunity to see whether that tendency is a feature of a specific language, the effect of a shared cultural understanding, or a combination of the two.

Although the presence of nouns and verbs in the input has not been examined in ASL, children's acquisition of nouns and verbs has (Henner et al., 2019). The most extensive studies of early ASL vocabulary development to date are those of Anderson and Reilly (2002), who developed and tested the original ASL version of the MacArthur-Bates CDI, and Caselli, Lieberman, and Pyers (2020) who report on an updated and normed ASL-CDI 2.0. Children's early ASL vocabularies in these samples show a significant noun bias. However, Anderson & Reilly report that the proportion of predicates in children's early ASL vocabulary was roughly twice that of children learning English: in children with vocabulary sizes between 0 and 50 signs, the proportion of predicates in ASL was .17 (compared to .07 in English). By the time children have 201–300 signs, the proportion of predicates was .30 for ASL (compared to .17 for English). Anderson and Reilly suggest that this may be due to differences in the syntax and word order of ASL compared to English, as discussed above.

Attentional cues in the input

In addition to the linguistic content of the input, the use of attentional cues such as points serves to scaffold the interaction by drawing children's attention to particular objects. Prior research has shown, in hearing parent–child dyads, that pointing facilitates word learning not merely by directing the child's gaze to the object(s) in question, but also by more explicitly linking a word to the item it labels (Kalagher & Yu, 2006; Rowe, 2000). In sign language, deaf parents further modify the input to make their language visually accessible to their children, since both the linguistic signal and non-linguistic context must be perceived visually (Lieberman, 2015). Parents may displace signs onto the child or into the child's line of vision, use attention-getters to obtain the child's gaze before signing, or wait for the child to shift gaze before providing input (Pizer et al., 2011; Spencer & Harris, 2005; Swisher, 2000).

Although points are critical visual attention-getting cues across modalities, in ASL points can also serve the linguistic function of reference, taking the form of a pronoun: pointing to oneself is the equivalent of “I” or “me;” pointing at objects is equivalent to “this” or “it.” During an interaction in ASL, it can be difficult to infer whether a particular point is intended as a gestural attention-getting cue (i.e., a directive for a child to shift gaze to a particular location) or as a pronoun (Cormier et al., 2013; Johnston, 2013). It is important to identify the range of points in child-directed signing to better understand how parents incorporate pronouns in their input to young children. To address this uncertainty and begin to shed light on the function of points in ASL interactions, we explored parents' points with regard to the utterances in which they occurred. Identifying the distribution of point functions within parental utterances, and the frequency with which points serve as a pronominal reference, will further inform our understanding of noun use: if pronouns are relatively frequent in the input, this may be one explanation for a relatively lower frequency of proper and common nouns.

Current study

Given the paucity of research on ASL parent input, the current study had three research goals. First, we investigated the linguistic content of deaf parents' ASL input to their young deaf children, to determine whether verbs are more frequent and salient than nouns and other lexical categories in the input. We predicted that verbs would be produced with high frequency relative to English input. Second, we analyzed the frequency and function of pointing during the interaction, and the distribution of utterances containing points, to determine whether points are more likely to serve as attention-getting cues or as pronouns. We predicted that pronominal points would be frequent and would take the place of common and proper nouns to some degree. Third, we explored whether parental input differs in nature based on the age and vocabulary of the child. We predicted that parents would use longer utterances and more varied signs with older children or those with larger vocabularies compared to younger children or those with smaller vocabularies.

Methods

Participants

Participants were seven deaf mother-deaf child dyads. The children ranged in age from 21 to 39 months (mean 31 months) and included five females and two males. Children and their mothers were part of a larger study on language and visual attention among young deaf children (Lieberman, 2015). There were two sibling pairs among the sample; thus, there were five different mothers interacting with seven children. The children were all identified at birth or shortly after with moderate to profound hearing loss. The mothers were all deaf or hard-of-hearing and used ASL as their primary language; thus, the children were all considered native signers. In addition to ASL exposure at home from one or two deaf parents, all of the children attended an early intervention program two to three mornings per week at a school for the deaf where ASL was the primary form of communication. Although some of the children used hearing aids and received services from an audiologist and speech-language therapist, none were regularly exposed to spoken language at the time of this study. Table 1 lists demographic information for each dyad.

Procedure

Language measures

Each parent completed a language background form that included information about the child's exposure to ASL and other languages. (Parents with two children in the study completed separate forms for each child.) In addition, all parents but one completed the ASL version of the MacArthur-Bates Communicative Development Inventory (CDI-ASL) (Anderson & Reilly, 2002), which was used as a measure of the child's current vocabulary.

Play interaction

Dyads were video recorded during a single naturalistic play session using a set of age-appropriate toys provided by the experimenter. Toys included a school bus set, picnic set, magnetic drawing board, and a baby doll with feeding accessories. All dyads were provided the same set of toys, but mothers and children were free to choose among the toys as they desired. Video recordings took place either at the family's home or in their early childhood classroom (outside of school hours). Before starting each recording, there was a warm-up period. Video recordings lasted for approximately 45 minutes each. Offline, the first 20 minutes of each session was transcribed and coded using ELAN (Crasborn & Sloetjes, 2008).

Transcription and coding

Coding focused on the spontaneous ASL productions and all points of the mothers during the 20-minute play session. Every maternal utterance was transcribed using glossing conventions developed in previous studies (Lieberman et al., 2014). Utterance boundaries were determined using prosodic markers (i.e., the signer rested her hands or paused in her signing) and grammatical cues. Next, every sign within each utterance was coded according to its lexical category. Additionally, every instance of

Table 1. Participant demographics.

Dyad	Sibling	Child age (mos)	Child gender
1	C7	21	F
2	C5	22	F
3		27	F
4		33	M
5	C2	38	F
6		38	F
7	C1	39	M

pointing was categorized according to whether or not the point occurred with a co-referential lexical noun. All transcription and coding were done by a deaf native ASL signer or a hearing proficient ASL signer. All transcripts were reviewed by a second coder. Any discrepancies or disagreements in transcription or coding were discussed by the coding team, and if agreement could not be reached, the team deferred to the judgment of the native signer.

Analysis

We analyzed maternal input at both the lexical level and the utterance level, as follows: At the lexical level, we coded the total number of unique sign types as well as total tokens produced by mothers in each dyad. We then coded each sign according to its lexical category and calculated the total number and relative proportion of signs from each category for each dyad. Finally, we calculated the most frequent nouns, verbs, and adjectives used across dyads. At the utterance level, we calculated the MLU for the mother in each dyad. We then examined lexical category use by looking at the presence and position of nouns and verbs (as well as other lexical categories) within each utterance.

Points in ASL have multiple functions. Like the co-speech gestures used in spoken language, some points in ASL serve to get an individual's attention or to provide a visual cue to accompany a linguistic utterance. Points can also be linguistic units in ASL when they are used as pronouns to refer to present or non-present people or objects. Unlike in spoken language, attention-getting points and pronouns are homophonous in sign. In our sample of dyadic interaction, we expected mothers to use both kinds of points. We were particularly interested in the occurrence of pronominal points, and whether pronominal points were likely to take the place of nouns. To investigate this, we looked at the surrounding signs in utterances containing points to determine the specific function of the point.

Results

Lexical level analyses

Maternal input and child characteristics

Analysis using Spearman's rho revealed a significant positive relationship between child age and CDI score ($\rho = .84, p = .04$) (Table 2). As expected, CDI scores increased with age.¹ Total maternal sign tokens for each dyad ranged from 291 to 687 ($M = 455$). There were positive but non-significant relationships between the mother's total sign tokens used during the interaction and the child's age ($\rho = .74, p = .06$) and CDI score ($\rho = .77, p = .07$). There was a significant correlation between child age and maternal noun tokens ($\rho = .88, p = .009$) and between child CDI score and maternal verb tokens ($\rho = .94, p = .005$); the correlations between the number of *unique* noun or verb types and child age or

Table 2. Characteristics of maternal input by dyad.

Dyad	CHILD		MOTHER				
	Age (mos)	CDI score	# utterances	Unique signs/total sign tokens	Unique nouns/total nouns	Unique verbs/total verbs	MLU in signs
1	21	238	128	122/291	25/50	74/137	2.27
2	22	200	182	134/401	40/69	58/125	2.20
3	27	n/a	131	109/298	22/64	61/112	2.27
4	33	343	269	139/509	26/67	69/171	1.89
5	38	411	207	194/558	45/93	97/192	2.69
6	38	526	234	188/687	41/83	78/211	2.94
7	39	457	172	161/438	37/97	80/177	2.55

¹As three of the children in the current sample were above the age of 36 months and had been exposed to ASL from birth, we anticipated potential ceiling effects; thus, the CDI scores were interpreted cautiously. There were no alternative ASL vocabulary assessments available at the time of data collection that were appropriate for this age range.

vocabulary were not significant. Thus, mothers produced more nouns and verbs overall when interacting with older children, but did not increase their lexical diversity in these categories.

Sign tokens and types

Table 2 provides characteristics of maternal input at the lexical level for each dyad. Correlations were calculated using nonparametric analysis with Spearman’s rho due to the small sample size. Each sign was labeled according to its lexical category. Lexical categories were comprised of the following: nouns (further divided by type, i.e., proper nouns, nouns referring to animate beings, and those referring to inanimate objects), verbs, adjectives, question signs (WHO, WHAT, WHERE, WHY, WHEN, HOW, DO-DO), pronouns (including only first and second-person pronouns “I” and “YOU,” possessives, plural pronouns, and demonstratives such as THIS and THAT), other (closed class words, interjections, etc.), and points. Points did not include first and second-person pronouns (i.e., points to the self or the child), because these points were able to be categorized with certainty as pronouns. All other points (i.e., to objects, locations, and additional people) were included in the point category. We then determined the relative proportion of signs produced during each interaction from each lexical category. We calculated both total tokens and unique types for each category.

To gain a more comprehensive picture of lexical categories in maternal utterances, we aggregated across all dyads (Table 3). Verbs were produced more frequently than all other sign types, accounting for an average of 36% (range 30% to 47%) of all signs. Mothers used an average of 74 unique verbs (range 58 to 97), and an average of 161 total verb tokens (range 112 to 211). This pattern held for each individual mother and dyadic interaction (Figure 1).

Nouns accounted, on average, for only 17% (range 12% to 22%) of all signs, with a mean of 34 unique nouns (range 22 to 45) and 75 (range 50 to 97) total nouns. We further divided nouns according to whether they were proper or common nouns. Across dyads, there were 522 nouns produced by the mothers. Of these, 54 were proper nouns that referred to either a parent (MOM or DAD, $n = 21$) or the name sign of the child or other individual ($n = 33$). Mothers used the first person pronoun to refer to themselves 66 times, and the second person pronoun to refer to the child 102 times. Thus, mothers are clearly more likely to refer to themselves and their children using pronouns rather than proper nouns. Common nouns consisted of toy people or animals ($n = 117$) or other inanimate objects ($n = 351$).

After verbs and nouns, the next most frequent lexical category was other (function signs, adverbs, prepositions, interjections, etc.), followed by points, question signs, and pronouns. Adjectives were the least frequent lexical category used.

Most frequent signs

To determine which specific nouns, verbs, and adjectives were most prevalent in the input, we calculated the five most common signs from each category. To be counted as a frequent sign, the sign had to be used in at least two of the seven sessions (i.e., signs used by only one mother were not counted in the most frequent tally).

Table 3. Maternal input by lexical category.

Word type	Mean (sd) tokens	Mean (sd) types	Mean (sd) % of all sign tokens	Mean % of utterance contain- ing sign type
Nouns	75 (17)	34 (9)	17.0% (4.0%)	31% (7.3)
Verbs	161 (37)	74 (13)	36.0% (6.2%)	57% (8.7)
Adjectives	27 (13)	15 (5)	6.2% (3.0%)	13% (5.0)
Pronoun (points to self and child, possessives, demonstratives)	34 (21)	6 (2)	6.8% (2.2%)	14% (5.8)
Question signs	39 (23)	8 (5)	7.8% (2.7%)	14% (7.3)
Points (to objects, locations, and people other than self/child)	50 (22)	n.a.	10.6% (3.0%)	17% (9.1)
Other	69 (37)	25 (10)	14.4% (3.2%)	n.a.

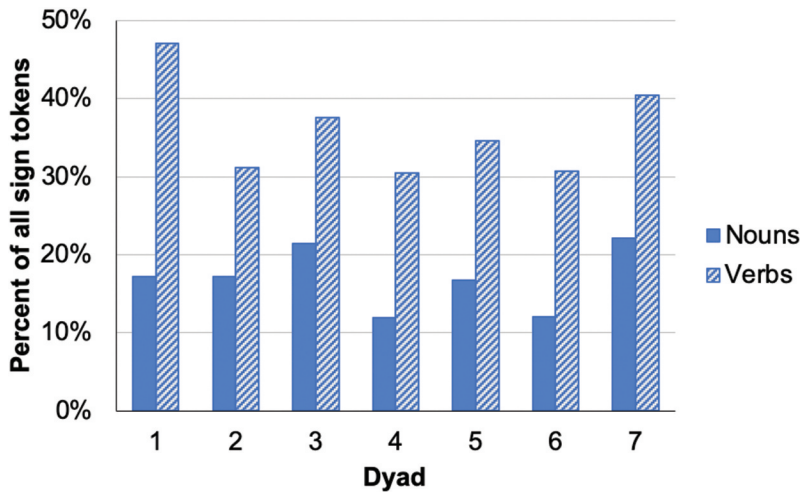


Figure 1. Proportion of nouns and verbs in maternal input by dyad.

The most common verbs used across dyads were WANT, SEE, COME, SEE-SEE,² and FINISH. The most common nouns were BABY(doll), BUS, MOM, FOOD, and SCHOOL. Many of these represented labels for the objects within the play sets. Not surprisingly, nouns were closely tied to present and concrete objects in the environment. The most common adjectives were OTHER, STUCK, BLUE, HOT, and RED. Similar to nouns, these frequent adjectives represented features of the objects in the toy set or characteristics of objects that arose during pretend play (e.g., pretending that food was hot).

Utterance-level analyses

Mean length of utterance

First, in order to characterize maternal input, we calculated the maternal mean length of utterance (MLU) for each dyad (Table 2). We counted MLU in signs. We first identified utterance boundaries and then counted how many signs (mono- or multi-morphemic) were in each utterance. All of the interactions included maternal use of classifiers; for the current analysis, these classifiers were counted as single signs and not analyzed further, so our MLU measure may be an underestimate of mothers' utterance complexity. Although MLU is typically used to measure utterance length in child language learners, in the current study we used MLU of the mothers' utterances for two reasons: first, due to the scarcity of data examining signed parental input, we wanted to document typical maternal input among deaf mothers who use ASL with their deaf children. Second, we used MLU to see whether there were substantial individual differences in the length of maternal utterances and whether there was any correlation between maternal utterance length and child vocabulary score (Goodwin et al., 2019).

The total number of maternal utterances ranged from 128 to 269 ($M = 189$). Maternal MLU for the dyads ranged from 1.9 to 2.9 signs per utterance ($M = 2.4$). Although there was a wide range in the number of sign tokens and total utterances, mothers generally produced two- to three-sign utterances across the play sessions. There was no correlation between maternal MLU and child age ($\rho = .6, p > .1$). Examples of prototypical utterances were as follows:

- BABY CRY POINT(at_baby) (Dyad 1)
- FOOD WANT HUNGRY YOU? (Dyad 7),
- NOSE WHERE (Dyad 2)
- CLEAN CL(put_in_bag) (Dyad 3).

²SEE-SEE was coded as a distinct lexical item from SEE in ASL and translates approximately to "Let's see."

Each interaction included some single sign utterances, such as the following:
HELP (Dyad 4)
SAME (Dyad 6).

Each interaction also included some longer maternal utterances, such as:
REMEMBER BREAD CL(bread_open) HOTDOG2 CL(hot dog) CL(eat_hotdog) REMEMBER
YOU? (Dyad 5)
BIG DINOSAUR KNOW SEE T-V BEFORE REMEMBER YOU? (Dyad 6).

Presence and location of nouns and verbs within the utterance

To characterize the composition of maternal input, we looked at the presence of signs by the lexical category within each utterance. There were 1344 utterances across dyads. For each maternal utterance, we coded whether the utterance contained a noun, verb, adjective, pronoun, question signs, and/or point. This allowed us to calculate the proportion of utterances containing signs from each lexical category (see Table 3). For the subset of utterances containing nouns and verbs, we examined the position of the noun or verb within the utterance. The results are presented in Table 3. Paralleling the results at the lexical level, verbs were the most frequent sign type to appear within an utterance. Verbs were present in an average of 57% of the maternal utterances, while nouns occurred in an average of 31% of all maternal utterances.

We then examined the position of nouns and verbs within the utterance (Figure 2). We coded utterance position as initial, middle, final, or isolated. Notably, nouns or verbs could appear in more than one position in the utterance, in particular at the start and the end of the utterance, so we added an additional category called “initial and final.” Since we considered initial and final positions the most salient, “initial” included utterances with a noun or verb in initial position even if an additional noun/verb occurred in the middle position, and “final” included utterances with a noun or verb in final position even if a second noun/verb occurred in the middle position. Nouns were most likely to occur in the middle of an utterance (147 times, or 37% of all noun-containing utterances). Verbs were most likely to occur in isolation (227 times or 30% of all verb-containing utterances). Overall, verbs were more likely than nouns to occur in salient positions, i.e., at the beginning or end of an utterance or in isolation.

A unique feature of ASL syntax is that the same sign can appear in both the initial and final positions, creating a “sandwich.” Such constructions highlight or emphasize the sign, making it particularly salient. In our sample, these constructions appeared with both nouns and verbs. We

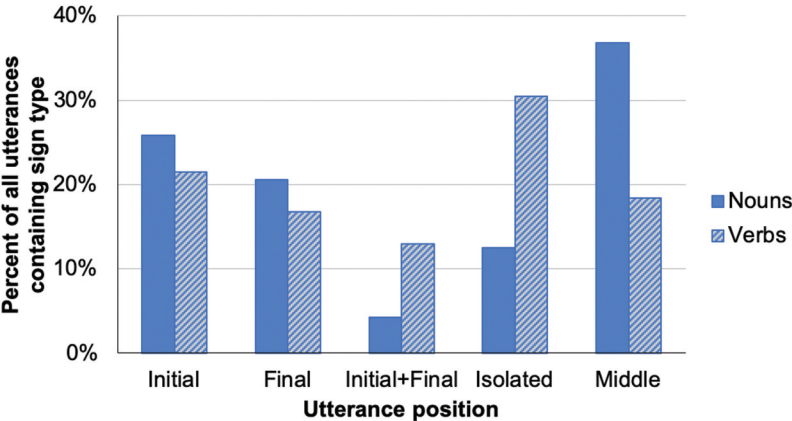


Figure 2. Utterance position of nouns and verbs across dyads. Percentages represent the proportion of total nouns or verbs that appeared in each utterance position.

examined all utterances that contained either nouns or verbs in both utterance-initial and utterance-final position and then looked at the subset of those where the initial and final noun or verb was the same sign. Examples of such constructions with verbs are SIT WHERE SIT, HURT HOT HURT, and WANT POINT(at_car) CAR WANT? Examples with nouns include STORY WANT STORY, and BREAD FORGET BREAD. In our dataset, these sandwich constructions occurred in only 8 out of the 17 utterances in which a noun appeared in both initial and final positions, and in 32 out of the 97 utterances in which a verb appeared in both initial and final positions.

Function of points within the utterance

We analyzed utterances with points to determine which signs co-occurred with the point, which allowed us to infer the function of the point. In this analysis, we excluded points that were directed to the self or child, as these are clear pronouns equivalent to “me” and “you.” For the remaining points, we categorized points as follows: 1) we identified utterances containing only a question sign and a point; these utterances are requests for labels, and thus we expected that they would not contain the noun referent about which the parent was asking (e.g., when a parent asks “What’s that?” we did not expect them to name the referent noun); 2) We identified points that occurred in isolation as attention-getting gestures with no accompanying utterance; 3) With the remaining points, we coded whether or not the utterance a) contained the noun to which the point referred, or b) did not contain the co-referential noun, with the goal of identifying whether these pronominal points served to replicate the referent noun or refer to the referent only with the point.

Across all dyads, there were 227 utterances that contained a point. Following the process described above, we found the following: There were 32 utterances that consisted of an isolated point, in which the mother pointed at an object with no accompanying sign. These points were considered attention-getting cues. There were 30 utterances that contained only a point and a question sign, as follows: there were 16 utterances in which the point occurred only with the sign WHAT (i.e., WHAT POINT (at_something) or POINT(at_something) WHAT?), 5 utterances that occurred only with the sign WHO, 1 utterance that occurred with WHERE, 1 with WHY, and 7 with FOR (or FOR-FOR).

There were 165 utterances that contained points in conjunction with other lexical signs. Our analysis focused on the proportion of point-containing utterances that also contained common nouns (in which case the point and the noun generally referred to the same object), versus the proportion of point-containing utterances that had no common nouns. We predicted that there would be a higher proportion of points that occurred *without* accompanying nouns. In fact, there were 80 utterances that contained both a point and a noun, and 85 utterances that contained a point but no referent noun. Thus, pronominal points were almost as likely to occur in utterances with a co-referential noun as they were to occur in utterances that did not contain a noun.

Discussion

The goal of this study was to provide an initial description of the lexical composition of child-directed signing in ASL as produced by deaf parents. We analyzed maternal ASL input to describe the distribution of signs from different lexical categories with a focus on the proportion of nouns and verbs. We found a significant verb bias in maternal input relative to all other lexical categories in types, tokens, and salient utterance position. Pronominal points to objects were equally likely to occur with or without nouns. Mothers used more signs overall with older children, but lexical diversity did not change with age. These findings and their implications are discussed below.

Mothers in this sample averaged an MLU of 2.4 signs. Although this is lower than that of hearing mothers interacting with hearing children of the same age (e.g., Rowe, 2008), this is likely at least in part due to the fact that many signs are poly-componential (Slobin et al., 2003), containing multiple meaning units to indicate agreement, aspect, manner, negation, and tense. Contrary to our expectations, there was no significant correlation between maternal MLU and child age, although our findings are consistent with a recent longitudinal study of deaf mothers and their deaf children (Goodwin et al.,

2019). It may be that the particular play context lent itself to short statements and questions, as children were largely focused on the present objects, but this warrants further investigation.

Analysis of lexical signs revealed a significant bias toward verbs in the input according to all metrics. Verbs were the most frequently used type of lexical item, had the highest number of unique types, were used in the highest proportion of utterances, and occurred in salient positions more than nouns. For several mothers, verbs were produced more than twice as often as nouns. There are several possible explanations for this verb bias. Linguistically, ASL is considered a pro-drop language (Lillo-Martin, 1986), which likely led to a high instance of utterances with no overt subject. Studies of spoken language that are pro-drop have found parallel patterns. In Tardif et al.'s (1997) comparison of noun and verb use in English, Mandarin, and Italian parent input, English-speaking caregivers produced an equal number of noun and verb types, Mandarin-speaking caregivers produced more verb types than noun types, and Italian-speaking caregivers produced more noun types than verb types, although caregivers in all three languages produced more verb tokens than noun tokens. Similarly, Gopnik et al. (1996) found that Korean-speaking caregivers used more verb types and tokens than noun types and tokens. The mothers in our sample showed patterns of input that most closely aligned with those observed for Mandarin and Korean input.

When the subject is included in an ASL utterance, it can be expressed as a noun, lexical pronoun (e.g., THAT, MY), or a pronominal point. If these categories are combined, they comprise 34% of all lexical items. Thus, while subjects in ASL can be expressed in a number of ways (or dropped), actions can only be expressed through verbs. Parents using ASL may also be more likely to describe ongoing actions than objects due to the rich classifier system in ASL that enables the production of complex verbs that incorporate aspects such as manner and path of movement (Morgan & Woll, 2007). Every dyad in our sample included maternal use of such classifiers. In addition, in natural sign languages, verbs take morphological markers to indicate agreement, and mothers incorporate these morphologically complex verbs in their input (Hoiting & Slobin, 2002). Finally, mothers might use verbs as a way of inviting children to play and to solicit children's attention. Of note, the most prevalent verbs included WANT, LOOK, SEE, and COME. In this free play scenario where the toys were largely new to the children, these verbs may have represented the mothers' attempts to engage the child in play. In the future work, it will be important to examine different contexts in which the objects in the child's environment are more routine and familiar and thus less likely to draw their attention away from the interlocutor.

In contrast to verbs, nouns were less frequent lexical items and occurred in only one-third of utterances. The ratio of nouns to verbs in the present sample is similar to previous findings related to Mandarin input and contrasts with findings of English input (Tardif et al., 1997). One explanation for the relative infrequency of nouns is that parents could point to present objects rather than label them. In these utterances where parents pointed to objects, parents often provided information about the objects (i.e., describing their properties with adjectives or describing their actions with verbs) but only about half of the utterances that contained these referential points included the actual referent noun label. When parents did label objects, they tended to name concrete objects that were present in the provided toys.

Maternal sign types were also likely influenced by context, specifically the fact that the interaction was one involving free play with toys. In studies of Korean caregiver input (Choi, 2000; Gopnik et al., 1996), nouns were more frequent in parent input in book-reading sessions and less frequent in free play interactions compared to verbs. The same pattern has been found in a study comparing French- and Turkish-speaking caregivers (Altınkımız et al., 2014), in that nouns and object-oriented utterances were more common in book reading, while verbs and action-oriented utterances were more common in free play across both languages. Tardif et al. (1999) found differences based on context as well. English- and Mandarin-speaking mothers used more noun types than verb types when looking at a picture book with their children, but showed the opposite pattern in a toy-based play interaction. Even within play-based interactions, the presence of toys can influence the composition of the input. Goldfield (1993) observed English-speaking mothers and children interacting with or without toys and found more noun use that

corresponded to object labeling in toy play, but more varied verb use during physical play. This aligns with our finding that many of the nouns that mothers used served to label the toy objects with which they were playing.

Our analysis of pronoun use and pointing in maternal input revealed that mothers used points both as linguistic units (i.e., by pointing to themselves or the child or incorporating a pronominal point into a sentence) and as attention-getting cues. To the extent that parent input is correlated with early child language acquisition, our findings align well with recent findings that children acquiring ASL point both to objects and to people (including themselves) before the age of three. Lillo-Martin and Chen Pichler (2018) contrasted the frequency of gestural and linguistic points in one- to three-year-old hearing and deaf children, and found that while both groups pointed to objects and locations, only the deaf children had started pointing to themselves and other people by the age of three. Lillo-Martin and Chen Pichler suggest that pointing is part of the linguistic system for deaf children acquiring ASL (Petitto, 1987), and thus functions as a pronoun in some early productions. In our sample, mothers frequently pointed to themselves and their child to indicate ME and YOU, thus modeling early pronominal use of points in ASL.

This study is limited in that only seven dyads were observed. Nevertheless, the fact that verbs were the most prevalent lexical category across all dyadic interactions suggests that these findings are likely to be generalizable to a broader sample of child-directed input in ASL from deaf parents. A second limitation is that children's language productions were not systematically measured beyond the parent-reported vocabulary. A clear direction for future research is to correlate the types of signs used in parental input with children's early vocabulary composition (Goodman et al., 2008; Hoff & Naigles, 2002). The current findings align with Anderson and Reilly's (2002) observation that children acquiring ASL show a higher proportion of verbs to nouns than children learning English. We predict that there are direct correlations between lexical categories in the input and children's later vocabulary composition.

The implications of the current findings are particularly relevant because of the unique conditions in which the majority of deaf children learn language. Over 90% of deaf children are born to hearing parents (Mitchell & Karchmer, 2004). Hearing parents who take on the task of learning ASL are learning it as a new language, and there are few established curricula guiding how ASL should be taught to this unique group of L2 learners (Snoddon, 2015). Knowing what typical linguistic input looks like from deaf parents during parent-child interaction can directly inform approaches to early intervention, specifically to ASL instruction for hearing parents. In sum, the current study provides an initial description of the lexical composition of parent input in ASL, broadening understanding of how input varies across languages by extending cross-linguistic comparisons to include input in the signed modality.

Acknowledgments

We are extremely grateful to the parents and children who participated in this study. We thank Erin Spurgeon and Marla Hatrak for help with coding, and the anonymous reviewers for helpful feedback. This work was supported by the National Institutes on Deafness and Other Communication Disorders (NIDCD) under grant number DC015272.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the National Institute on Deafness and Other Communication Disorders [DC015272].

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