

## THE INTERPRETATION OF MULTIPLE EMBEDDED GENITIVE CONSTRUCTIONS BY WAPICHANA AND ENGLISH SPEAKERS

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### ABSTRACT

While research on Amazonian languages shows controversial data about the universality of recursive structures, researchers in language acquisition with Indo-European and East Asian languages have shown that complex recursive constructions are acquired very early by children. This study contributes to both debates about recursive structures in indigenous languages and the acquisition of recursion by children. We tested the comprehension of multiple embedded genitive constructions in Wapichana and English to answer two distinct questions: (1) Does the Wapichana grammar accept recursive genitives? (2) If yes, do Wapichana children acquire the multiple embedded genitives at a similar rate as English speaking children? Our data show that the interpretation of recursive genitives in English and Wapichana by adult speakers is exactly the same. Moreover, we show that both groups of children acquire multiple embedded genitives very early, but only achieve adult performance after the age of seven.

**KEYWORDS:** Recursion, Amazonian Languages, Wapichana, Acquisition.

### RESUMO

Enquanto as pesquisas com línguas amazônicas lidam com dados controversos sobre a universalidade de estruturas recursivas, pesquisadores de aquisição da linguagem mostram que construções recursivas complexas são adquiridas muito cedo por crianças falantes de línguas indo-europeias e do leste da Ásia. O estudo aqui apresentado contribui para esses dois debates sobre estruturas recursivas em línguas indígenas e seu processo de aquisição. Nós testamos a compreensão de construções com múltiplos genitivos encaixados em Wapichana e inglês para responder a duas perguntas distintas: (1) A gramática do Wapichana aceita genitivos recursivos? (2) Em caso afirmativo, as crianças wapichana adquirem as construções com múltiplos genitivos encaixados na mesma velocidade em que as crianças falantes de inglês o fazem? Nossos dados mostram que a interpretação das construções com o genitivo recursivo por falantes adultos de inglês e Wapichana é exatamente a mesma. Além disso, nós mostramos que ambos os grupos de crianças adquirem genitivos encaixados muito cedo, apesar de só terem uma performance igual a dos adultos após os sete anos de idade.

**PALAVRAS-CHAVE:** Recursividade, Línguas Amazônicas, Wapichana, Aquisição.

## 1. INTRODUCTION

A significant property of human language is its ability to generate an infinite number of constructions using a finite lexicon. At the core of this phenomenon is the possibility of combining those lexical items in very productive ways, including the embedding of syntactic constructions within other constructions of the same type. Modern linguistic theory calls this *recursion*, and it has been described by some as a universal property of human language (Hauser, Chomsky and Fitch, 2002). Recursion can be present at the word level (1), the phrasal level (2) or the sentential level (3).

(1) *re-re-read*

(2) *Mary's friend's car*

(3) *Mary thinks that I think that John is her friend.*

At early stages of acquisition, children go from a one-word phase to a two and then multiple-word constructions. If multiple embedding is present in adult language, at some point we should be able to see it emerge in child language. Some researchers have shown that children start to acquire complex recursive structures as early as 3 to 5 years of age (Limbach and Adone, 2010; Perez-Leroux et al, 2012; Roeper and Snyder, 2004). However, adult-like performance only comes later in the acquisition process.

There is an intense debate about the universality of recursive structures that originated with data from indigenous languages of South America (Everett, 2005; Nevins, Pesetsky and Rodrigues, 2009). As far as we know, there are almost no studies that look into the bilingual acquisition of recursive constructions in indigenous languages of South America. In this paper we show the results of an experiment that tested the understanding of multiple genitive constructions in Wapichana<sup>1</sup> and in English (4) by adult native speakers, and looked into the acquisition pattern of monolingual and bilingual children between the ages of 4 and 7.

(4) *Dana's friend's flower's color.*

Wapichana and English have (somewhat) similar left-branching genitive constructions, with the possessor appearing to the left of the possessed. In both languages, the DPs can be embedded under other genitive DPs, creating multiple embedding<sup>2</sup>. We tested two groups of children, monolingual English speakers (in Georgetown, Guyana) and bilingual Wapichana-English speakers (in different villages of Guyana's Region 9). The bilingual children were tested both in English and in Wapichana. We compare their results with two adult control groups.

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1. According to Migliazza (1985), in Brazil and the Cooperative Republic of Guyana, the term Wapichana is used to designate speakers of dialects: Wapishana and Atorai. Wapichana is a language of the Arawak family and is spoken in Brazil (Roraima) and in the Cooperative Republic of Guyana (Region 9). In Brazil, there are approximately 6500 Wapichana, though the Insikiran Institute estimates that only around 40% still speak the language. In Guyana, some estimates suggest that there are approximately 7500 Wapichana. As far as we know there are no reliable sources about the number of speakers in Guyana.

2. The differences between Wapichana and English genitives are explained in section 2.

Our results show that Wapichana speakers do accept (and understand) multiple embedded genitives, similarly to English monolingual speakers. The results with children also suggest that bilingual speakers acquire the recursive genitives as early as English speaking children.

## 2. GENITIVE CONSTRUCTIONS IN WAPICHANA AND ENGLISH.

Crystal (1985:136) states that the genitive case typically demonstrates a possessive relation (e.g. the girl's bag.), but there is a wide variation between the languages in which it is used. Both English and Wapichana have genitive structures morphologically marked where the possessor is found to the left of the possessed element.

According to Gomes dos Santos (2006), just as the majority of Arawak languages, Wapichana establishes a difference between alienable and inalienable nouns. Alienable nouns, such as *sumara* (bow), take a suffix “-n” when possessed (5), while inalienable nouns, such as *daynai* (meat), lose the final semi-vowel /j/ (spelled with an “i”) in genitive constructions (6).

(5) *Maria sumaran*  
Maria bow-POS  
“Maria's bow”

(6) *Bakyry daynaa<sup>3</sup>*  
Peccary meat  
“Peccary's meat”

It is important to notice that in colloquial Guyanese English the genitive construction loses its marker (the 's), similarly to what happens in African American English. This change approximates the Guyanese English genitive constructions to Wapichana, especially the ones with inalienable nouns where no morphemes are inserted. Since all bilingual speakers in our study are speakers of Guyanese English, this similarity could have a facilitative effect.

In principle, English allows infinite embedding of Determiner Phrases (DPs). Example (7) shows the simple genitive where the possessor is found to the left of the possessed element. Such a construction can be used recursively. In other words, it is possible to generate infinite possessive structures through the embedding of the DPs (8).

(7) Fiona's Ball.

(8) Fiona's brother's Ball.

Some languages that have similar genitive structures do not allow for multiple embedding. In German, for example, a nominal construction such as (9) is grammatical, while (10) is just impossible.

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3. The word “daynaa” undergoes a vowel lengthening process after it loses the inalienable marker.

(9) Fionas Bruder.  
Fiona's brother.

(10) \*Fionas Bruders Auto.  
Fiona's brother's car.

As we will see below, we try to answer experimentally if Wapichana also accepts multiple embedding of genitive constructions, like English. Preliminary data from our informants suggest that nominal constructions like (9) are possible. However, those constructions rarely appear in spontaneous speech, and it might be difficult to evaluate if the grammaticality judgment of a few informants might truly reflect the grammar of the language.

(9) Fiona minhayda'y az ballan.  
Fiona friend brother ball-GEN.  
*"Fiona's friend's brother's ball."*

### 3. PREVIOUS STUDIES IN ACQUISITION

One of the first studies in monolingual and bilingual acquisition of recursive genitive constructions in English was done by Limbach and Adone (2010). They tested children between the ages of 3 and 5, as well as monolingual adult speakers and L2 adults whose first language was German. They created scenarios where the characters represented by little dolls had different objects. Both adults and children saw the same scenarios, the only difference being that adults interacted with a computer screen while children were interviewed by a native speaker. All of their situations allowed for five different types of answers, as shown in figure (1), taken from Limbach and Adone (2010) p.5.

<u>Context story example for screen setting:</u>	
Jane has a nice blue bike and Jane's father Gordon has a racing bike. When they do a tour together they have another bike which they can ride together.	
Sam has a red bike and his father Paul has a silver bike.	
<b>Which picture shows Jane's father's bike?</b>	
Jane's father's bike	correct
Jane's bike	drop of middle DP
Sam's father's bike	drop of first DP
Sam's bike	unrelated, not mentioned
Jane and father's bike	conjunctive reading

Figure 1: example of situation from Limbach and Adone (2010)

Their results showed that although children between the ages of 3 and 5 often provide the correct interpretation, compared to adult native speakers they are more prone to either drop one of the DPs (3 year-olds) or provide a conjunctive interpretation (4 and 5 year-olds). Another interesting finding is

the fact that non-native speakers only produce the correct interpretation 63% of the time, well below native speakers.

These results support what was suggested by Roeper (2011), who says that initially, a child looks for any possible way to resist the interpretation that recursion demands. The preferred movement is to convert the recursive sentence into conjunctives. Roeper's study shows a child resisting a recursive comprehension though he has the pragmatic support and the required knowledge of the world. He also presents a dialogue in which a father tries to make a child repeat the possessive recursive. The child was able to understand the meaning but converted the nominal construction into a single possessive with a compound element (Roeper, 2011).

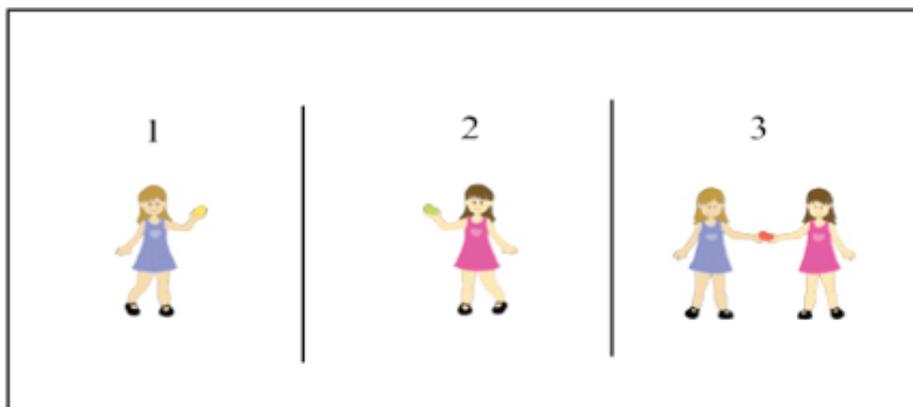
Further evidence of this preference for conjunctive interpretation in children comes from a corpus study by Radford & Galasso (1998), who showed a tendency for children avoiding complex embedding. Gentile (2003) had also shown that children may drop embedded DPs in genitive constructions at 30% to 35% rate. In another study by Gentile (2003) in which pictures based on characters of *Sesame Street* were used, the results showed that approximately one third of children (3 to 4 year-olds) chose a conjunctive reading (Cookie Monster's *and* sister's picture) instead of *Cookie Monster's sister's picture*.

In a pilot study, Amaral and Leandro (2013) tested speakers of Wapichana (in Roraima) between the ages of 7 and 62, using a picture-matching task. In the experiment, participants heard a story about some characters while they saw three pictures on a computer screen (12).

(12) The story told (in Wapichana):

*Maria dia'aa kainha'a uzukau manguru na'iki uinhauz dia'aa kainha'a ku'uriu manguru. Indary tan Maria na'ik uinhauz-ati wuzay'u manguru*

(English translation: *Maria has a yellow mango and her sister has a green mango. Their father gave them a red mango.*)



After hearing the story, they heard a sentence that asked them to choose one of the pictures, such as in (13).

- (13) Py - aida un-ati Mary inhauz manguru-n.  
 2sp - show 1ps-to Mary sister mango-GEN.  
 “Show me Mary’s sister’s mango.”

According to Amaral and Leandro (2013) it is necessary to look beyond the period of early childhood to understand the availability of recursive interpretations for bilingual speakers who speak Wapichana and Portuguese (a Romance language that does not have similar genitive constructions). Their results show that while 7 and 8 year-old children can interpret a phrase cited in the example above recursively, they argue that the performance at an adult level only happens after 13 years of age in this group of bilinguals (see figure 2).

Group	Recursive	Conjunctive	Middle Drop
Adults (N=18)	77%	10%	13%
7-8 year olds (N=10)	33%	45%	22%
9-10 year-olds (N=6)	42%	38%	20%
11-12 year-olds (N=13)	42%	30%	28%
13-14 year-olds (N=10)	60%	23%	17%
15-16 year-olds (N=8)	66%	22%	12%
17-20 year-olds (N=9)	64%	17%	19%

Figure 2: Results from Amaral and Leandro (2013)

The experiment described in this paper is a version of an original experiment designed by Roeper (personal communication) and first piloted by one of his students Fujimori (2010)<sup>4</sup>, who tested constructions with up to four possessives in Japanese. Japanese has a similar genitive structure to English, which is morphologically marked with ‘no’ (14).

- (14) John’s brother’s car  
 John **no** otouto **no** kuruma.  
 John-**GEN** brother-**GEN** car.

Fujimori (2010) tested 7 kids, and her preliminary results suggest that younger children interpret constructions with one possessive correctly but have difficulties with the interpretation of recursive genitives with two or more embedded expressions (see Roeper 2011).

4. See the description of the experiment in the next section.

These previous studies in acquisition clearly show that the genitive constructions with two possessives are already present in the grammar of three-year-old children, however not at the same level as the adult grammar. The younger the child, the harder it is for them to interpret recursive possessives.

#### 4. METHODOLOGY

The research presented here has two main objectives. The first one is to check the degree of acceptability of multiple embedded genitive constructions in Wapichana by adult native speakers, and the second one is to look into the acquisition of these constructions by bilingual Wapichana-English children. Based on these two goals we can formulate our two research questions:

(i) Does Wapichana allow for multiple genitive embedding, such as English, or does it limit the number of genitives to one, such as German?

(ii) In case Wapichana accepts multiple genitive embedding, do Wapichana children acquire such recursive constructions at a similar rate as monolingual English children?

As far as the first research question is concerned, some preliminary elicitations from a small sample of native speakers seem to suggest that Wapichana does indeed allow for multiple embedding, like English. However, there are several limitations when looking at such constructions in a traditional fashion. The first one is that these constructions are usually rare, which means that there would be very few examples of naturally occurring sequences of four genitive DPs in any corpus for any language, including the most documented language of all: English. The second limitation is that traditional elicitation with few speakers can bias the results, especially if these speakers are bilinguals with a high degree of fluency in the language of the researcher. In cases like these, experimental methods can shed some light onto the real interpretation of such rare constructions within the population at large.

In what regards the second research question, we have no reason to believe that bilingual Wapichana-English children are faster or slower than monolingual English ones. As we mentioned before, the input for such rare multiple embedded genitives is supposedly very low in both languages, so children would have to rely on the availability of these constructions in their grammar in the first place to interpret the examples presented to them. We expect that Wapichana-English bilinguals will show the same delay in having an adult-like performance when it comes to multiple embedding.

The participants were divided into four groups: (i) *English monolingual children*; (ii) *English-Wapichana bilingual children*; (iii) *adult speakers of English*; (iv) *adult speakers of Wapichana*. The monolingual participants were recruited in Georgetown, the capital city of the Cooperative Republic of Guyana and the bilingual (Wapichana-English) participants are from indigenous communities in southern Guyana. The study was done with 55 adults and 113 children<sup>5</sup> between the ages of 3 and 7.

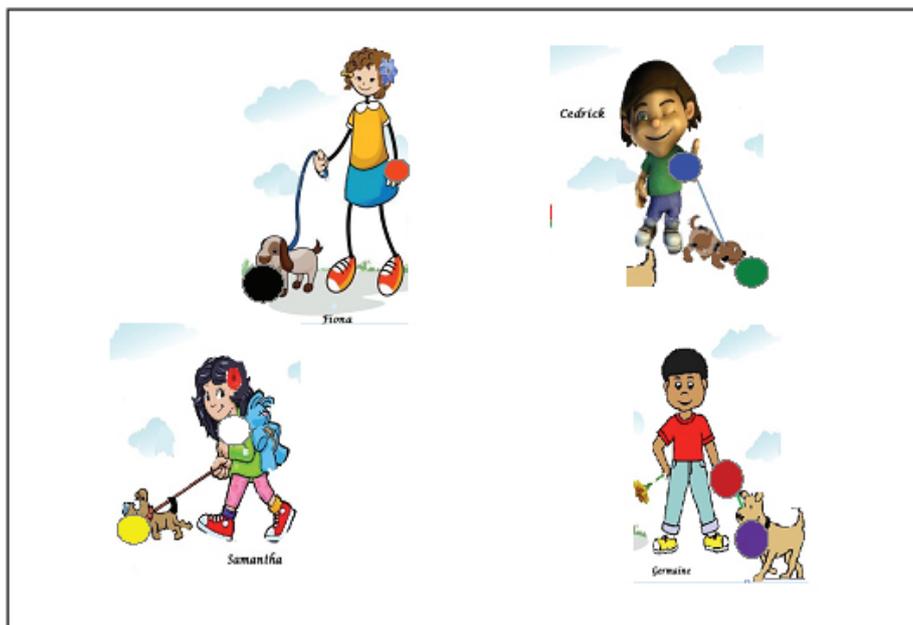
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5. One of the limitations of the study was due to the difficulty in recruiting bilingual children. While the individual age groups of monolingual English speaking children in Georgetown had between 15 and 20 participants, the bilingual age groups had mostly 4 children each. This forced us to use non-parametric statistical analyses, and impacts the generalizability of our results. We want to address this issue in the follow up experiments that will include bilingual Wapichana-Portuguese speakers in Brazil (see section 6: conclusion).

#### 4.1. The experiment

As we mentioned above, our experiment is an adapted version of an experiment designed by Roeper and piloted by Fujimori for Japanese. It consists of an interpretation task based on a picture about four related characters. We created two sets of questions with eight test items for our script that appears in (12).

(12)



Script: “We are going to talk about this picture and I am going to ask you some questions. Before we start, I am going to show you some colors. (Show flash with different colors and point out each one to participants and ask: What color is this?)

-Now look at these pictures, there are two boys and two girls. Her name is Fiona and his name is Cedrick. Fiona and Cedrick are brother and sister, they both have a ball in their hands and they also have dogs. Their dogs both have a ball. Fiona has a blue flower in her hair.

-Her name is Samantha and his name is Jermaine. Samantha and Fiona are friends and Jermaine and Cedrick are friends too. Samantha and Jermaine also have a ball in their hands and they also have dogs. Samantha has a red flower in her hair and Jermaine has a yellow flower in his hand.

While listening to the story, the children would start hearing filler questions such as: “Does Fiona have a dog?” or “Does Cedrick have a friend? What is his name?”

After the introduction, participants started answering questions about the characters. The test items were 8 questions using genitive constructions, two per number of genitives in the sentence. We tested sentences with one to four genitives, such as in (13). Example (14) shows a sentence with four genitives in Wapichana. The other Wapichana sentences tested were similar to the English version in (13). We also used fillers in a 2-1 ratio to test items.

- (13) i. *What color is Fiona's ball?*  
 ii. *What color is Fiona's dog's ball?*  
 iii. *What color is Fiona's friend's dog's ball?*  
 iv. *What color is Fiona's brother's friend's dog's ball?*
- (14) Xa'apauran Cedrick dadukuu minhayda'y yza bala-n tan?  
 What Cedrick sister friend dog ball-GEN color?  
 "What color is Cedrick's sister's friend's dog's ball?"

The dependent variable is the color of the objects that would give us the interpretation for each target question. The independent variables are the language, age and whether the participants are bilingual or monolingual. With the bilingual group (Wapichana-English), the two scripts were translated into the two languages. The picture used was similar to the one used by Fujimori (2010), however the names of the characters were those common both in Georgetown and the indigenous communities. The same picture was used with both experimental and control groups. In order to verify their knowledge of the colors used, a flash card with colors from the experiment was presented.

The bilingual children groups took both the Wapichana and the English versions of the experiment. There were two sets of questions and half of the children started with set A in Wapichana and the other half with the same set in English to avoid any bias.

#### 4.2. Coding

For coding the responses we focused primarily on contrasting recursive interpretations with non-recursive ones. For example, in a question such as "*What color is Fiona's brother's ball?*", if the participant said "green", we would mark it as a recursive reading (see image above). We also distinguished between conjoint (when participants pointed to more than one color), nonsensical, and deletion (when one of the genitive DPs was ignored) answers. For the purpose of our analysis, though, we combined these three last categories into one, and compared the results with the recursive interpretations.

### 5. RESULTS AND ANALYSIS

Let's start by reviewing our first research question: "Does Wapichana allow for multiple genitive embedding, such as English, or does it limit the number of genitives to one, such as German?" If we look at the adult performance depicted in figure 3, it is easy to see that Wapichana behaves exactly like English when it comes to multiple embedded genitives.

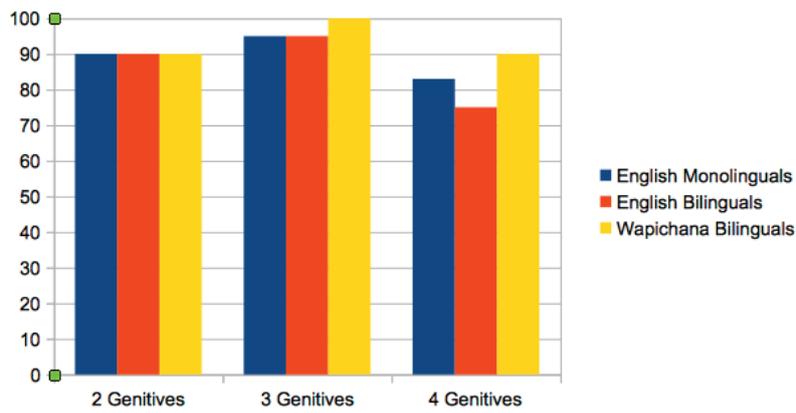


Figure 3: Results for adult performance

When we look at the results by adult speakers, it is important to remember that this group is made of older bilingual speakers that have Wapichana as their dominant language. Although it is still possible to find a few elderly speakers who are monolingual, this reality is changing fast and the future of Wapichana is to become a language spoken (almost exclusively) by bilingual speakers, as it is the case with a great number of indigenous languages in the Americas. The graph clearly shows us that both English and English-Wapichana speakers have a very similar performance with sentences that have two, three or four genitive DPs. The small differences found in the cases of 3 and 4 genitives are not statistically significant ( $C^2(4, N=55) = 0.789$ ;  $p = .94$ ).

Our second research question is about the acquisition of the recursive embedding in genitive constructions by bilingual children. Before we look at the results it is important to make a comment about the generalizability of our results. Although it was relatively easy to recruit monolingual English speaking kids in Georgetown (Guyana's capital), it was significantly harder to recruit Wapichana children in Region 9. While we had 91 English speaking kids participating in the experiment, only 22 bilingual kids were recruited for the research. We had 4 kids per age group, except for the 4-year-old group that had 6 participants. When analyzing the results, we should also remember that the bilingual speakers saw two different versions of the experiment, one in each language. In some cases, there were groups that showed a better performance in one specific language, which could be explained by the language dominance of the kids in that group.

Figure 4 below shows the results for the interpretation of DPs with two genitives (e.g., *Fiona's dog's ball*).

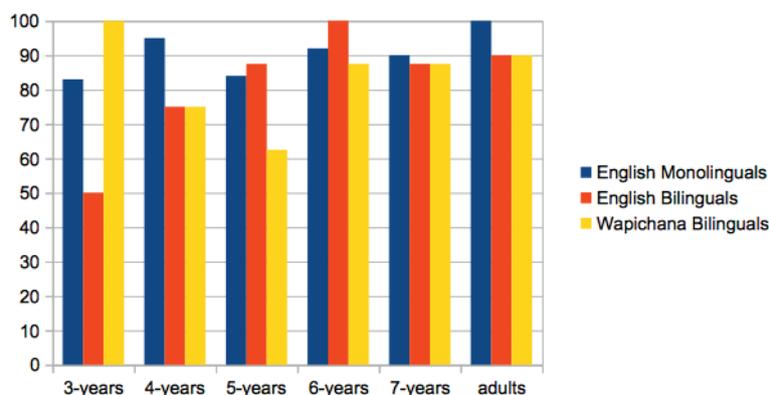


Figure 4: 2 Genitives: performance by age group.

When we compare the 6 and 7 year-olds with adults, we find no significant among the individual groups' performance for 2 genitives ( $C^2(4, N=102) = 1.031$ ;  $p = 0.91$ ). Although the difference seems to be bigger with 5 and 4 year olds, we also did not find a statistically significant difference, with  $C^2(2, N=78) = 2.26$ ;  $p = 0.32$  for 5 year-olds, and  $C^2(2, N=85) = .582$ ;  $p = 0.75$  for 4 year-olds. The only groups where we could find an overall difference in performance when compared to adults is the 3 year-olds ( $C^2(2, N=68) = 9.3$ ;  $p = 0.009$ ). The graph nicely shows what seems to be an improvement in performance between the ages of 3 and 5, however we do see some distortions in the data, such as our group of bilingual 3 year-olds who seem to be Wapichana dominant, and show an outstanding performance in the interpretation of the Wapichana examples.

Let's look at the individual group performances when interpreting DPs with three genitives (e.g., *Fiona's brother's dog's ball*).

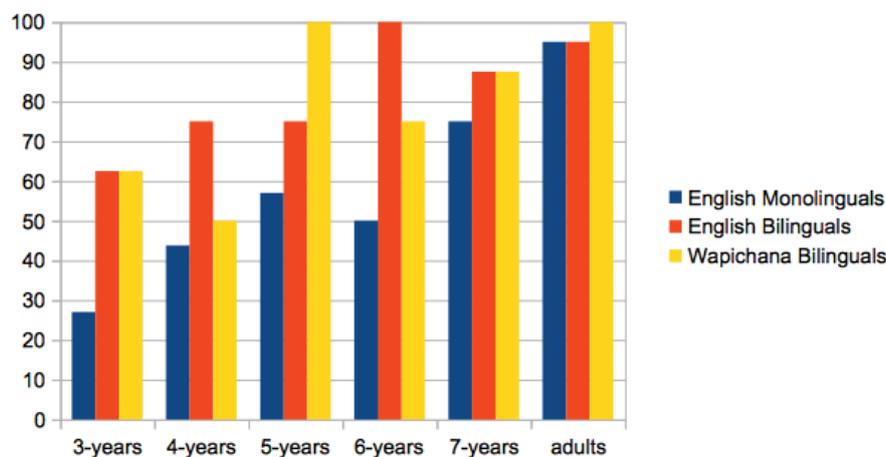


Figure 5: 3 Genitives: performance by group

Already with 3 genitives we can clearly see a difference in performance among groups. Not only 3 and 4 year-olds clearly differ from adults (with  $C^2(2, N=68) = 11.5$ ;  $p = 0.003$  and  $C^2(2, N=85) = 6.3$ ;  $p = 0.04$  respectively) but they also differ between them, with 4 year-olds outperforming 3 year-olds ( $C^2(2, N=43) = 5.4$ ;  $p = 0.06$ ). 5 year-olds also outperform 4 year-olds ( $C^2(2, N=53) = 8.65$ ;  $p = 0.01$ ). On the other hand, 5 and 6 year-olds have a very similar performance. The only difference being that the 5 year-old bilinguals in our group seem to be Wapichana-dominant while the 6 year-olds are English-dominant. If we adjust our results to this language preference, and compare the 5, 6 and 7 year-olds, we see that their difference in performance is not significant ( $C^2(4, N=82) = 6.2$ ;  $p = 0.18$ ). The three groups also get very close to adult performance, but there is still a significant difference basically because of the monolingual group ( $C^2(6, N=137) = 11.9$ ;  $p = 0.06$ ). As the graph shows the bilingual group outperforms the monolingual one in all ages, except for the adults.

Finally we look at the performance by groups for DPs that have 4 genitives (i.e., *Fiona's brother's friend's dog's ball*).

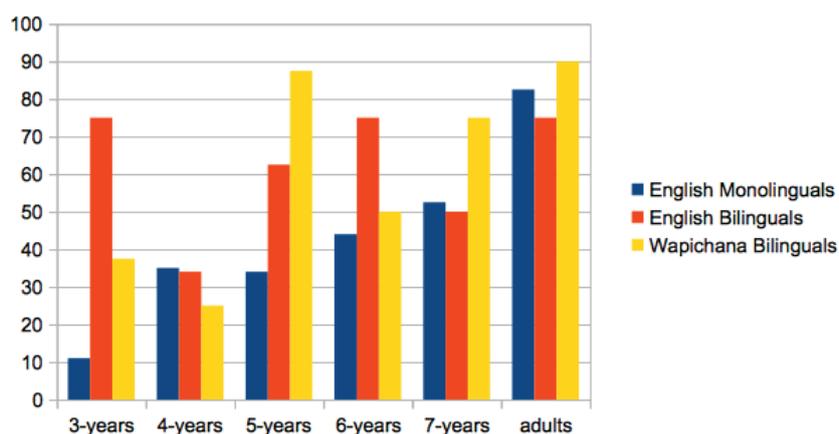


Figure 6: 4 Genitives: performance by group

First, it is important to notice that constructions with 4 genitives are harder for speakers to process, as shown by the results for all groups. Second, there are some clear outliers in our data, such as the 3 year-old bilinguals in English, or the 5 year-old bilinguals in Wapichana. We do not have an explanation for this at this point, and we would like to collect more data from bilingual speakers before we provide a more detailed analysis. At this point our data seems to suggest that bilinguals can acquire the multiple embedded genitives faster than the monolinguals in cases when both languages are typologically similar. We have no data that could be directly comparable to what we are presenting here that suggest that bilinguals with typologically different languages would behave any differently, although our pilot study (Amaral and Leandro, 2012) indicates that bilingual Wapichana-Portuguese could potentially have a significantly different performance. Future studies will show if this is the case. What the current data clearly shows is that children until the age of 6 do not have an adult-like performance for DPs with 4-genitives. Only the 7 year-olds get close enough to adults for their performance to show no significant difference ( $C^2(2, N=79) = 1.52; p = 0.46$ ).

## 6. CONCLUSION

This paper presented an experiment with multiple embedded genitive constructions in Wapichana and English. The results show that the Wapichana grammar does accept recursion within genitive DPs, and their interpretation by adult speakers is the same as the one of English speakers. The use of experimental methods was crucial to show the true nature of the Wapichana grammar in this respect, since naturally occurring sequences of four or even three genitives are quite rare.

The experiment with kids also showed that Wapichana children acquire recursive genitives during their first years, similarly to English kids. Unfortunately we did not have enough data to compare the results of monolingual versus bilingual children in a way that would allow us to make claims about how fast each group acquires embedded genitives. Our data does show an overall tendency for bilingual speakers to outperform monolingual ones until the age of seven, a fact that has been demonstrated by other research projects on bilingual development (e.g., Bialystok, 2001).

In future research we would like to collect more data from bilingual children so that we can look into the possible facilitative effects of acquiring two typologically similar languages regarding genitive constructions. We would also like to extend our experimental group to bilinguals who speak Wapichana and Portuguese. This would allow us to see if differences between the languages being acquired by bilinguals can yield different results when comparing typologically similar with typologically different language pairs.

## 7. ACKNOWLEDGEMENTS:

We would like to thank the participants from Georgetown and from the Wapichana communities in the Cooperative Republic of Guyana who helped us with data gathering. We would also like to express our gratitude to our research partners at the Federal University of Roraima (Elder Lanes, Joana Autuori, Marcelo Giovannetti and Simone Guessser) and at the Language Acquisition Research Center at the University of Massachusetts Amherst (Tom Roeper, Jill de Villiers, Barbara Pearson, Jeremy Hartman and Magda Oiry) for their feedback during earlier presentations of the data and suggestions regarding the experiment. All errors remain our sole responsibility. Finally we would like to thank the Faculty Development Grant at the University of Massachusetts Amherst for partially financing this research project.

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