Morphological simplification in Inuktitut child-directed speech

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Abstract: When addressing young children, caregivers typically use a simplified mode of the language — 'child-directed speech' (CDS). The most studied domains of CDS are the lexicon, phonetics and phonology, and syntax (Snow 1995). Relatively less is known about the morphological properties of CDS. In this study, we ask how caregivers morphologically simplify their CDS in Inuktitut — an Inuit language with polysynthetic agglutinative structure. We also ask whether such simplification is fine-tuned in accordance with the children's stage of linguistic development. Our findings show that the morphological complexity (e.g., the number of verb root types and noun root types; use of structures where the word class changes within a word) and lexical diversity of CDS progress as the children advance through the stages of linguistic development. This research contributes to answering the questions about the nature and role of input in the language acquisition process by supporting and adding to the earlier findings in which caregivers adjusted the complexity of their CDS (i.e., Snow & Fergusson 1977), presumably, to ease communication by simplifying the morphology to the comprehension level of their children and to help facilitate their acquisition.

Keywords: child-directed speech (CDS), Inuktitut, morphological simplification, morphological complexity

1 Introduction

All children learn to speak and understand language at approximately the same age following approximately the same course of linguistic development despite the fact that they grow up in different environments (Kosslyn & Osherson 1995; Friederici 2011). In order for them to acquire language, children need to be exposed to linguistic input. A central question in language development is what kind of linguistic experience and how much input are needed to support first language acquisition. One key component of this input in many cultures is a special mode of speech used by the caregivers when addressing young children — child-directed speech (CDS) — that supports children's linguistic development by providing a simplified model of adult-directed speech (Mueller Gathercole & Hoff 2009).

When it comes to studying CDS, morphology gets comparatively little attention as compared to other domains of language. In our study, we investigate the morphological simplification of CDS in Inuktitut — an Inuit language with polysynthetic agglutinative structure spoken in arctic Quebec. Using the data from the mothers addressing eight Inuktitut-speaking children aged 0;11 to 3;6,[1] we ask whether and how the morphology and lexical diversity of the mothers' CDS is adjusted depending on their children's stage of linguistic development.

[1] Ages are given as years;months. Thus, 0;11 denotes 0 years and 11 months, while 3;6 denotes 3 years and 6 months.

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1.1 Characteristics of child-directed speech

In the past 60 years, multiple studies have demonstrated that speech directed to a child interlocutor is distinct from adult-directed speech (e.g., Snow 1972; Ferguson 1978; Ringler 1981; Gallaway & Richards 1994; Foulkes et al. 2005). Adults adapt their speech addressed to children in numerous ways. Child-directed speech tends to be highly interactional (Hoff & Naigles 2002), hyper-articulated (Lindblom 1990; Minjung & Stoel-Gammon 2005; Green et al. 2010), prosodically exaggerated (Fernald & Simon 1984; McLeod 1993), and syntactically and lexically adapted for young listeners (Fernald & Morikawa 1993; Kunert et al. 2011). Numerous studies also show that CDS is preferred by children (Fernald 1985; Schachner & Hannon 2011; Masapollo et al. 2016) and helps them in the task of word segmentation (Thiessen et al. 2005).

Many researchers have proposed that CDS exists universally across all cultures (Fernald 1992; Bryant & Barrett 2007; Saxton 2009). Among the more recent works is a study by Piazza and colleagues (2017) examining child-caregiver pairs that spoke ten different languages. They found that mothers in all the languages consistently shifted their timbre between adult- and child-directed speech, and that this shift was similar across languages, which suggests that such alterations may be universal.

Other researchers, however, argue that CDS is not universal and/or not essential to language learning. In some societies, adults do not speak to children at all until a certain age (Schieffelin & Ochs 1984; Duranti & Ochs 1986), while in others they do not use CDS. However, children learn to speak regardless of such differences in input. For example, Schieffelin (1990) demonstrated that despite the fact that the Kaluli of Papua New Guinea do not typically use CDS, Kaluli child language acquisition is not impaired. Ultimately, although found in many languages, CDS can differ substantially across cultures in terms of style and amount of use.

1.2 Domains of child-directed speech

To date, the most studied domains of CDS have been the lexicon, phonetics and phonology, and syntax (Snow 1995). When it comes to the lexicon, CDS is characterized by a restricted range of vocabulary and a preference for concrete words. With regard to phonetics and phonology, CDS is usually described as having higher pitch overall, a greater pitch range, slower speech, syllable-lengthening, longer pauses, fewer dysfluencies, and exaggerated intonation and stress. As for syntax, CDS tends to have shorter, simpler utterances compared to adult-directed speech.

When it comes to morphology, however, there is still a distinct shortage of literature. In this regard, polysynthetic languages constitute a valuable source for investigation. While identifying words and morphemes in the stream of speech is a challenging task for young children in any language, this difficulty is magnified in a morphologically rich languages like Inuktitut.

1.3 Inuktitut

Inuktitut belongs to the Inuit-Yupik-Unangan language family and is spoken by some 34000 speakers in north-eastern Canada. Its polysynthetic structure allows more than ten morphemes per word and syntax within the word. There are three word classes (noun, verb, other), more than 1000 obligatory nominal and verbal inflections, and more than 400 optional word-internal morphemes (e.g., tense, aspect, negation, passive, causative). Example (1) offers a glimpse into the morphological complexity of Inuktitut by demonstrating how its polysynthetic agglutinative structure allows expressing the meaning of an entire sentence in one word:

(1) Illujaraalummuulaursimannginamalittauq.[2]
illu-juaq-aluk-mut-uq-lauq-sima-nngit-gama-li-ttauq
house-big-EMPH-ALL.SG-go-PAST-PERF-NEG-CSV.1sS-but-also
'But also, because I never went to the really big house.' (Dorais 2011)

In the present study, we investigate the Tarramiut dialect, which is spoken by some 3000 speakers in the Hudson Strait area of arctic Quebec (Allen 1996).

2 The current study

2.1 Questions and hypotheses

The current study examines whether and how mothers simplify the complex morphology in Inuktitut to make it more accessible to children, and whether such simplification is fine-tuned in accordance with the children's stage of linguistic development (Snow 1995). We hypothesized that the morphology of CDS would be simpler for younger than older children, and thus that the morphological complexity would increase as the children advance through the stages of linguistic development. We also hypothesized that the lexical diversity of CDS would be reduced in speech to younger children, and would increase as the children's own linguistic ability increases.

2.2 Participants and data

We analyzed the speech of the mothers addressing eight Inuktitut-speaking children aged 0;11 to 2;10 at onset.[3] The data came from two sets. In both sets, the amount of data varied across children and sessions. The data for the first set were videotaped on four occasions at three-and-a-half-month intervals across a one-year period. They were originally collected in two communities (fewer than 400 inhabitants) in Nunavik for a study of communicative competence in Inuit children. The data comprise 80 hours of video recordings of spontaneous naturalistic interactions between four children and their family members/friends. The children, aged 0;11–1;8 at onset, were monolingual typically developing speakers of Inuktitut (Crago 1988).

The data for the second set were videotaped every month for nine months and were originally collected in one small community (about 250 inhabitants) in Nunavik for a study of morphosyntactic development in Inuit children. The data comprise some 65 hours of video

[2] The following abbreviations are used in the glosses: 1 = first person, 2 = second person, ABS = absolutive, ALL = allative, CAUS = causative affix, CND = conditional, CSV = causatives, EMPH = emphatic, ICM = incontemporative, IMP = imperative, IND = indicative; INT = interrogative, LOC = locative, NEG = negative, PASS = passive, PAST = past, PEJ = pejorative, PERF = perfective aspect, POL = politeness affix, S = subject, SG = singular (nominal), p = plural, s = singular (verbal).

[3] In our recordings, we could observe interaction between the target children and their family members, including their mothers, fathers, much older siblings, and grandparents who often live in the same household. All of them can be considered the children's caregivers. However, there have been some debates on whether CDS differs depending on the gender and age of the speaker, their relationship to the child and their role in the child's life. For example, multiple studies have pointed out differences between mothers' and fathers' CDS (Gleason, 1975; Leaper et al. 1998; Pancsofar & Vernon-Feagans 2006; Hill 2009; VanDam & De Palma 2014). A study by VanDam and De Palma (2014) shows that mothers use higher pitch and vary their pitch more when interacting with their child than with adults, while the fathers talk to their children using intonation patterns more like when they talked to other adults. We decided that analyzing different types of CDS together could potentially blur the results and, ultimately, we only analyzed the mother's CDS since it provided the most data.

recordings of spontaneous naturalistic interactions between four children and their family members/friends during daily home activities. The children, aged 2;0–2;10 at onset, were also monolingual and typically developing (Allen 1996).

All utterances spoken by and to the target children were extracted, transcribed, and translated into English by native speakers in CHAT format according to the standards of the CHILDES initiative (MacWhinney 2000). All morphemes were then identified and glossed. Non-verbal information was also included in the transcripts to provide sufficient context for utterances. The data were divided into six groups representing the stages of the children's linguistic development according to their mean length of utterance in morphemes (MLUm).

Table 1: Data statistics

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Children's MLUm	1.0 – 1.5	1.5 – 2.0	2.0 – 2.5	2.5 – 3.0	3.0 – 3.5	> 3.5
Children's Mean Age	1;7	2;1	2;7	2;7	2;11	2;9
Children's Age Range	0;11 – 2;3	1;8 – 2;8	2;0 – 3;1	2;1 – 2;10	2;3 – 3;5	2;4 – 3;1
Child-Mother Pairs	3	3	4	3	4	2
Mothers' Utterances	1119	1043	1764	2958	1045	1885

Table (1) shows children's mean length of utterances in morphemes by stage, starting from one morpheme per utterance in Stage 1 and increasing to more than three and a half morphemes in Stage 6. For each stage, the table specifies the children's mean age and age range, the number of child-mother pairs, and the number of child-directed utterances produced by the mothers.

3 Analysis

3.1 Points of interest in the data

The data for the following points of interest were extracted and calculated using CLAN (only mothers' CDS was considered): (a) the number of verb root (VR) types and noun root (NR) types; (b) the lexical diversity in morphemes; (c) the structures where the word class changes once within a word; (d) the structures where the word class changes more than once within a word; and (e) the structures where the noun-to-verb change is combined with the use of passive.

3.1.1 Number of verb root (VR) types and noun root (NR) types

Examples (2) and (3) show words with VR and NR morphemes. We only counted *different* VR and NR morphemes produced by the mothers in each data file — VR types and NR types. We considered the types (and not the tokens, which represent the total number of items per transcript) as an increase in the number of types would indicate an increase in complexity of the mothers' CDS.

(2) Uqaatsialaurin.
uqaq-tsiaq-lauq-git
speak-well-POL-IMP.2sS
'Talk some more.' (Paul's mother addressing Paul, 2;6)

(3) Amaamait.
amaama-it
baby.bottle-ABS.2Ssg
'Your bottle.' (Jini's mother addressing Jini, 0;11)

3.1.2 Lexical diversity in morphemes

We looked at lexical diversity in morphemes — a measurement of how many different morphemes occur in a text. We used a method that calculates the moving-average type to token ratio (MATTR) for morphemes, because this method is the least dependent on the sample size.

3.1.3 Structures where the word class changes within a word

We counted the number of structures present in CDS where the word class changes within a word — either from verb to noun, or from noun to verb. Example (4) shows how a verb becomes a noun with the help of the nominalizer *juq* ('one which'). Example (5) shows how a noun can change into a verb with the verbalizer *it* ('be').

(4) Aahaaturulu.
aahaaq-juq-guluk
hurt-one.which-EMPH.PEJ
'Little one is in pain.' (Jini's mother addressing Jini, 2;0)

(5) Qariamilluti.
qariaq-mi-it-lutit
bedroom-LOC.SG-be-ICM.2sS
'Stay in the bedroom.' (Lizzie's mother addressing Lizzie, 2;6)

3.1.4 Structures where the word class changes more than once within a single word

We also counted the number of structures present in CDS where the word class changes more than once within a word — either from verb-to-noun-to-verb (6) or from noun-to-verb-to-noun (7). Example (6) shows how a verb can change to a noun with the help of the nominalizer *juq* ('one which') and then back to a verb with the verbalizer *u* ('be'). Example (7) demonstrates how a noun changes into a verb and back to a noun using the verbalizer *mitiq* ('cover with') and the nominalizer *juq* ('one which').

(6) Ijukkalaurtualuuvutit.
ijukka-lauq-juq-aluk-u-vutit
fall-PAST-one.which-EMPH-be-IND.2sS
'You are one who fell.' (Elijah's mother addressing Elijah, 2;9)

(7) Aputimitirnatualu.
aputi-mitiq-naq-juq-aluk
snow-cover.with-CAUS-one.which-EMPH
'Thing that gets covered with snow.' (Elijah's mother addressing Elijah, 2;9)

3.1.5 Structures where the noun-to-verb change is combined with passive

Finally, we examined structures where the noun-to-verb change is combined with passive. Both examples (8) and (9) show how such complex polysynthetic structures are constructed in Inuktitut. In (8), a noun changes into a verb with the help of the verbalizer *taaq* ('acquire'), and then the verb turns into passive by adding a passive morpheme *jau*. Similarly, in (9), a noun becomes a verb by attaching the verbalizer *taq* ('fetch'), and then attaches the passive morpheme *jau.*

(8) Kiinaujartaatitautuaruvit?
kiinaujaq-taaq-tit-jau-tuaq-guvit
money-acquire-CAUS-PASS-only-CND.2sS
'You are being made to acquire money.' (Elijah's mother addressing Elijah, 2;9)

(9) Imirtatausirquuriirivita?
imiq- taq -jau-siq-qquuq-giiq-gi-vita
water-fetch-PASS-do-probably-already-again-INT.1pS
'Are we probably going to get delivered water again?'
(Elijah's mother addressing Elijah, 2;9)

3.2 Data preparation and analysis

We divided the CDS data into six groups that represent the stages of the children's linguistic development. The data files were assigned to a certain group based on the children's mean length of utterance in morphemes. Each stage was further divided into substages. Each substage included the data from one mother recorded within one month. Table (2) provides an example of how the data (here, VR types from Stage 2) were organized and prepared for the analysis.

Table 2: VR types from Stage 2

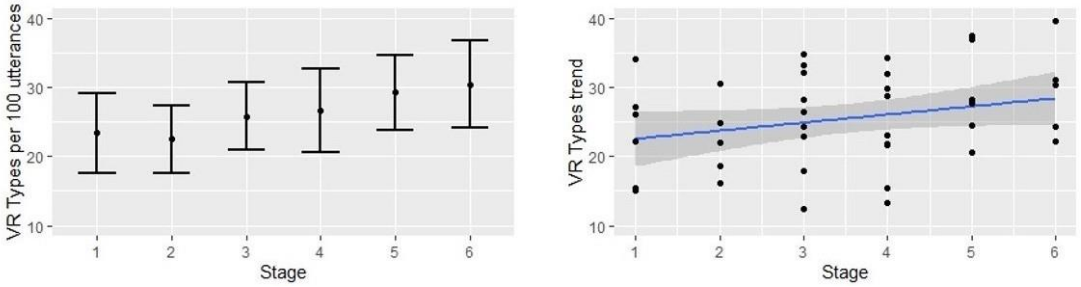
Data files by Substage	Number of items (NI)	Number of items per substage (NI_substage)	Number of utterances (NU)	Number of utterances per substage (NU_ substage)	Mean NI per utterance per substage
Jini7	30		112		
Jini8	21	56	91	225	0.248
Jini9	5		22		
Jini10	21		106		
Jini11	18	62	105	332	0.186
Jini12	23		121		
Lucasi10	19		68		
Lucasi11	-	38	< 15	124	0.306
Lucasi 12	19		56		
Sarah7	16		59		
Sarah8	2	39	18	177	0.22
Sarah9	21		100		
Sarah10	-		< 15		
Sarah11	17	30	114	185	0.162
Sarah12	13		71		

In the first column, we see the number of substages (five) and the number of data files in each substage (three per substage), as well as the names of the data files (there are data from three participants in this stage: Jini, Lucasi, and Sarah). The second column shows the number of items (NI) that were produced by each mother per data file, while the third column shows the total number of items in each substage (NI_substage). In the fourth column we can see the number of utterances (NU) that each mother produced per data file,[4] while the fifth column shows the total number of utterances per substage (NU_substage). In the last column, we can see the mean NI per utterance per substage, which we calculated by dividing NI_substage by NU_substage. The resulting dataset for the six stages was then analyzed using the Pearson correlation test in R.

4 Results

4.1 Verb and noun root types

First, we investigated the use of different verb and noun roots in the speech of the mothers. Figure (1) demonstrates how the number of verb root types in CDS increases with the stage of the children's linguistic development ($r(42) = .31$, $p = .03$).[5] A similar trend was observed for the noun roots (see Figure 2), where the number of noun root types in the speech of the mothers positively correlated with the stage ($r(42) = .36$, $p = .01$).

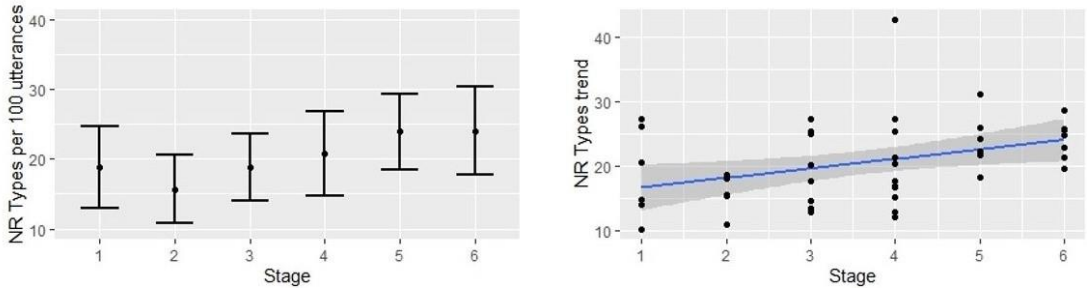


Panel A Panel B

Figure 1: Verb root types per 100 utterances by stage in CDS (Panel A) and the developmental trend in verb root types by stage in CDS (Panel B).

[4] If the number of utterances was < 15, the data from that data file were excluded from the analysis (i.e., files Lucasi11 and Sarah10).

[5] For all subsections, except subsection 4.2 ('Lexical diversity'), the left graph (Panel A) shows the mean number of items per 100 utterances by stage, with the bars representing the confidence intervals; the right graph (Panel B) shows the developmental trend, with the dots representing the 'collapsed' substage means for each stage.

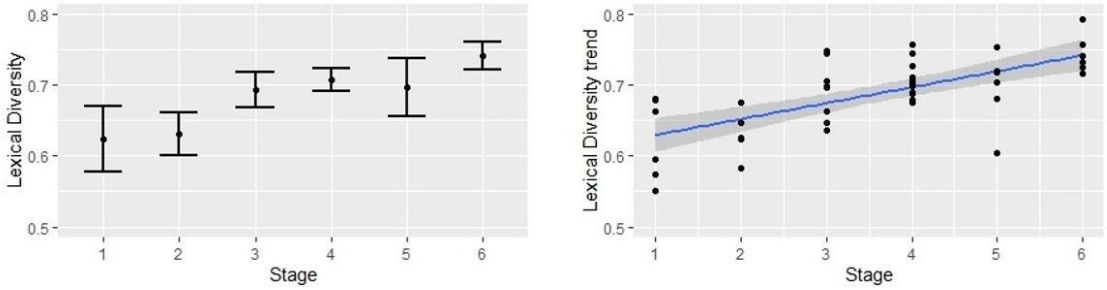


Panel A Panel B

Figure 2: Noun root types per 100 utterances by stage in CDS (Panel A) and the developmental trend in noun root types by stage in CDS (Panel B).

4.2 Lexical diversity

Figure (3) shows how lexical diversity of the child-directed speech increases from Stage 1 to Stage 6. The Pearson correlation test showed that lexical diversity of the mothers' speech and stages of the children's linguistic development are strongly positively correlated ($r (42) = .67$, $p < .001$).[6]



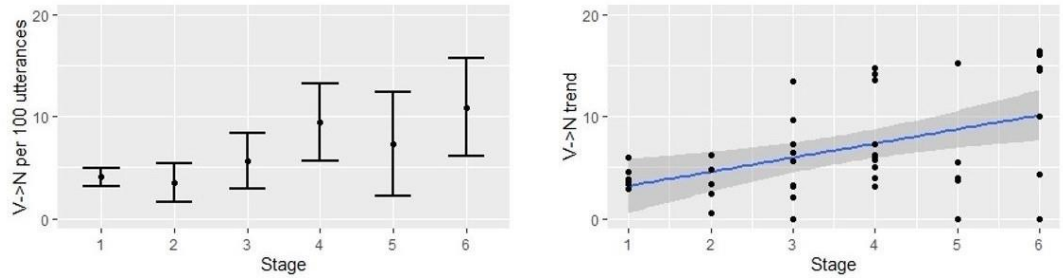
Panel A Panel B

Figure 3: Lexical diversity in morphemes by stage in CDS (Panel A) and the developmental trend in lexical diversity by stage in CDS (Panel B).

4.3 Verb-to-noun and noun-to-verb structures

We then examined polysynthetic structures where the word class changes within a single word. Figure (4) shows that the use of the structures where a verb changes into a noun within a single word is positively correlated with the stages of linguistic development ($r (42) = .41$, $p = .01$).

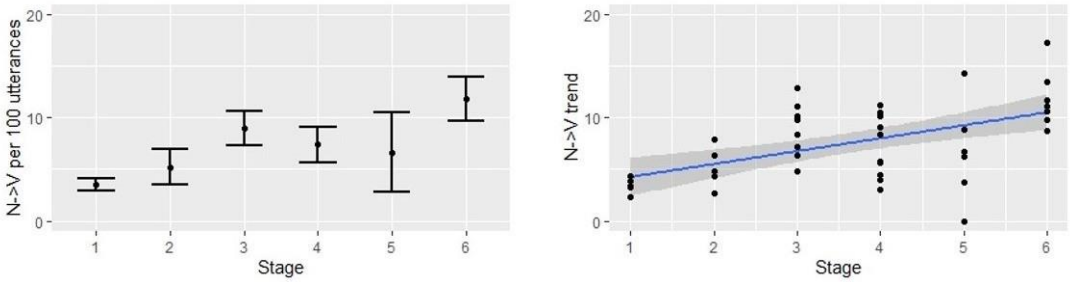
[6] In the subsection 4.2 ('Lexical diversity'), the left graph (Panel A) shows the mean lexical diversity in morphemes by stage (calculated using MATTR), with the bars representing the confidence intervals; the right graph (Panel B) shows the developmental trend, with the dots representing the 'collapsed' substage means for each stage.



Panel A Panel B

Figure 4: Verb-to-noun per 100 utterances by stage in CDS (Panel A) and the developmental trend in verb-to-noun by stage in CDS (Panel B).

Figure (5) shows a similar trend for the structures where a noun changes into a verb within a single word ($r(42) = .53$, $p = .01$).

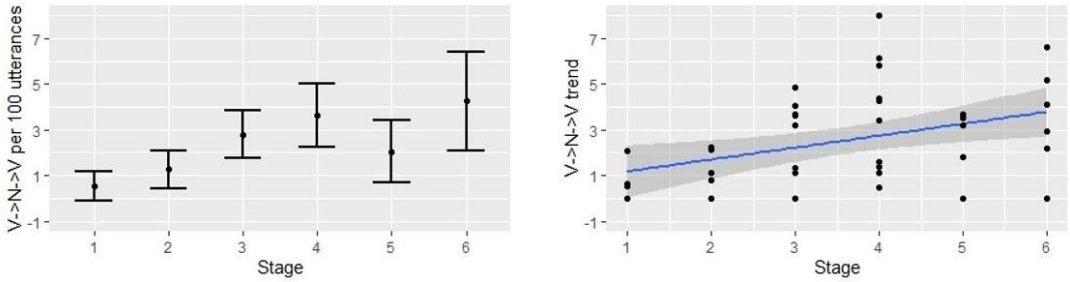


Panel A Panel B

Figure 5: Noun-to-verb per 100 utterances by stage in CDS (Panel A) and the developmental trend in noun-to-verb by stage in CDS (Panel B).

4.4 Verb-to-noun-to-verb and noun-to-verb-to-noun structures

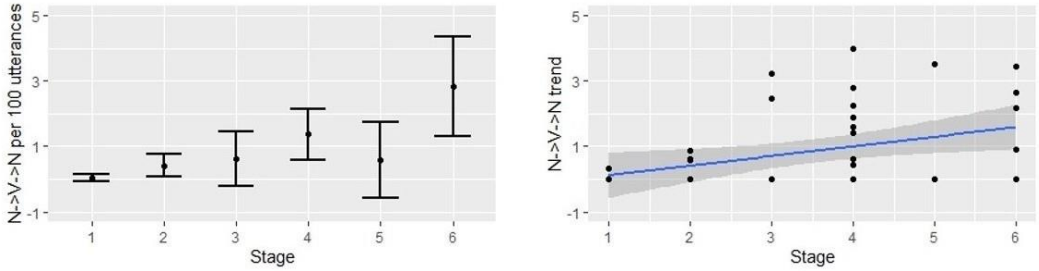
We then proceeded to examine the more complex polysynthetic structures — those where the word class changes more than once within a single word. Figure (6) shows a positive correlation between the use of the verb-to-noun-to-verb structures and the stages of linguistic development ($r(42) = .44$, $p = .02$).



Panel A Panel B

Figure 6: Verb-to-noun-to-verb per 100 utterances by stage in CDS (Panel A) and the developmental trend in verb-to-noun-to-verb by stage in CDS (Panel B).

Figure (7) demonstrates a positive correlation between the stages and the noun-to-verb-to-noun structures (r (42) = .47, p < .01).

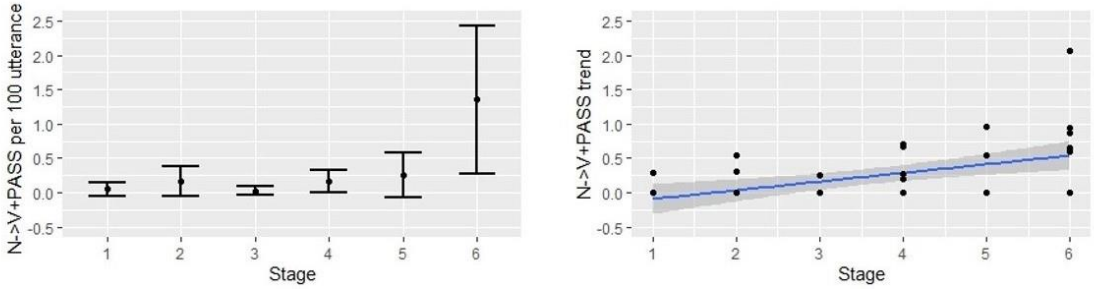


Panel A Panel B

Figure 7: Noun-to-verb-to-noun per 100 utterances by stage in CDS (Panel A) and the developmental trend in Noun-to-verb-to-noun by stage in CDS (Panel B).

4.5 Noun-to-verb plus passive structures

We also looked at the structures where the noun-to-verb change is combined with the use of passive and found a positive correlation (see Figure 8) between the use of the noun-to-verb+passive structures by the mothers and the stages of children's linguistic development (r (42) = .45, p-value < .01).



Panel A Panel B

Figure 8: Noun-to-verb+passive per 100 utterances by stage in CDS (Panel A) and the developmental trend in noun-to-verb+passive by stage in CDS (Panel B).

4 Conclusions

In this study, we investigated whether and in which ways Inuktitut-speaking mothers simplify their morphology when addressing young children. Inuktitut is an agglutinative polysynthetic language that allows more than ten morphemes per word, which present significant challenges for children acquiring it as their first language. Besides learning to extract words from a continuous current of speech, children have to learn to segment very long and morphologically complex words into morphemes. This raises a question of whether the input they get from their caregivers is altered in any way to simplify the segmentation process.

The results we obtained show that the morphological complexity and lexical diversity of the child-directed speech in Inuktitut increase from Stage 1 to Stage 6, which suggests that mothers

simplify the morphology, presumably to facilitate their children's acquisition. The simplification appeared to be, for the most part, adjusted in accordance with the children's stage of linguistic development. In our future studies, we plan to concentrate on investigating the patterns of increase in complexity and on comparing the data to a sample of adult-directed speech in Inuktitut, which would provide an important insight to the nature of the morphological aspect of child-directed speech.

References

Allen, Shanley. 1996. *Aspects of argument structure acquisition in Inuktitut*. Amsterdam, Netherlands: John Benjamins.

Bryant, Gregory A., and H. Clark Barrett. 2007. Recognizing intentions in infant-directed speech: Evidence for universals. *Psychological Science* 18(8):746–751.

Crago, Martha B. 1988. *Cultural context in communicative interaction of Inuit children*. Doctoral Dissertation, McGill University, Montreal, QC.

Dorais, Louis-Jacques. 2011. An Inuit pidgin around Belle-Isle Strait (research note). In Ernst H. Jahr and Ingvild Broch (eds.), *Language contact in the Arctic: Northern Pidgins and Contact Languages*. Berlin, Germany: De Gruyter Mouton, 311–316.

Duranti, Alessandro, and Elinor Ochs. 1986. Literacy instruction in a Samoan village. In Bambi B. Schieffelin and Perry Gilmore (eds.), *The acquisition of literacy: Ethnographic perspectives*. Norwood, N.J.: Ablex, 213–232.

Ferguson, Charles A. 1978. Talking to children: A search for universals. In Joseph H. Greenberg (ed.), *Universals of human language*. Stanord, CA: Stanford University Press, 203–224.

Fernald, Anne, and Thomas Simon. 1984. Expanded intonation contours in mothers' speech to newborns. *Developmental Psychology* 20(1):104–113.

Fernald, Anne. 1985. Four-month-old infants prefer to listen to motherese. *Infant Behavior & Development* 8(2):181–195.

Fernald, Anne. 1992. Meaningful melodies in mothers' speech to infants. In Hanuš Papoušek, Uwe Jürgens, and Mechthild Papoušek (eds.), *Studies in emotion and social interaction. Nonverbal vocal communication: Comparative and developmental approaches*. Cambridge, UK: Cambridge University Press, 262–282.

Fernald, Anne, and Hiromi Morikawa. 1993. Common themes and cultural variations in Japanese and American mothers' speech to infants. *Child Development* 64(3):637–656.

Foulkes, Paul, Gerard Docherty, and Dominic Watt. 2005. Phonological variation in child-directed speech. *Language 81*(1):177–206.

Friederici, Angela D. 2011. The brain basis of language processing: From structure to function. *Physiological Reviews* 91(4):1357–1392.

Gallaway, Clare, and Brian J. Richards (eds.). 1994. *Input and interaction in language acquisition*. Cambridge, UK: Cambridge University Press.

Gleason, Jean B. 1975. Fathers and other strangers: Men's speech to young children. In Daniel P. Dato (ed.), *Developmental psycholinguistics: Theory and applications*. Washington DC: Georgetown University Press, 289–297.

Green, Jordan R., Ignatius S. Nip, Erin M. Wilson, Antje S. Mefferd, and Yana Yunusova. 2010. Lip movement exaggerations during infant-directed speech. *Journal of Speech, Language, and Hearing research* 53(6): 1529–1542.

Hill, Elizabeth. 2009. Do mother and father differ in their speech styles when speaking to their children? Are there speaker gender effects on parents' language behaviour? *Innervate: Leading Undergraduate Work in English Studies* 2:163–168.

Hoff, Erika, and Letitia Naigles. 2002. How children use input to acquire a lexicon. *Child Development* 73:418–433.

Kosslyn, Stephen M., and Daniel N. Osherson. 1995. *An invitation to cognitive science*. Cambridge, MA: MIT Press.

Kunert, Richard, Raquel Fernandez, and Willem Zuidema. 2011. Adaptation in child directed speech: Evidence from corpora. *Proceedings of the 15th Workshop on the Semantics and Pragmatics of Dialogue*, 112–119.

Leaper, Campbell, Kristin J. Anderson, and Paul Sanders. 1998. Moderators of gender effects on parents' talk to their children: A meta-analysis. *Developmental Psychology* 34(1):3–27.

Lindblom, Bjorn. 1990. Explaining phonetic variation: A sketch of the H&H theory. In William Hardcastle and Alain Marchal (eds.), *Speech production and speech modelling*. Dordrecht, Netherlands: Kluwer Academic, 403–439.

MacWhinney, Brian. 2000. *The CHILDES Project: Tools for analyzing talk*. Transcription format and programs (Vol. 1). Psychology Press.

Masapollo, Matthew, Linda Polka, and Lucie Ménard. 2016. When infants talk, infants listen: Pre-babbling infants prefer listening to speech with infant vocal properties. *Developmental Science* 19(2):318–328.

McLeod, Peter J. 1993. What studies of communication with infants ask us about psychology: Baby-talk and other speech registers. *Canadian Psychology/Psychologie canadienne* 34(3):282–292.

Minjung, Kim, and Carol Stoel-Gammon. 2005. Acoustic characteristics of Korean stops in Korean child-directed speech. *The Journal of the Acoustical Society of America* 117:24–58.

Mueller Gathercole, Virginia C., and Erika Hoff. 2009. Input and the acquisition of language: Three questions. In Erika Hoff and Marilyn Shatz (eds.), *Blackwell handbook of language development*. Malden, MA: Blackwell Publishing.

Pancsofar, Nadya, and Lynne Vernon-Feagans. 2006. Mother and father language input to young children: Contributions to later language development. *Journal of Applied Developmental Psychology*, 27:571–587.

Piazza, Elise A., Marius C. Iordan, and Casey Lew-Williams. 2017. Mothers consistently alter their unique vocal fingerprints when communicating with infants. *Current Biology* 27(20):3162–3167.

Ringler, Norma M. 1981. The development of language and how adults talk to children. *Infant Mental Health Journal* 2:71–83.

Saxton, Matthew. 2009. The inevitability of child directed speech. In Susan Foster-Cohen (ed.), *Language acquisition*. London, UK: Palgrave Macmillan, 62–86.

Schachner, Adena, and Erin E. Hannon. 2011. Infant-directed speech drives social preferences in 5-month-old infants. *Developmental Psychology* 47(1):19–25.

Schieffelin, Bambi B. 1990. *The give and take of everyday life: Language socialization of Kaluli children*. Cambridge, UK: Cambridge University Press.

Schieffelin, Bambi B., and Elinor Ochs. 1984. Language acquisition and socialization: Three developmental stories and their implications. In Richard Shweder and Robert Levine (eds.), *Culture theory: Essays on mind, self and emotion*. Cambridge, UK: Cambridge University Press, 276–320.

Snow, Catherine. 1972. Mothers' speech to children learning language. *Child Development* 43(2):549–565.

Snow, Catherine. 1995. Issues in the study of input: Finetuning, universality, individual and developmental differences, and necessary causes. In Paul Fletcher and Brian MacWhinney (eds.), *The handbook of child language*. Oxford, UK: Blackwell, 180–193.

Snow, Catherine E., and Charles A. Ferguson. (eds.). 1977. *Talking to children: Language input and acquisition*. Cambridge, UK: Cambridge University Press.

Thiessen, Erik D., Emily A. Hill, and Jenny R. Saffran. 2005. Infant-directed speech facilitates word segmentation. *Infancy* 7:53–71.

VanDam, Mark, and Paul De Palma. 2014. Fundamental frequency of child-directed speech using automatic speech recognition. *Proceedings of 2014 Joint 7th International Conference on Soft Computing and Intelligent Systems (SCIS) and 15th International Symposium on Advanced Intelligent Systems (ISIS)*, 1349–1353.