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BRIEF RESEARCH REPORT

Early lexical acquisition in the Wichi language

Andrea S. TAVERNA[1]* and Sandra R. WAXMAN[2]

[1]Consejo Nacional de Investigaciones Científicas y Técnicas (National Research Council) Formosa, Argentina and [2]Northwestern University, USA
*Corresponding author. Instituto de Investigaciones sobre Lenguaje, Sociedad y Territorio, Facultad de Humanidades, Universidad Nacional de Formosa (UNaF), Av. Gutnisky 3200, C.P. 3600 Formosa, Argentina. Tel.: +54 03704-452473; E-mail: andtaverna@gmail.com

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Abstract

This research brings new evidence on early lexical acquisition in Wichi, an under-studied indigenous language in which verbs occupy a privileged position in the input and in conjunction with nouns are characterized by a complex and rich morphology. Focusing on infants ranging from one- to three-year-olds, we analyzed the parental report of infants' vocabulary (Study 1) and naturalistic speech samples of children and their caregivers (Study 2). Results reveal that: (1) although verbs predominate in the linguistic input, children's lexicons favor nouns over verbs; (2) children's early noun-advantage decreases, coming into closer alignment with the patterns in the linguistic input at a MLU of 1.5; and (3) this early transition is temporally related to children's increasing productive command over the grammatical categories that characterize the morphology of both nouns and verbs. These findings emphasize the early effects of language-specific properties of the input, broadening the vantage point from which to view the lexical acquisition process.

Keywords: lexical acquisition; cross-linguistic development; Wichi language

Introduction

Across the world's communities, infants produce their first words at roughly their first birthdays. This achievement, one that is greeted with special joy by parents, has also attracted considerable research attention. Decades of research has been dedicated to identifying the content of infants' earliest vocabularies and the mechanisms by which they are acquired. For example, based on considerable evidence that infants' earliest words are predominantly nouns, researchers went on to identify the mechanism underlying this phenomenon. Some argued that the early advantage for learning nouns over verbs is a universal feature of human language (Gentner, 2006; Gentner & Boroditsky, 2009; Gleitman, Cassidy, Nappa, Papafragou, & Trueswell, 2005; Golinkoff & Hirsh-Pasek, 2008; Golinkoff, Hirsh-Pasek, McDonough, & Tardif, 2009; McDonough, Song, Hirsh-Pasek, Golinkoff, & Lannon, 2011), but others propose instead that the noun advantage is a consequence of the particular native language being acquired (Tardif, 1996; Tardif, Gelman, & Xu, 1999; Tardif, Shatz, & Naigles, 1997). Current research offers evidence for adopting a

more nuanced approach, focusing on the relative contributions of both factors inherent in the child and in the input to lexical acquisition (see Bornstein *et al.*, 2004; Imai *et al.*, 2008, and Waxman *et al.*, 2013 for a review). In addition, there is growing recognition that the evidence regarding early lexical acquisition comes from an exceptionally narrow base. There are between 6,000 and 7,000 known spoken languages in the world, but in only 2% is there at least one study of language acquisition (Stoll, 2009). As a result, we have a limited vantage point from which to view the content and process of lexical acquisition.

Here, we seek to broaden the empirical base by reporting new evidence on early lexical acquisition in Wichi, an under-studied indigenous language spoken in the Gran Chaco regions of Argentina and Bolivia. In Wichi, verbs predominate over nouns in adult language use, in which both nouns and verbs are characterized by complex morphology. Early lexical acquisition in infants who are acquiring a verb-heavy language with complex inflectional morphology remains sparse (Kelly, Wigglesworth, Nordlinger, & Blythe, 2014).

The Wichi language

The term *wichi*, roughly translated as 'people', refers to both the Wichi people and the language they speak. The Wichi language, also known as Matacoan (Greenberg, 1987; Kaufman, 1990; Loukotka, 1968; Tovar, 1964), is one of four Mataguayan language families (Fabre, 2005; Najlis, 1984). In the Gran Chaco region, the locus of our fieldwork, Wichi is acquired naturally as a first language.

More specifically, in the Wichi community in which we work, Wichi is the exclusive language spoken in the home. Children are not introduced to Spanish, the national language of Argentina, until they enter public school at roughly five or six years of age. Even at school, children speak exclusively in Wichi with Wichi teachers and children. Moreover, in their curriculum, Spanish is introduced gradually and co-exists with Wichi in lessons on a range of academic subjects. Within the broader community, few Wichi adults are conversant in Spanish.

In sum, because Wichi is the sole language used within the family and broader community context, children's early language input is comparable to the input of other infants acquiring a single language.

Specifying the input characteristics: morphology and the prevalence of nouns and verbs in Wichi

Morphology

Typologically, nouns and verbs in Wichi are polysynthetic and agglutinative under all possible interpretations of those terms (for phonological and grammatical evidence from Wichi, see Nercesian, 2010, 2011, 2014; Vidal & Nercesian, 2005). Therefore, as in other such languages featuring such extensive morphological complexity, a single noun or verb can express information that would otherwise be expressed in an entire phrase in other languages.

For example, the single Wichi verb in (1a) covers the meaning conveyed by the entire phrase in (1b).

(1a) N'-**y'aj**-hila-'am-ej=hen. (Wichi)
1SUJ-**to hit**-FUT-2OBJ-INS = PL

(1b) 'I will hit you (PL.) with something.' (English)[1]

[1]Here and throughout, we mark the roots in **bold**. SUJ = subject; FUT = future; OBJ-INS = object-instrumental; PL = plural.

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This morphological complexity, also evident for nouns, as can be seen in (2a) and (2b), appears to be especially pronounced for verbs. For any given verb, the root may be combined with up to five different morphological markers and fifteen grammatical categories.[2]

The same is true for nouns; the root may be combined with up to eight different grammatical categories.[3] Among these, one category – possession – divides nouns into two major classes: alienable vs. inalienable nouns. Alienable nouns have no inherent possessor, including nouns that typically refer to particular artifacts, animals, and plants. In contrast, inalienable nouns do have an inherent possessor, including nouns referring to kinship relations (e.g., my mother) and body parts (e.g., your nose, his arm), among others. This alienable/inalienable distinction is marked on the surface of the input in many ways. For example, inalienable noun roots (like 'Mother' or 'nose') cannot be produced alone; instead, they require a pronominal prefix to indicate the speaker's possessive relation to the referent. In examples (2–5), the inalienable noun root (e.g., *-ku*, or 'mother') appears consistently, but takes different possessor prefixes depending on the relation between the speaker and the referent object: *n'-* if the possessor is the speaker (i.e., first grammatical person) and *a-* (or zero) if the possessor is the listener (i.e., second grammatical person):

(2a) n'ku [n'-**ku**] 'my mother'
(2b) aku [a-**ku**] 'your mother'
(3a) n'tkwey [n'-t**kwey**][4] 'my arms'
(3b) atkwey [a-t**kwey**] 'your arms'
(4a) n'tset [n'-**tset**] 'my walking stick'
(4b) atset [a-**tset**] 'your walking stick'

There are two ways in which this morphological complexity may bear on early lexical acqusition. First, because words appear in such highly inflected forms, it may be challenging for young children to identify instances of the same root across diverse utterances. Interestingly, a cross-linguistic analysis of languages varying in morphological complexity suggests that children learning morphologically complex languages are not hampered by this 'challenge' (Xanthos *et al.*, 2011). Second, because Wichi nouns and verbs share some inflectional morphology, some obligatory (e.g., pronominal subject prefixes, ***n'ka toto*** 'my toy'; ***n'yenlhi*** 'I do something') and some optional[5] (e.g., tense, *atsina**ne'** yik* 'the woman that was recently here is gone'; *y'umet**ne'** itoj* 'the fire has just gone out'), it may be challenging for young children tease apart the nouns from the verbs on the surface of a Wichi utterance.

[2]The Wichi verb as a morphologically complex word receive a variety of at least 15 categories including person of subject and object, number, tense, mode, aspect, reflective/reciprocal, causative, applicatives, instrument, modality/evidentiality, directional, locative, negation, and manner/diminutive. The quantity and variety of morphological categories that the verb admits (although not co-occurring all at once) is apparently an extended feature among the languages of the Gran Chaco (Nercesian, 2014).

[3]Nouns in Wichi admit the following catgeories: possession, number, deixis, classifiers, derivatives, the augmentative and the diminutive, time (future and not future), the distributive (verbal aspect marker), and negation (in possessed nouns).

[4]Within the class of inalienable nouns that refer to body parts, there is a small group that interposes the prefix *t-* between the pronominal possessor and the stem (Nercesian, 2014).

[5]Wichi nouns and verbs share grammatical categories such as tense and iterative aspect, pronominal subject prefixes, negative affixes, and evaluative morphology (Nercesian, 2014).

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This matter remains unresolved. Some argue that morphological complexity does indeed present just such a challenge for children acquiring Chintang, another language with complex morphology (Stoll *et al.*, 2012). But others interpret the evidence from the Maya languages, Tzotzil (de León, 1999) and Tzeltal (Brown, 1998) as evidence against this view. Moreover, based on a cross-linguistic analysis of languages varying in morphological complexity, Xanthos and colleagues (2011) argue that children learning morphologically complex languages acquire words more rapidly than their counterparts learning less richly inflected languages.

Relative salience of nouns and verbs in the Wichi input

In Wichi, verbs tend to occupy a more privileged position than nouns. First, verbs can appear alone, as bare stems, in the third person and imperative. Second, verbs often occur in the salient, phrase-final position. Third, verbs are used to refer not only to events, activities, and states, but also to properties of objects. This is because in Wichi, as in Navajo and other languages, adjectives do not constitute an independent word class. Finally, in Wichi, an entire clause can be indexed with a verb. This is because arguments are indexed on the verb following a nominative–accusative alignment in the first and second person and a neutral alignment in the third person (zero for both subject and object).

Socialization factors. There is also intriguing preliminary evidence that Wichi mothers engage their children in socialization practices that favor labeling actions (*khel* 'come'; *chuma* 'take it') rather than objects (*kusala*, 'a spoon') (Taverna, 2019).

In sum, the Wichi language – acquired as a first language in an indigenous Amerindian community – represents a language type in which verbs occupy a relatively privileged position in the input; it is also a language characterized by complex and rich morphology for both nouns and verbs.

The current research

This project represents the first investigation of the developmental trajectory underlying early lexical acquisition in Wichi. We report here on data from a small group of one- to three-year-old Wichi children, collected by the first author in a series of field stays from August 2012 to April 2017. Certainly, like others working within small indigenous language communities (Brown, 1998; Gómez López & Itorroz, 2013; Pfeiler & Carrillo Carreón, 2013; Schneidman & Goldin-Meadow, 2012; Stoll *et al.*, 2012, among others), our sample is smaller than those reported in investigations of more widely spoke languages. Nonetheless, if the goal is to represent language acquisition from a broader perspective that incorporates more language diversity, evidence like that reported here is essential.

We adopted a two-pronged approach. First, we developed a Wichi Vocabulary Checklist (Study 1), based on other parental report measures used in the field (e.g., a recent ongoing research effort in *Hñañhú* language; Jackson-Maldonado, 2019). We applied this measure to 22 mothers with children ranging from 12 to 47 months to identify the words in each child's lexicon. Second, we followed three children longitudinally, gathering naturalistic language corpora, including the language production of the target child and the elders surrounding them. We then derived, for each child and each speaker present in the recorded sessions, the words produced in each recording cycle. By comparing each child's production data from the checklist

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and the naturalistic speech sample, we gain a more comprehensive index of the content of Wichi children's lexical knowledge. By comparing each child's production data with that of their elders at each recording cycle, we assess whether and how well their production of nouns and verbs mirrors that of their own language input.

Armed with the checklist and naturalistic data, we test two hypotheses. First, that in Wichi, as in other verb-heavy languages, children's early lexicons should favor nouns over verbs. And second, that the early advantage for learning nouns over verbs should decline over developmental time, bringing children's lexical production into closer alignment with that in the language input.

Study 1: The Wichi checklist – development and application

Method

Participants

We recruited 22 Wichi mothers with children of three age groups: one-year-olds (9 total, 5 girls, $\text{Range}_{\text{age}}$ 1;0–1;9; $M = 1;3$; $SD = 0;2$); two-year-olds (6 total, 3 girls, $\text{Range}_{\text{age}}$ 2;5–2;11; $M = 2;7$; $SD = 0;3$); three-year-olds (7 total, 3 girls, $\text{Range}_{\text{age}}$ 3;6–3;11; $M = 3;8$; $SD = 0;2$), to complete the Wichi Vocabulary Checklist. All were living in the Wichi Lawet Community in Laguna Yema, Formosa, Argentina. Children came from large families, had on average 3.7 siblings ($SD = 1$; range = 2–5); roughly 2/3 of the children in our sample are the youngest in their families.

As in our prior work in this community, we trained native Wichi-speaking women from the community (who were bilingual in Spanish) to serve as research collaborators. We relied upon them to recruit Wichi mothers and to maintain contact with them throughout the investigation. To recruit mothers, the native research collaborators explained our interest in studying the language of Wichi children. The community chief, Luisa Pérez, provided written consent for this investigation. Because most of the mothers were barely literate, they gave consent verbally (for more details about this population and our investigations, see Baiocchi, Waxman, Pérez, E.M., Pérez, A., & Taverna, 2019; Taverna, Waxman, Medin, Moscoloni, & Peralta, 2014; Taverna, Waxman, Medin, & Peralta, 2012; Taverna, Medin, & Waxman, 2016, 2018).

Procedure

Developing the Wichi checklist. We devoted almost a full year to developing a vocabulary checklist that would be comparable to those used in prior cross-linguistic investigations, but that would also be tailored to reflect the distinct charateristics of the Wichi language. The checklist was developed in two stages, working in close collaboration with two native speakers (our local research collaborators) and a trained linguist.

Stage 1. Since our native collaborators were bilingual Wichi and Spanish, we first translated the Spanish version of the MacArthur Communicative Development Inventory (MCDI) (Jackson-Maldonado *et al.*, 1993; López Ornat *et al.*, 2005; Resches, Kohan Cortada, & Picón Janeiro, 2018) into Wichi. In this process, we considered both (a) the MCDI communicative categories, and (b) the words within them. Regarding communicative categories, we retained those on the Spanish MCDI, with a few exceptions. To accommodate the experience of Wichi children, we omitted three categories entirely ('sounds effects and animal sounds'; 'vehicles'; 'toys') since Wichi does not include the words in these categories. We also omitted other words that have no counterpart in this Wichi community ('household items';

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'furniture/room'; 'outside things'; 'places to go'). In the case of 'body parts', 'actions and processes', and 'properties' we made grammatical adaptations.

Stage 2. Researchers and local collaborators convened a focus group with three native-speaking mothers who were not in our sample. Our goals were to fine-tune the checklist, to insure that we had identified correctly each word's grammatical category assignment and, perhaps most importantly, to build trust for this child-focused research within the community. The group met on three occasions, each for approximately 2 hours in duration. Meetings were audio-recorded. All suggestions made in these meetings were reviewed by the linguist in conjunction with the first author. The final checklist included 340 Wichi words (168 nouns, 119 verbs) (see 'Appendix' in the Supplementary materials, available at <https://doi.org/10.1017/S0305000919000898>).

Administering the Wichi checklist. Because most mothers in our sample (and in this community) do not read, a trained research collaborator read each checklist word aloud, asking the mother to indicate whether her child: (a) understood the word, (b) produced the word, and if so, (c) how the child pronounced it.[6]

Coding. We tabulated the words most frequently understood and produced by children at each age (Table 1). With this as a foundation, we derived for each child (1) the total number of words in her vocabulary, (2) the total number of nouns and verbs, and (3) the noun-to-verb ratio (total number of nouns / total number of nouns + total number of verbs). This yields a bounded scale, ranging from 0 (no nouns, all verbs) and 1 (all nouns, no verbs).

Results and discussion

We highlight three main findings (see Table 2). First, mothers reported that their children had learned more nouns than verbs at all ages in both production (one-year-olds: $z = 2.6$, $p < .05$; two-year-olds: $z = 2.2$, $p < .05$; three-year-olds: $z = 2.3$, $p < .05$) and comprehension (one-year-olds: $z = 2.5$, $p < .05$; two-year-olds: $z = 2.2$, $p < .05$; three-year-olds: $z = 2.2$, $p < .05$). Second, this learning advantage for nouns decreased reliably with age; children's productive vocabulary was inversely related to their noun–verb ratio over time ($r = -0.55$, $p < .05$, $n = 22$).

Third, in an additional analysis, we were able to assess whether this early noun-advantage was an artifact of the sheer number of nouns (N = 168) and verbs (N = 119) included on the checklist. Following Caselli, Casadio, and Bates (1999), we calculated, for each child, the 'percentage opportunity filled' for both nouns and verbs produced, dividing the total number of nouns (and verbs) reported for that child by the total number of nouns (and verbs) available on the checklist. The mean percentage opportunity filled for nouns (0.32) was significantly higher than that for verbs (0.19) ($z = 2.6$, $p < .001$). This rules out the possibility that the observed noun advantage in the early Wichi lexicon merely reflected the raw number of nouns and verbs on the checklist.

Thus, the results of the Wichi checklist reveal an advantage for learning nouns over verbs in Wichi acquisition. This converges with previous findings in other verb-heavy

[6]The current analysis focused on data from (a), and (b). Data from (c), which served to explore the form of child's early productions, will not be discussed in this paper.

Table 1. Study 1. Vocabulary checklist. Most frequently produced words in each age-group. *For Spanish loanwords, we note here the Spanish word from which the Wichi word evolved.

Age Group	Noun	Semantic field	%	Verb	Semantic Field	%
	hu´lhos 'chick'	Animal	88,9	*imo* '(s)he sleeps'	Body	44,4
One-year-olds	*inot* 'water'	Food	88,8	*t´alham* '(s)he defecates'	Body	33,3
	hu´u 'hen'	Animal	77,7	*is* '(s)he/it good'	Moral	33,3
	*pan** 'bread'	Food	77,7	*nitechoj* '(s)he/it is cold'	Physical property	33,3
	lafwcha 'father'	Poeple	77,7	*inay* '(s)he takes a bath'	Body	22,2
	laku 'mather'	People	77,7	*oytaj* '(s)he has pain'	Emotion	22,2
	sinoj 'dog'	Animal	66,6	*ichin* (s)he is thirsty'	Body	22,2
	*estofado** 'beef stew'	Food	66,6	*nich´ayuhi* '(s)he is hot'	Physical property	22,2
	*guiso** 'stew'	Food	66,6			
	letsi 'milk'	Food	66,6			
	itoj 'fire'	Home	66,6			
	*mamadera** 'feeding bottle'	Food	66,6			
	chilay´i 'little pigeon'	Animal	55,5			
	tulu 'cow, meat'	Animal/Food	55,5			
	fwenche 'bird'	Animal	55,5			
Two-year-olds	*sinoj* 'dog'	Animal	100	*imo* '(s)he sleeps'	Body	83,3
	hu´u 'hen'	Animal	100	*iyahin* '(s)he looks at'	Perception	83,3
	hu´lhos 'chick'	Animal	100	*nom* '(s)he comes'	Action	83,3
	tulu 'cow/meat'	Animal/food	100	*afwit* '(s)he blows'	Body	50
	inot 'water'	Food	100	*itunhi* '(s)he pools''	Action	50

	*pan** 'bread'	Food	100	*iyoyej* '(s)he drinks'	Body	50
	atsinha 'women'	People	100	*lachoten* '(s)he trips''	Action	50
	lafwcha 'father'	People	100	*latolh'po* '(s)he falls down'	Spatial Relation	50
	laku 'mother'	People	100	*fwumej* '(s)he throws'	Action	33,3
	chilay´i 'pigeon'	Animal	83,3	*ichoj* '(s)he brings'	Action	33,3
	chukuk 'butterfly'	Animal	83,3	*ilej* '(s)he washes'	Action	33,3
	fwotsajh 'snake'	Animal	83,3	*ilota* '(s)he hears'	Perception	33,3
	kayla 'goat'	Animal	83,3	*inay* '(s)he takes a bath'	Body	33,3
	mitsi 'cat'	Animal	83,3	*inayhit* '(s)he ties'	Action	33,3
	yel´ataj 'horse'	Animal	83,3	*ine´alhuhu* '(s)he runs'	Action	33,3
Three-year-olds	*fwenche* 'bird'	Animal	100	*lachoten* '(s)he trips''	Action	100
	alhetaj 'cayman'	Animal	100	*imo* '(s)he sleeps'	Body	100
	wentana 'window'	Home	100	*tachema* '(s)he takes'	Action	85,7
	halo 'tree'	Outdoors	100	*takasit* '(s)he stand ups' Spatial Relation	85,7	
	iwumchó 'rain'	Outdoors	100	*takatin* '(s)he jumps'	Action	85,7
	kates 'stars'	Outdoors	100	*tataypho* '(s)he sit down' Spatial Relation	85,7	
	pele 'sky/cloud'	Outdoors	100	*ýaj* '(s)he hits you/it'	Action	85,7
	tokos 'cultivatled plants'	Outdoors	100	*ichin* '(s)he is thirsty'	Body	85,7
	atsinha 'woman/girl'	People	100	*is* '(s)he/it is good'	Moral	85,7
	lafwcha 'father'	People	100	*nitechoj* '(s)he is cold'	Physical property	85,7
	lakatela 'grandmother'	People	100	*isek* '(s)he sweeps'	Action	71,4
	laku 'mother'	People	100	*iwun* '(s)he opens'	Action	71,4

(*Continued*)

Table 1. (*Continued.*)

Age Group	Noun	Semantic field	%	Verb	Semantic Field	%
	siwuele 'no wichi'	People	100	*tataya* '(s)he waits'	Action	71,4
	towulh 'yoghurt'	Food	85,7	*takatin* '(s)he jumps'	Action	71,4
	tulu 'cow/meat'	Food	85,7	*yik* '(s) he goes'	Action	71,4
	buzo 'sweater'	Clothing	85,7	*yikuy* '(s)he plays'	Action	71,4
	law'ey 't-shirt'	Clothing	85,7	*oytaj* '(s)he has pain'	Emotion	71,4

Table 2. Study 1. Vocabulary checklist. Productive and receptive measures, based on maternal report using the Wichi check list at each age group.[7]

	Productive Vocabulary									Receptive Vocabulary								
	One-year-olds			Two-year-olds			Three-year-olds			One-year-olds			Two-year-olds			Three-year-olds		
Measures	Median	*M*	*SD*	Median	*M*	*SD*	Median	*M*	*SD*	Median	*M*	*SD*	Median	*M*	*SD*	Median	*M*	*SD*
Number of words	24	23.1	13.5	70	71	31	176	183.4	69	118	133	53	184	190	60	252	254	12.4
Nouns types	23*	18.4	10.8	47.5*	51.6	19.1	111*	111.5	29	77*	78.2	30.9	124*	116	28	137*	138	8.4
Verbs types	3	4	3.6	13.5	15.11	13.5	51	56.1	30	44	48.1	20.2	52	60	28	91	92	19
Noun/Verb Ratio Type	0.88	0.83	0.15	0.76	0.78	0.15	0.68	0.68		0.65	0.61	0.07	0.68	0.66	0	0.59	0.59	0

*$p < .05$

[7]All values fall within the range of those reported for the Spanish Versions of the MCDI (e.g., López Ornat *et al.*, 2005; Resches *et al.*, 2018).

langauges with complex morphology. Moreover, the evidence that this early noun bias wanes with age likely reflects the shaping role of the linguistic input.

Study 2: Naturalistic corpus of child and adult language

Our next goal was to advance these findings, supplementing the analysis based on the Wichi checklist with an analysis of naturalistic corpus data of child and adult speech. This permits us to move beyond relying on retrospective parental report as an index of the early lexicon (Au, Dapretto, & Song, 1994; Gentner & Boroditsky, 2009; Pine, Lieven, & Rowland, 1996; Tardif *et al.*, 1999; Waxman *et al.*, 2013). It also permits us to examine the morphology present in the naturalistic speech of both adults and young children. We adopted a longitudinal design, gathering naturalistic speech samples when infants ranged from one- to three-year-olds. This let us identify the extent to which children's lexical production begin to match those of the adult input that surrounds them.

Method

Participants

For this longitudinal corpus of naturalistic speech, we selected three parent–child dyads[8] from Study 1, with one child from each targeted age period, to participate in the longitudinal corpus of naturalistic speech (see Figure 1 for a description of the children's age at each recording cycle).

Materials

We employed a Zoom H4N audio-recorder as well as a Countour + 2 Camera positioned on a tripod and equipped with an external uniPdirectional microphone with windscreen.

Procedure

At each age, we audio- and videotaped two 45 min visits in a recording cycle within a single week. In an effort to capture a representative sample of speech in daily life, one visit took place in the morning and the other in the afternoon. In this community, life takes place outside the house, in the yard or the surrounding areas, people often eat outside, women weave and wash clothes (women), or are just sitting drinking *mate*;[9] children are often playing around and interactions that take place in those contexts include more than the target child and mother: other children and adults are usually present, interacting either with the child or with one another. Typically, many people were present during the recordings, some talking a lot and others rarely. All were instructed to act as they would if the camera were not present.

Transcription and coding

In the current analysis, we use the first 30 mins of each visit (yielding a total of 1 hour) for each of the five recording cycles within a single year. This yielded a total of 10 visits and 900 mins of recordings (see Figure 1).

All recordings were transcribed in Wichi and then translated into Spanish by trained native speakers of Wichi (Elan 4.7.3). Then, each entire transcript and translation was

[8]This represents a part of a larger ongoing longitudinal corpus study involving monthly videotaped recordings of five Wichi children.

[9]*Mate* is a traditional non-alcoholic, caffeinated drink.

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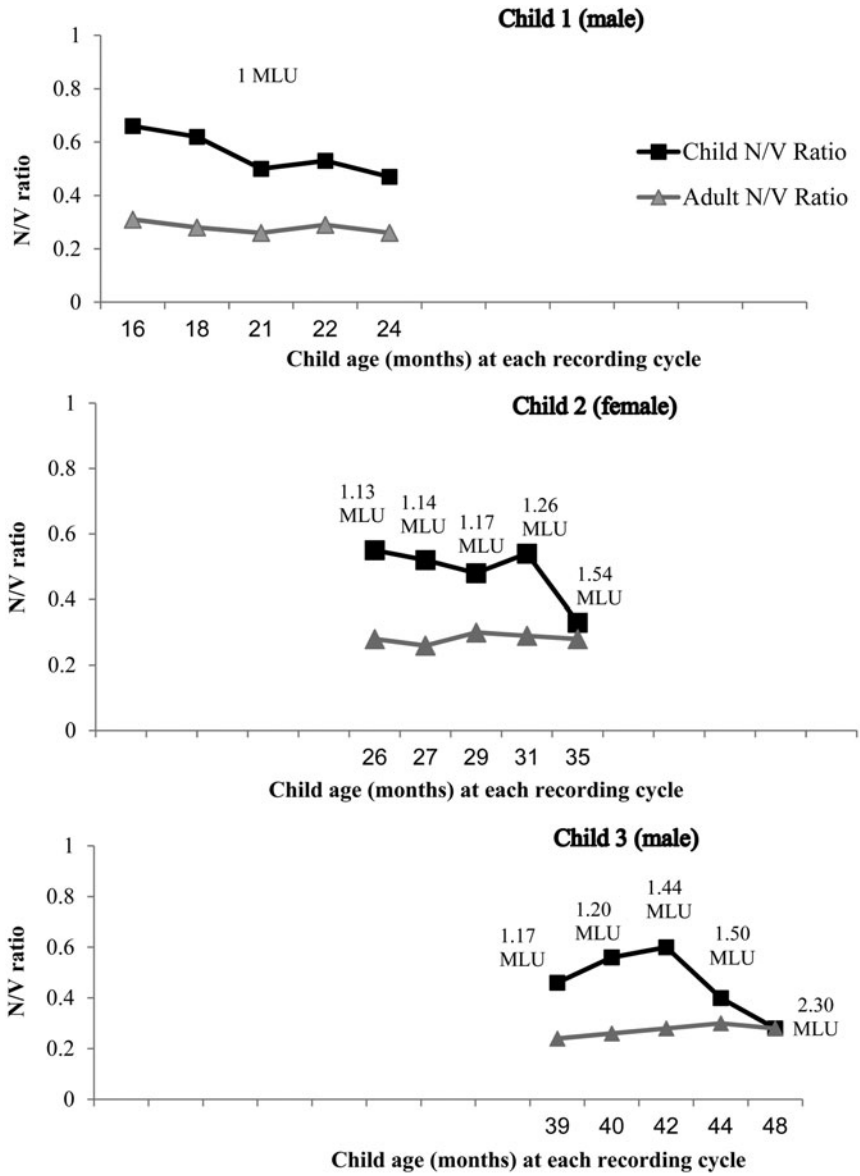

Figure 1. Study 2. Noun-to-verb ratio in child and adult production, expressed as a function of child age and MLU.

reviewed by the linguist. Next, all utterances produced by the three target children (a total of 900 utterances) and the adults (3,000 utterances) were coded to identify every noun and verb either produced by the target child or in the input speech.[10] In

[10]As in other research on this issue, we (a) identified nouns and verbs based on Wichi adult grammar, and (b) included only count nouns (excluding proper nouns) (Tardif *et al.*, 1999).

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addition, for each noun and verb produced by each child we also encoded any affixes. Coding was completed by two trained coders; half of the transcriptions and translations were checked for reliability by a third native speaker; inter-rater agreement was 90%. All cases of disagreement were resolved by discussion. The nouns and verbs most frequently produced by each child are presented in Table 3.[11]

We then derived four measures, including (1) the nouns and verbs (types and tokens) produced by each target child, (2) the nouns and verbs (types and tokens) produced by any adult or child older than six years of age present during the recording, and (3) the noun-to-verb ratio (number of nouns divided by number of nouns + number of verbs) in both child and input data, and (4) the nominal and verbal affixes (types and tokens) produced by each target child.

Results

The analysis of naturalistic speech converges well with the evidence from the checklist (see Figure 1). The number of verbs far outstrips the number of nouns in the adult input for all three children (Child 1, 2, 3, $M_{\text{noun/verb}}$ ratio = .28, .28, and .27, respectively), yet this ratio is not reflected in the children's own productions where nouns outstrip verbs ($M_{\text{noun/verb}}$ ratio = .55, .48, and .46, respectively). Children's noun–verb ratio is twice that of their input.[12] Moreover, the noun–verb ratio for each child declines reliably over time (Child1: $\rho = -0.965$, $p < .05$, $n = 5$; Child 2: $\rho = -0.932$, $p < .05$, $n = 5$; Child 3: $\rho = -0.88$, $p < .05$, $n = 5$). Interestingly, the timing of this decline is better predicted by a child's MLU than age. More precisely, the child's noun–verb ratio comes into better aligment with their input when they reach an MLU of 1.5 (Child 2: $r = -0.99$, $p < .05$, $n = 5$; Child 3: $r = -0.93$ $p < .001$, $n = 5$).

Second, an analysis of children's naturalistic productions reveals increasing productivity of inflectional and derivational morphology of nouns and verbs (see Table 4).

As we have pointed out, the noun–verb ratio declines reliably as the MLU increases ($r = 0.662$, $p < .05$). But to be more precise, as a child's MLU increases, so does the number of verbal stems, verbal affixes (type and token), and nominal affixes (type and token) (verbal stems: $r = 0.801$ $p < .001$ (type); $r = 0.532$ $p < .05$ (token); verbal affixes: $r = 0.879$, $p < .001$ (type); $r = 0.854$ $p < .001$(token); nominal affixes $r = 0.479$ $p < .05$ (type); $r = 0.736$ $p < .001$(token)). This finding – that as they advance beyond an MLU of 1, children produce more verb stems, verb affixes, and noun affixes, but not an increase in the number of noun stems – is consistent with evidence that learners require and build upon an initial repertoire of nouns to acquire verbs and other relational meanings (Gleitman *et al.*, 2005; see Waxman *et al.*, 2013, for a review). These relational meanings, often expressed in Wichi morphosyntactically within the word level for both nouns and verbs, increase as children approach a 1.5 MLU. More specifically, when the MLU barely exceeds 1 (1.05–1.17), nominal and

[11]Note that most of the word types observed in naturalistic data match those reported by mothers in Study 1 (words in bold). The few exceptions are Spanish loanwords such as things from the modern world (e.g., *globo* 'balloom'; *gol* 'goal', *foto* 'photograph'; *cunta* ' to count'), a few Wichi words that had not been included in the checklist (e.g., *chole* 'a sip'; *elh* 'another one'; *helo* 'to go away'; *tsitey* 'to play'; *kelh* 'to come').

[12]To be comparable to data from the checklist (Study 1), here we limited our analysis to nouns and verbs types (no tokens).

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Table 3. Study 2. Production data. List of most frequently produced words between child MLU 1 and 2. **In bold**, the words that match with words in maternal reports. *For Spanish loanwords, we note here the Spanish word from which the Wichi word evolved.

Period	Noun	Semantic field	Frequency	Verb	Semantic Field	Frequency
MLU 1	***mama* 'mom'** (child form)	People	58	***ichoj* '(s)he takes/buys sth'**	Action	16
	***titit* 'cars'** (child form)	Home	31	***ikpho* '(s)he goes up'**	Spatial Relation	16
	***tata* 'daddy'** (child form)	People	21	***yahin* '(s)he looks at'**	Perception	13
	***lape'* 'door'**	Home	13	***na* 'take it'a**	Action	11
	***papa* 'edible things'** (child form)	Food	11	***tafwumej** '(s)he throws it'*	Action	6
	*gol** 'goal'	Modern world	9	***tse* 'give me it to me'a**	Action	5
	***pipis* 'bird'** (child form)	Animal	6	***yik* '(s)he goes'**	Action	5
	*globo** 'balloom'	Modern world	5			
	hunhat 'soil'	Outdoors	5			
	elh 'other/another'		5			
MLU 1 -2						
	***mama* 'mom'** (child form)	People	161	*kelh 'come'*	Action	78
	***athsina* 'woman/girl'**	People	64	*na* 'take it'a	Action	36
	katita 'parrot'	Animal	47	***yik* '(s)he goes'**	Action	33
	***tata* 'daddy'** (child form)	People	46	***yahin* '(s)he looks at'**	Perception	24
	***ele* 'parrot'**	Animal	43	***ichoj* '(s)he takes/buys sth'**	Action	20

(*Continued*)

Table 3. (*Continued.*)

Period	Noun	Semantic field	Frequency	Verb	Semantic Field	Frequency
	***laku* 'mother'**	People	24	***nana* '(s)he feels pain' (child form)**	Emotion/ perception	17
	***titit* 'cars'** (child form)	Modern world	20	*helo* 'go away'	Action	14
	***papa* 'edible things'** (child form)	Food	16	***ithat* 'to throw out sth'**	Action	13
	elh 'other/another'		13	*nofwej 'it finishes'*	Action/ Disappear	7
	***mimi* 'water'** (child form)	Food	8	***hiwenhu* '(s)he gives you'**	Action	7
	***chichi* 'breast'** (child form)	Food	7	***tsitey* '(s)he plays'**	Action	6
	***siwuele* 'no wichi'**	People	7	***ikpho* '(s)he goes up'**	Spatial Relation	6
				ilanhi '(s)he extracts/takes out'	Action	6
				***ikcho'* '(s)he it goes down'**	Spatial relation	5
				***tefw* '(s)he eats'**	Body	5

Notes. a According to native speakers, *na* and *tse* are used in interpersonal interaction when someone gives something to another by hand (*na* 'take it') or when someone asks somebody for something by hand (*tse* 'give it to me'). Since both terms denote actions, we codified them as 'events'.

Table 4. Number of stems and affixes for nouns and verbs in child production at each MLU period

		NOUN				VERB			
		Stem		Affixes		Stem		Affixes	
MLU	N/V	type	token	type	token	type	token	type	token
1,05	.57	34	67	3	5	49	45	4	4
n = 9									
1,17	.5	71	151	6	5	74	140	6	6
n = 12									
1,57*	.29*	44	70	10**	17*	110*	264*	32*	69*
n = 9									

Notes. * $p < .001$; ** $p < .05$.

verbal affixes (type and token) represent only 4% of the total number of nouns and verbs produced in this period, suggesting that most first nouns and verbs have the forms of stems stripped of affixes. However, as soon as children approach an MLU of 1.50, both nominal and verbal affixes (type and token) represent 20% of the total of the nouns and verbs, five times more than the previous period. For instance, at this stage, among nominal affixes, we observed possesive pronominal prefixes for: (5) alienable and (6) inalienable nouns, (7) deixis refering to space orientation of the entity expressed by the noun, and evaluative morphology in the form of augmentative (8). As for verbal affixes, we observed evidence of pronominal pronouns for both subject (9) and object (10). In addition, hortative, and prohibitive mood (11 and 12, respectively) were also observed.

Nominal affixes

(5) **tim**-n'-ka- **toto** (CH2. 2,11; MLU 1.5)
[3SUBJ] **to swallow**–1POS-CL-**toy**
'he/she swallows my toy'

(6) *n'-**chuku** (n'-lo=chuku) (CH3. 3,3; MLU 1.5)
1pos-*-DOGGIE 1pos-cl=DOGGIE
'my doggie'

(7) **moto**-tsu (CH2. 2,7; MLU 1.25)
motorbike-DEM.on.that.way (position against speaker)
'the motorbike that goes away'

(8) ¿hap-ihi-**tulu**-taj? (CH2.2,11;MLU 1.5)
INT-[3SUBJ] to be-**cow**-AUG
'Where is the big cow?'

Verbal affixes

(9) n'-**yenlhi** (CH2.2,11;MLU 1.5)
1SUBJ-**to do**
'I do it'

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(10) lha-ku-**yaj**'-am (CH3. 3,3; MLU 1.5)
1pl.POS-mother-to **hit**-2OBJ
'our mother hits you'

(11) na-**tunpho** (CH2.2,11;MLU 1.5)
HORT-stand up
'let's stand up'

(12) ¡yaj-**hupe!** (CH3. 3,3; MLU 1.5)
PROH-**to go up**
'do not go up!'

Overall, children's own morphosyntactic development for nouns and verbs predict the timing when their own –verb ratio comes into closer alignment to that of their linguistic input.

General discussion

The results reported here provide the first evidence of early lexical acquisition in Wichi, an indigenous language characterized by complex and rich morphology on both nouns and verbs. In 1989, Mithun noted that the opportunities to study the acquisition of morphologically complex languages were diminishing due to the death of those languages and that "there is much to discover in a short time" (p. 286). Now, three decades later, when this call is even more imperative (Kelly *et al.*, 2014), the current results offer three main findings. First, infants acquiring Wichi reveal a noun advantage, one that is not mirrored in the input they receive. Second, this noun advantage in the early lexicon, evident in both checklist (Study 1) and naturalistic data (Study 2), is attenuated over developmental time, as learners' production comes into closer aligment with the noun–verb ratio of their linguistic input. Third, this transition is well predicted by the inflexional productivity of grammatical categories for both nouns and verb.

The data from Study 2 takes us one step further, suggesting that during the 1 MLU period, Wichi-acquiring infants are building a foundational repertoire of words, a preponderance of which are nouns that will provide the foundation for acquiring other kinds of words, including verbs and other relations (Arunachalam, Excovar, Hansen, & Waxman, 2013; Arunachalam & Waxman, 2010, 2011; Gleitman *et al.*, 2005; Klibanoff & Waxman, 2000; Snedeker & Gleitman, 2004). In addition, it also reveals that Wichi learners begin to produce a shift to productive inflectional and derivational morphology of both nouns and verbs as soon as they reach a 1.5 MLU. This is earlier than has been observed in other languages, such as English (Brown, 1973; Tomasello, 1992, 2000; but see Fisher, 2002), but in line with evidence from other typologically related languages such as several Maya languages (Brown, 1998; de León, 1999; Pfeiler & Carrillo Carreón, 2013).

Certainly, there are limitations to the current work. First, like others working within small communities of people speaking indigenous or minorized languages (Brown, 1998; Courtney & Saville-Troike, 2002; Leon Pasquel, 2005; Schneidman & Goldin-Meadow, 2012; Stoll *et al.*, 2012, among others), our sample size is small. Second, although we devoted almost a year of sustained work with native and trained linguists to create the Wichi checklist, this list has not been validated on a large number of Wichi children. And even though our approach resembles that of many others who work on checklists within small communities (see Jackson-Maldonado, 2019, for an ongoing parental report in *Hñañhü*), it would indeed be advantageous

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in future work to increase its size, not just for its research purpose, but for the potential application that this checklist could have as a diagnostic tool in Wichi-speaking children as well.

These limitations bring into sharp focus that research with small groups of under-studied languages is a double-edged sword. On the one hand, the evidence we report here broadens the range of languages included in studies of early acquisition. But, on the other hand, working within a small community like this one necessarily sets firm limits on the number of available participants, especially at young ages and in longitudinal studies. Nonetheless, if the goal is to represent language acquisition from a broader perspective that incoprorates more language diversity, evidence like that reported here is essential.

These results broaden the window through which one can see how lexical development takes place in the first years, which underscores the importance of its examination from an inter-cultural and linguistic perspective. They also open several routes for a more extensive investigation.

First, since Wichi is a language with a complex morphology, and since much of the focus on the acquisition of morphology has tended to focus on isolating languages – languages with a low morpheme to word ratio – (Mandarin, English, and other Indo-European languages are prototypical examples) – it would be relevant to focus more attention on how Wichi-acquiring children deal with its morphology and how it interacts with other levels – syntactic, semantic, etc. – of language acquisition. This work also raises questions about naturally occuring cross-cultural variation in adult–child interactions. We are currently pursuing this issue, focusing too on pragmatic aspects of Wichi acquisition (Taverna, 2019).

Finally, the current results have strong implications for designing education in cross-cultural and bilingual contexts (see Pérez, A. Pérez, E. M., Taverna, & Baiocchi, 2017a, 2017b, 2017c, 2017d, 2017e, for an example of how we have begun to do so in Wichi). Understanding how language acquisition unfolds in Wichi may also be instrumental in supporting positive developmental outcomes for Wichi children when they enter primary school and face the challenge of acquiring Spanish in their classrooms.

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