

Quantity judgments in bilingual speakers (Yudja/Brazilian Portuguese)

Julgamentos de quantidade em falantes bilíngues (Yudja/Português Brasileiro)

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Abstract: This paper contributes to investigations on language-specific encoding of the count mass distinction. Two quantity judgment studies tested adult bilingual speakers in two languages that encode the count-mass distinction differently: Yudja and Brazilian Portuguese. In Yudja all nouns have count denotations. That is, all nouns (including notional mass nouns like ‘water’) can be directly combined with numerals and with count quantifiers. Conversely, in Brazilian Portuguese count and mass nouns are grammaticalized in different ways. For example, only count nouns can be directly combined with numerals. In two studies with 20 Yudja bilingual adults we investigate whether the performance of Yudja speakers in quantity judgment tasks varied depending on the language that they were operating.

Keywords: Count-mass; Semantics; Acquisition; Bilingualism; Quantity judgment task

Resumo: Este artigo contribui para o debate sobre a codificação gramatical da distinção contável-massivo. Dois julgamentos de quantidade testaram adultos bilíngues em duas línguas que codificam a distinção contável-massivo de formas diferentes: Yudja e o português brasileiro. Em Yudja todos os nomes têm uma denotação contável. Isto é, todos os nomes (incluindo nomes nocionalmente massivos como *água*) podem ser diretamente combinados a numerais e a quantificadores contáveis. Por outro lado, no português brasileiro, nomes contáveis e massivos são gramaticalmente distintos. Por exemplo, somente nomes contáveis podem ser diretamente combinados a numerais. Em dois estudos experimentais com 20 falantes bilíngues da língua Yudja, nós investigamos se a performance dos falantes Yudja bilíngues em tarefas de julgamento de quantidade variavam de acordo com a língua na qual eles eram testados.

Palavras-chave: Contável-massivo; Semântica; Aquisição; Bilinguismo; Tarefa de julgamento de quantidade

1 Introduction

In the literature that explores the interpretation of count (such as *dog*) and mass nouns (such as *water*), quantity judgment tasks (BARNER and SNEDEKER, 2005) have been extensively used in order to investigate whether speakers interpreted differently those classes of nouns. In languages like English, for example, count and mass nouns have different grammatical properties: while count nouns can be directly combined with numerals (*three dogs*) and be pluralized (*three dogs*), mass nouns cannot (**three blood(s)/ three tubes of blood*). In classifier languages, while classifiers are required in every construction where a numeral is combined with a

noun, researchers have claimed that different classifiers are associated with mass and count nouns (CHENG and SYBESMA, 1999). For example, while the classifier *ge* ‘unit’ can occur in constructions with count nouns, it cannot be used in constructions with mass nouns or it forces a count interpretation:

Mandarin Chinese

- (1) ?? San ge xue
three CL blood
‘Three portions of blood’
(Chierchia 2010; 107 – example 14)

These two languages exemplify a critical property of the nominal domain cross-linguistically: the

distinction between nouns that denote objects (most often grammaticalized as count nouns) and nouns that denote unindividuated masses (most often grammaticalized as mass nouns) is grammaticalized by means of the distribution of the plural morpheme, quantifiers and numerals.

In Yudja (spoken in Brazil by 348 people (Census UNIFESP 2010 apud ISA)¹, previous studies have shown (LIMA, 2014) that all nouns can be used as count nouns. That is, in this language there is no grammatical feature that distinguishes count from mass nouns. For example, in Yudja, notional mass nouns can be directly combined with numerals without intervening classifiers or container phrases, as illustrated by the acceptability of sentence (2):

- (2) Txabiü asa he wĩ he
 Three flour in port in
 ‘There are three (bags of) flour in the port.’

Note that (2) does not show that *asa* ‘flour’ has a default count interpretation: the acceptability of (2) might be due to mass-to-count coercion. This form of coercion (aka ‘universal packager’) is illustrated in ‘three beers’ (for ‘three bottles of beers’). Its availability in English is dependent on the existence of standardized or otherwise naturally occurring bounded amounts of the relevant substance (cf. GLEASON (1965), PELLETIER (1975), FRISSON and FRAZIER (2005), WIESE and MALING (2005)). If coercion played a role in Yudja, speakers would consistently refuse scenarios where a notional mass noun is combined with a numeral and a standardized container is not involved in the individuation of the portions of substance. This fact was tested in Lima (2012). In a scenario-based elicitation session carried out with two adult Yudja speakers, the consultants were presented with a scenario (verbal and visual stimuli) and then they had to provide a sentence to describe the scenario provided. A total of 20 notional mass nouns were used in two different scenarios: one that included individualized portions and a standardized container (3a) and another that included individualized portions, but not a standardized container (3b). The two speakers combined numerals directly with notional mass nouns in both scenarios, even when containers are not available at all, thus reinforcing that the Yudja facts cannot be explained as coercion:

- (3a) A woman brought three bowls of water to the school and put them on a bench.
 Txabiü y’a pikaha txade anu.
 Three water bench above asp
 ‘There are three (bowls of) water on a bench.’

- (3b) A woman was carrying a pan of water. Three drops fell on the ground.
 Txabiü y’a anu.
 Three water asp
 ‘There are three (drops of) water.’

In other words, in Yudja all nouns can be interpreted as count nouns given that they can be directly combined with numerals and other expressions that in other languages are restricted to count nouns. For example, when a notional mass noun such as *y’a* ‘water’ is combined with a count quantifier – such as *itxibi* ‘many’ – in Yudja, it is interpreted as quantifying over the number of concrete portions of *x*. That is, this quantifier conveys that there are many portions of water (many bags, many piles, many pans, etc), not that there is a lot of water in a single container (cf. LIMA, 2014a). This is different from a language like English, for example, where count-quantifiers only combine with count nouns.

In Brazilian Portuguese, differently from Yudja as presented above, count and mass nouns have different morphological and syntactic properties. In Brazilian Portuguese² only count nouns can be pluralized (4 and 5) and only count nouns can be directly combined with a numeral without an intervening measure phrase (contrast 8 and 9b):

- | | | | |
|------|--|------|---------------------------------|
| (4a) | cachorro
dog
‘Dogs’ | (4b) | cachorro-s
dog-PL |
| (5a) | menina
girl
‘Girl’ | (5b) | menina-s
girl- PL
‘Girls’ |
| (6a) | ouro
gold
‘Gold’ | (6b) | *ouro-s
gold-PL |
| (7a) | farinha
flour
‘Flour’ | (7b) | *farinha-s
flour-PL |
| (8) | Eu comprei três maçãs
1S buy three apples
‘I bought three apples’ | | |
| (9a) | *Eu comprei três ouro
1S buy three gold | | |
| (9b) | Eu comprei três barras de ouro
1S buy three pieces of gold
‘I bought three pieces of gold’ | | |

¹ Entry about the Yudja people (Enciclopédia dos povos indígenas do Brasil): <<http://pib.socioambiental.org/pt/povo/yudja>> (access on: August 27, 2014).

² For an extended discussion on the count-mass distinction in Brazilian Portuguese cf. Paraguassu (2005) and Paraguassu (2010).

In this paper we investigated whether Yudja bilingual speakers are sensitive to the grammatical differences between Yudja (L1) and Brazilian Portuguese (L2) in the count-mass distinction domain. We will show that Yudja speakers present different quantity judgments in their L1 and L2. This shows that language affects quantity judgments in bilingual speakers and, as such, bilingual Yudja speakers are sensitive to the fact that in Brazilian Portuguese and not in Yudja, count and mass nouns have different grammatical properties. In Section (2) we present a brief overview of the bilingualism scenario in Yudja communities. In Section (3) we present a review of quantity judgment studies in the literature. In Section (4) we present the results for the quantity judgment studies in Brazilian Portuguese with bilingual Yudja speakers.

2 Bilingualism in Yudja communities

In Yudja communities, most adults are bilinguals (Yudja and Brazilian Portuguese) or multilinguals (Yudja, Brazilian Portuguese and another indigenous language spoken in the Xingu Indigenous Territory, such as Kawaiwete (Tupi)). Most of the Yudja speakers learn Brazilian Portuguese in local schools as a second language after 6 years of age.

Two other factors will be important when we analyze the use of Brazilian Portuguese in Yudja communities: gender and age. In a sociolinguistic analysis of the indigenous languages spoken in the lower Xingu – which includes all the six Yudja communities – it was observed that men consider themselves fluent bilinguals in speaking and comprehending Brazilian Portuguese and women do not. Given cultural constraints, women rarely speak in Brazilian Portuguese (even with non-Yudja people) unless it is absolutely necessary; young men, on the other hand, tend to only speak in Yudja with Yudja speakers, but speak in Brazilian Portuguese with non-Yudja speakers. Apart from gender, age seems to be a significant factor correlating with Brazilian Portuguese proficiency in Yudja communities. The oldest members of the community are less proficient in Brazilian Portuguese in comparison to the younger generations. Over the years, the contact with outsiders intensified for many different reasons, such as political engagement, undergraduate programs for indigenous peoples outside the indigenous villages, courses for training of indigenous nurses, the presence of researchers in the field, etc. These circumstances influence the number of Yudja speakers who are fluent Brazilian Portuguese bilinguals.

3 Quantity judgments in the literature

3.1 Introduction

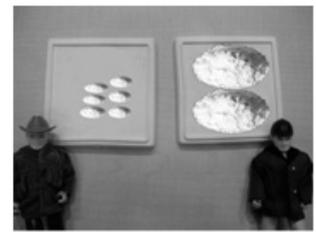
Quantity judgment tasks (cf. BARNER and SNEDEKER, 2005) consist of asking “Who has more

x ?” where x could be a count noun (10a), a substance-mass noun (10b) or an aggregate (encoded as a mass noun in languages such as English (10c)). While listing this question, participants are presented to two figures: one that represented a big portion of a substance (e.g. a big pile of flour) or a big object/individual relative to x (e.g., a big chicken) which we will refer in this paper as the ‘Volume’ answer and another figure that represented a number of piles of a substance (e.g. piles of flour) or a number of objects (e.g., chickens) that together did not have the same volume as the big portion, which we will refer from now on as ‘Number’ answer:

(10a)



(10b)



(10c)



In English (BARNER and SNEDEKER, 2005) and Chinese (LI, BARNER and HUANG, 2008), participants (16 adults and 16 4-year-olds in English and 56 adults in Chinese) presented different quantity judgments depending on the noun being used in the comparison of these quantities. Participants based their quantity judgments on ‘Volume’ significantly more when they evaluated mass nouns (such as *flour*) and they based their quantity judgments significantly more on ‘Number’ when they evaluated count nouns (such as *chicken*) or object-mass nouns (such as *furniture*)³.

The goal of this paper is to report the studies that tested whether bilingual Yudja adults were sensitive to the grammatical differences between Yudja and Brazilian Portuguese. The results of the current study – in Brazilian Portuguese – were compared with the results of a similar study made in Yudja (using the same photos) with 18 adult

³ Object-mass nouns (a.k.a. fake mass nouns) are nouns that are ‘cognitively count’, but syntactically mass (cf. CHIERCHIA, 2010).

Yudja speakers that answered quantity judgments in Yudja (cf. LIMA, 2014a, LIMA, 2014b). When this task was done in Yudja, the participants saw two different drawings one with a big portion of *x* (Volume) and another with many different portions of *x* (Number). The target question was *Ma de bitu x dju au?* ‘Who has more *x*?’, as illustrated below. The participants had to point to the drawing that corresponded to the answer:

- (11a) Notional mass nouns
(*asa* ‘flour’, *y’a* ‘water’, *kania atxa* ‘meat’):



Ma de bitu asa dju a’u?
who more flour have
‘Who has more flour?’

- (11b) Notional count nouns
(*xaa* ‘bowl’, *txarina* ‘chicken’, *karaxu* ‘spoon’):



Ma de bitu xaa dju a’u?
who more bowl have
‘Who has more bowls?’

- (11c) Aggregate nouns
(*abeata* ‘clothes’, *wã’e* ‘ceramic’):



Ma de bitu abeata dju a’u?
who more clothes have
‘Who has more clothes?’

The results of quantity judgments in Yudja have shown that there was no significant effect of Noun type (Table 1). That is, Yudja speakers did not differentiate notional count, notional mass and aggregates when evaluating quantities. Instead, they answered ‘Number’ significantly more than ‘Volume’ for all nouns. One factor with three levels (‘count’, ‘mass’ and ‘aggregate’) was manipulated in two Helmert contrasts. In the first contrast notional count nouns were contrasted with aggregate nouns. It was observed that aggregate nouns have a greater probability of ‘Number’ responses in comparison to notional count nouns, but that is not significant (Wald’s $Z=0.9$, $p=0.35$, $\beta=0.208$). In the second contrast notional mass nouns were contrasted with aggregate and notional count nouns (that is, in the second contrast notional count and aggregate nouns were considered a single category). It was observed that notional count/aggregate nouns are numerically more likely to give ‘Number’ responses in

comparison to notional mass, but that is not significant (Wald’s $Z=-0.617$, $p=0.53$, $\beta=-0.070$).

Table 1. Mixed effects modeling using Helmert contrasts – Results Study 1 (Yudja speakers tested in Yudja)

	Estimate β (Standard error)	z value (Wald’s Z)	Pr(> z)
Intercept	-0.76421 (0.96600)	-0.791	0.4289
Age	0.12246 (0.04801)	2.551	0.0107*
First contrast (notional count nouns vs. aggregate nouns)	0.20876 (0.22525)	0.927	0.3540
Second contrast (notional count nouns and aggregate nouns vs. notional mass nouns)	-0.07007 (0.11363)	-0.617	0.5375

†: $p < .1$; *: $p < .05$; **: $p < .01$; ***: $p < .001$.

The results of quantity judgment tasks done in Yudja support the hypothesis that all nouns can be interpreted as count nouns in this language. The results for Yudja are not surprising given that there is no grammatical distinction between notional mass and notional count nouns in the language. Now, the critical question is how speakers of a language where the count-mass distinction is not encoded (Yudja) will perform in quantity judgment tasks in a language that does encode the count-mass distinction (BP). For bilingual speakers of Yudja, we could expect one of two outcomes:

- **Possible outcome 1:** if Yudja speakers were sensitive to the grammatical differences between Yudja and Brazilian Portuguese, they should present different quantity judgments in Yudja and Brazilian Portuguese and answer ‘Number’ significantly more for count nouns only when tested in Brazilian Portuguese as we would expect for L1 Brazilian Portuguese speakers.
- **Possible outcome 2:** if Yudja speakers are not sensitive to the grammatical distinction between count and mass nouns in Brazilian Portuguese, they would answer ‘Number’ indistinctively for all noun types. That is, hypothetically, they could transfer their quantity judgments from Yudja to Brazilian Portuguese.

A quantity judgment task tested these predictions in both a L1 BP group (Brazilian Portuguese speakers) and a L2 BP group (Yudja speakers).

3.2 Participants

Participants were 20 bilingual Yudja adults (9 men and 11 women) and 38 Brazilian Portuguese speakers (control group).

3.3 Materials and methods

In this study, each participant saw two different drawings, one with a big portion of *x* ('Volume') and another with many different portions of *x* ('Number'). The target question was *Quem tem mais x?* 'Who has more *x*?', as illustrated below:

(12a) Mass nouns

(*farinha* 'flour', *água* 'water', *carne* 'meat'):



Quem tem mais farinha
who have more flour
'Who has more flour?'

(12b) Count nouns

(*cuia* 'bowl', *galinha* 'chicken', *colher* 'spoon'):



Quem tem mais cuia
who have more bowl
'Who has more bowl?'

(12c) Aggregate nouns

(*roupa* 'clothes', *cerâmica* 'ceramics'):



Quem tem mais roupa
who have more clothes
'Who has more cloth(es)?'

As illustrated in (12a-12c), three classes of nouns (mass, count and aggregate nouns) were tested. All target questions were asked using mass syntax, i.e., we did not pluralize nouns that could be used as singular or plural such as the nouns in (12b) and (12c). This choice was possible because Brazilian Portuguese is a language that allows bare singulars and because we wanted the target questions to not be different from the target questions in Yudja (that did not include pluralized nouns because plural nouns are restricted to [+human] nouns only in Yudja).

Each participant answered eight items in random order: three items that included a notional count noun (*cuia* 'bowl'), three items that included a notional mass noun (*farinha* 'flour') and two items that included an aggregate noun (*roupa* 'clothes'). Participants were tested individually. The study was introduced by explaining that one person owned the quantity of a substance *x* in the right size and another person owned the quantity of a

substance *x* in the left size. Participants had to point to one of the drawings to answer the target question ('who has more *x*?').

3.4 Results and discussion

Results (control group)

The results for L1 Brazilian Portuguese speakers are presented in Figure 1. The participants based their quantity judgments on the number of individuals significantly more for count and aggregate nouns compared to substance-mass nouns. These results are in congruence with the results from previous quantity judgment studies in languages where count and mass nouns are grammatically distinct (English, cf. BARNER and SNEDEKER (2005), Chinese, cf. LI, BARNER and HUANG'S (2008)). That is, different classes of nouns are associated with different answers in quantity judgment tasks:

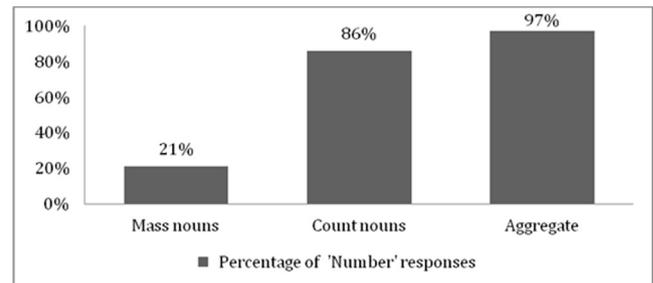


Figure 1. Results of quantity judgment studies in BP presented in percentage of Number responses (BP L1 speakers)

Results (critical group)

The results for L2 Brazilian Portuguese speakers (Yudja bilinguals) are presented in Table 2. The results show that bilingual Yudja speakers were sensitive to the grammatical distinction between count and mass nouns in Brazilian Portuguese. These results confirm that Yudja speakers present different quantity judgments depending on the language that they are tested, that is, they are sensitive to the fact that in BP the count-mass distinction is grammaticalized while in Yudja it is not:

Table 2. Results of quantity judgment studies in BP presented in percentage of Number responses (Yudja speakers tested in Brazilian Portuguese)

Noun category	Answers (Brazilian Portuguese)	Answers (Yudja)
Mass (<i>farinha</i> 'flour', <i>água</i> 'water', <i>carne</i> 'meat')	55%	85%
Count (<i>cuia</i> 'bowl', <i>galinha</i> 'chicken', <i>colher</i> 'spoon')	63%	83%
Collective (<i>roupa</i> 'clothes', <i>cerâmica</i> 'ceramics')	65%	79%

Mixed effects modeling using Helmert contrasts confirmed that there was an effect of noun type when we contrasted count and mass nouns. In this study one factor with three levels ('count', 'mass' and 'aggregate') was manipulated in two Helmert contrasts. In the first contrast, notional count nouns were contrasted with aggregate nouns. In the second contrast, notional mass nouns were contrasted with aggregate and notional count nouns (that is, in the second contrast notional count and aggregate nouns were considered a single category). It was observed that mass nouns are *significantly less likely* to be associated with 'Number' responses in comparison to count nouns (Wald's $Z = -2.256$; $p = 0.02408$; $\beta = -0.48$). There was also a significant effect of Age in proportion of 'Number' responses as younger bilingual speakers tend to differentiate count from mass nouns in most trials in contrast to older bilingual speakers (Wald's $Z = -2.33$; $p = 0.19$; $\beta = -0.21$). These results are different in comparison to quantity judgment task in Yudja where we did find a significant effect of Age, but not noun type:

Table 3. Mixed effects modeling using Helmert contrasts – Results Study 2 (Yudja speakers tested in Brazilian Portuguese)

	Estimate β (Standard error)	z value (Wald's Z)	Pr(> z)
Intercept	6.91948 (2.64027)	2.621	0.00877**
Age	-0.21379 (0.09141)	-2.339	0.01935*
First contrast (notional count nouns vs. aggregate nouns)	0.33442 (0.42262)	0.791	0.42876
Second contrast (notional count nouns and aggregate nouns vs. notional mass nouns)	-0.48746 (0.21608)	-2.256	0.02408*

t: $p < .1$; *: $p < .05$; **: $p < .01$; ***: $p < .001$

It is important to note that Yudja speakers are not performing as native speakers of Brazilian Portuguese would perform in this task. In Brazilian Portuguese, the 'Number' answer was unlikely when the question involved a mass noun (cf. Figure 1), as observed for the results in the control groups but also as observed for other languages in the literature (English and Chinese in BARNER and SNEDEKER'S (2005) and LI, BARNER and HUANG'S (2008) studies). For Yudja speakers, the 'Number' answers decreased in comparison to their answers in the quantity judgments in Yudja for nouns like 'water', but they were not close to zero (cf. Table 2). Therefore, while their quantity judgments are different from Yudja, they do not perform as native speakers of Brazilian Portuguese in this task even though their answers show that they are not just transferring their judgments from Yudja to BP.

A small group of participants (three female participants, age 44, 45 and 47) did not seem sensitive to a differentiation between count and mass nouns in Brazilian Portuguese as they did present different answers according to noun type. That may be explained by the fact that older speakers are less proficient speakers of Brazilian Portuguese. Note however that they do not reproduce their pattern in Yudja where there was a clear and high probability of 'Number' answers across noun types for adults. The three speakers who did not differentiate noun type in quantity judgments preferred the 'Volume' answer indiscriminately for all nouns. The reason why the speakers of this age group preferred 'Volume' answers over 'Number' answers for all noun types in Brazilian Portuguese could hypothetically indicate the path of acquisition of such nouns. When Yudja children participated in quantity judgment tasks (cf. LIMA, 2014a, 2014b), we observed that adults and 2-to-5 year olds answered 'Number' significantly for all nouns (reinforcing the hypothesis that all nouns can be interpreted as count nouns in Yudja). Crucially, 6-to-11-year-olds presented a very distinct pattern in comparison to these two other age groups: in this group, children consistently answered 'Volume' for all nouns. Two hypotheses could be explored to discuss those facts. First, we could hypothesize that the acquisition of the distributional properties of notional count and notional mass nouns in Yudja pass by a U-shaped curve where children start with the 'Number' response (the basic interpretation of all nouns in Yudja, including for notional mass nouns), but then they pass by a phase where they answer 'Volume' which is later corrected and they return to the 'Number' response. The 'Volume' phase could be an effect of children's exposure to BP as a second language in the local schools. Thus, 6-to-11 year olds and adults that are less proficient in BP share a common quantity judgment in this task which might be due to the preliminary introduction to a second language (BP). Therefore, it may be the case that patterns of second language acquisition may be affecting the answers of these speakers in quantity judgment studies, but to make such a statement we would have to pursue a detailed investigation of bilingualism within Yudja speakers. Therefore, this remains a question to be investigated in the continuation of these studies.

4 Final remarks

When we contrast the results of Studies 1 (with Yudja speakers in Yudja) and 2 (with Yudja speakers in BP) we observe that Yudja speakers presented different quantity judgments when tested in a language where all

nouns are count nouns, (Yudja) and in a language where count and mass nouns are grammatically distinct (BP). As such, these results suggest that bilingual speakers of Yudja do not transfer their quantity judgments from their first language to their second language.

This paper introduced a new set of results to the literature on the denotation of count and mass nouns. In previous papers, it was observed that speakers of number-marking languages (that is, languages where count nouns can be pluralized) and classifier languages (that is, languages where a noun is followed by a classifier) presented the same quantity judgments: participants associated the answer 'Number' to count and object-mass nouns and they associated the answer 'Volume' to mass nouns. Crucially, there was no study before this one that tested speakers of a number neutral language in this task (languages where classifiers or plural morphology are not used to differentiate count from mass nouns) nor a study that tested the same group of bilinguals in two different languages, especially in languages that have as different properties such as Yudja and Brazilian Portuguese, where in one language all nouns are count and in the other language there is a grammatical distinction between count and mass nouns.

This kind of task is not conclusive on making predictions on how people perceive objects and substances because speakers presented different answers not based on the essential difference between objects and substances, but instead on the difference between the two languages to which they were exposed. As such, quantity judgment tasks seem to be a fundamental technique in order to reveal the grammaticalization (or the lack of thereof) of the count and mass nouns across languages.

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