On the locative interpretation of container phrases in Yudja

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Abstract
In this paper I discuss the grammatical properties of container phrases in Yudja (Tupi; Brazil). I show that container phrases are syntactically indistinguishable from locative phrases. Based on two experimental studies with Yudja children and adults, I address two questions about the interpretation of container phrases. First, given that container constructions are identical to locative constructions in Yudja, could they be interpreted as simple locatives in constructions with numerals (i.e., indicating the location of a substance)? Second, when container nouns are overt in the sentences, do they necessarily refer to the unit being used for counting? Based on the results of these studies, I develop a compositional analysis of the locative interpretation of container phrases in Yudja.
On the locative interpretation of container phrases in Yudja

Suzi Lima*

1 Introduction

Container nouns are nouns that denote concrete objects that can be used as containers for substances, such as ‘cup’, ‘bucket’ or ‘bag’. Container nouns can be used in numeral constructions like ‘two glasses of water’. It has been argued that in this environment, they can be interpreted in at least two different ways (Selkirk 1977, Doetjes 1997, Chierchia 1998, Landman 2004, Rothstein 2009, 2012, Partee and Borchev 2012). Firstly, a container noun can be used to denote actual containers filled with some substance, e.g., ‘glasses of water’ can be used to denote actual glasses filled with some quantity of water. In constructions with numerals, the number word is then used to count the number of these receptacles. Following Rothstein (2012), let us call this the individuation interpretation of container nouns. Secondly, a container noun can be used as the description of a unit of measurement. In constructions with numerals, the number word is used to specify a quantity on a scale whose units are described by the container noun. In that use, the container noun does not denote the concrete objects that it describes under its receptacle reading; e.g., ‘glasses of water’ need not refer to actual glasses filled with water, but only to portions of water whose volume corresponds to the content of one glass. Let us call this the measurement interpretation of container nouns, again following Rothstein (2012). These two interpretations are illustrated in the following examples:

(1a) Mary, bring two glasses of water for our guests! (individuation interpretation most salient)
(1b) Add two glasses of water to the soup! (measurement interpretation most salient) (Rothstein 2012:4 – examples 15)

Whereas (1a) is used to refer to actual glasses filled with water, (1b) is used to refer to an amount of water equivalent to the contents of two glasses, and it is asserted that this amount of water must be added to the soup. Rothstein (2009, 2010b, 2012) suggests that individuation interpretations and measurement interpretations are associated with different grammatical properties in English. Firstly, when they describe units of measurement, container nouns can be suffixed with the morpheme –ful (2a/2b). Secondly, the distributive quantifier each can be combined with container nouns when they describe actual receptacles (i.e., in the individuation reading), but not when they describe measurement units (3a–3c):

(2a) Bring two glasses(#ful) of wine for our guests! (individuation reading)
(2b) Add two glasses(ful) of wine to the soup! (measurement reading)
(3a) Two packs of flour cost 2 euros each. (individuation reading)
(3b) #Two kilos of flour cost 2 euros each. (measurement reading)
(3c) The two glasses of wine (#in this soup) cost 2 Euros each.

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Rothstein (2012) analyzes the individuation interpretation as a process of counting atomic individuals, whereas she analyzes the measurement interpretation as a process of measuring portions of stuff. The counting process is described as “putting atomic entities in one-to-one correlation with the natural numbers” (Rothstein 2012:5). The measurement process is described as “giving a value to a quantity on a calibrated dimensional scale, as in ten kilos of flour/books”. An important semantic difference between these two processes is that counting presupposes individuation, i.e., the identification of a set of atomic entities that can be enumerated, while measuring doesn’t (Rothstein 2012:5).

Partee and Borchev (2012) also explored the distinction between individuation and measuring. The authors described four possible readings associated with container nouns in Russian: container + contents, concrete portion, ad hoc measure and standard measure. The container + contents interpretation is equivalent to Rothstein’s individuation reading; the other three readings are subtypes of Rothstein’s measurement reading. Partee and Borchev (2012) claim that these interpretations are derived by a series of lexical shifts going from the most concrete use of the container noun to the most abstract. The first reading on the derivational scale (from the most concrete to the most abstract interpretation of container nouns) is the container + contents reading. According to the authors, the container + contents reading (the individuation reading in Rothstein’s terms) is characterized by three grammatical features: first, the container phrase is incompatible with fractional numbers; second, it can refer to containers of different sizes; third, it combines with verbs that apply to concrete objects. For example:

(4) On prines butylku vodka.
He brought bottle-ACC.SG vodka-GEN.SG
‘He brought a bottle of vodka’

The interpretation container + contents in (4) is selected in a scenario where the phrase refers to an actual bottle filled with vodka. Under this interpretation, the container phrase is incompatible with fractional numbers such as half, because there is no physical object such as a half-bottle filled with vodka. By contrast, if butylku ‘bottle’ was interpreted as a measurement unit, it would refer to the amount of vodka that was brought, i.e., the volume of vodka that fills one bottle, independently of the container that was actually used to bring the vodka. In that case, we could use the expression half a bottle of vodka to refer an amount of vodka equal to half of the volume of vodka that fills one bottle.

The second reading on the derivational scale is the concrete portion interpretation. The concrete portion refers only to the substance (Partee and Borchev 2012:28), i.e., it ‘characterizes the substance in terms of its occupying those containers’ (Partee and Borchev 2012:28). The concrete portion reading shares some grammatical properties with the container + contents reading, such as: it requires the substance to be in a particular container (or containers); it can refer to containers of different sizes filled with the same substance and fractional numerals are not compatible with this reading, as illustrated below:

(5) On svaril dvé kastruži supa, bol’ sužu dlja nas i malen’ kužu dlja ko’ski. us and small-ACC for cat
He cooked two pots-ACC soup-GEN big-ACC for
‘He cooked two pots of soup, a big one for us and a small one for the cat.’
(Partee and Borchev, 2012:28 – example 37)

1According to Partee and Borchev (2012:24) Rothstein’s individuation reading makes reference primarily to the container. The Container + Contents reading described by Partee and Borchev makes reference to both container and its contents.
The difference between the container + contents reading and the concrete portion reading lies in the fact that in the concrete portion interpretation the reference is the substance only, whereas in the container + contents reading the reference is the container (and its contents) (Partee and Borchev 2012:32).

The other two interpretations on the derivational scale proposed by Partee and Borchev (2012) – the ad hoc measure and the standard measure - are measurement interpretations. The Ad hoc measure interpretation is available for all container nouns; a priori, any container noun can be used to measure, context permitting. The standard measure reading refers to containers that are lexicalized as measurement units in a particular language. In other words, the ad hoc measure reading differs from the standard measure reading insofar as in the latter but not in the former the container noun is lexicalized as a measurement unit and has the semantic status of other non-container measure words such as liter. When a container noun is lexicalized as a standard measurement unit, there is no requirement that the particular container in question will be involved or appealed to. For example, in English ‘cup’ is a standardized measurement unit (‘two cups make a pint, two pints make a quart’ (Partee and Borchev 2012:25)) that can be used even when the cup-object is not salient in the context. Two grammatical properties characterize both the ad hoc and standard measure readings. First, when a container noun is used as a measurement unit, there is an expectation that the container will be full (Susan Rothstein, apud Partee and Borchev 2012:16 – footnote 6). For example, if we are cooking and I say “add two cups of water to the bowl” we are expecting that two full cups of water are required. Secondly, container nouns used as measurement units are compatible with fractional numbers. In the same cooking scenario, I could say “Add 2 and a half cups of water to the pan”. The following table summarizes the grammatical properties associated with the different interpretations of container phrases:

<table>
<thead>
<tr>
<th>Does it allow fractional numbers?</th>
<th>Container + contents</th>
<th>Concrete Portion</th>
<th>Ad hoc Measure</th>
<th>Standard Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does it require the container to be full?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Can it refer to containers of different sizes filled with the same substance?</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Table 1. Grammatical properties of interpretations of container nouns (Partee and Borchev 2012).

In this paper I will investigate the semantic properties of container nouns in Yudja, which are always optional in constructions with numerals (cf. Lima 2012). I will show that container nouns in Yudja differ from their English and Russian counterparts insofar as they are syntactically and semantically indistinguishable from constructions with locative phrases, i.e., constructions such as water in a bowl in English, as opposed to bowl of water. This will be apparent in Section 2, and it will be confirmed in three experimental studies in Section 3.

In Section 2 I discuss the grammatical properties of container phrases in Yudja. I show that container phrases are syntactically indistinguishable from locative phrases. In Section 3, I present two experimental studies that investigate the interpretation of container phrases. I conclude that container phrases in Yudja are primarily interpreted as locative phrases. Finally, in Section 4, I develop a compositional analysis of the locative interpretation of container phrases in Yudja.

2 Grammatical Properties of Container Constuctions in Yudja

Four grammatical properties characterize container phrases in Yudja. First, container phrases are optional in constructions with numerals (cf. Lima 2012):

Context: people are organizing a workshop in Paksamba and they requested three bottles of honey in order to prepare juice. Anana brings three bottles of honey:
In (6), the salient individuation unit is provided by the context and therefore it can be elided as in (6b). When speaker and listener do not share a common knowledge about the minimal unit being used for individuation, a container noun will most likely be included in the sentence and it will coincide with the unit for individuation salient in the context. This was tested in a production task based on Semanza et al. (1997:673) as part of an elicitation session. In Semanza et al. (1997)’s study, a consultant had to build a sentence from a target noun (count or mass) and ‘a semantically associated noun’ (i.e., ship/sea, water/glass). In Yudja, speakers had to construct a sentence using a target noun (a notional mass noun) and a numeral (yauda ‘two’ or txabii ‘three’). For all pairs of notional mass noun and numeral, no context was provided. As expected, all the sentences the speakers produced included a container phrase, as illustrated below:

Pair provided: txabii ‘three’/ũ ‘oil’
Sentence produced:
(7) Txabii ũ’a karaha he au pìkahâ txade
thrice oil bottle in have bank above
‘There are three bottles of oil above the bank’

Pair provided: txabii ‘three’/asuka ‘sugar’
Sentence produced:
(8) Txabii karaxu he asuka ameku pe
three spoon in sugar put in
‘(Someone) put in three spoons of sugar’

The second property that characterizes container phrases is that container nouns in constructions with numerals are necessarily followed by the postposition he ‘in’, as illustrated in the examples above (6a, 7 and 8).

The third characteristic property of container phrases (container noun + postposition) is that they can occur in different positions in the sentence (see 9a–9d), except between the object and the verb (9e). Finally, container phrases cannot be discontinuous, insofar as the container noun and the postposition he ‘in’ cannot be separated by expressions that are not part of the container phrase, as illustrated in (9f):

| (9a) | Yauda senahï yukïdï dju wi xãã he two man salt bring bowl in |
| (9b) | Xãã he yauda senahï yukïdï dju wi bowl in two man salt bring |
| (9c) | Yauda xãã he senahï yukïdï dju wi two bowl in man salt bring |
| (9d) | Yauda senahï xãã he yukïdï dju wi two man bowl in salt bring |
| (9e) | * Yauda senahï yukïdï xãã he dju wi two man salt bowl in bring |
| (9f) | * Yauda senahï xãã yukïdï he dju wi two bowl bowl salt in bring |

‘(A) man brought two bowls of salt’ (for 16a-16d)

It is important to observe that container phrases are syntactically identical to locative phrases in Yudja. Locative and container phrases are post-positional phrases, although they can be constructed with post-positions other than he. Secondly, locative phrases have a free distribution with-
in the sentence (see 10a–10c); just as the container phrases (9), they can occur in virtually any position in the sentence, except between the object and the verb (10d). Finally, locative phrases cannot be discontinuous, as illustrated in (10e):

(10a) Pikaha txade na pitxa maku
chair above 1s fish put
(10b) Una pikaha txade pitxa maku
1s chair above fish put
(10c) Una pitxa maku pikaha txade
1s fish put chair above
'I put the fish above (the) chair' (for 10a-10c)
(10d) * Una pitxa pikaha txade maku
1s fish chair above put
(10e) * Pikaha na pitxa txade maku
chair 1s fish above put

I conclude from these observations that container phrases in Yudja are in fact locative phrases. At a semantic level, I propose that they are used to indicate that the individuals or portions of substances in the extension of the NP that they are adjoined to are located in receptacles of the sort that are denoted by the locative noun. In the next section I present two experimental studies that support this proposal.

3 Studies with Container Nouns in Yudja

3.1 Study 1: Photo/sentence Matching

In the previous section I have shown that container nouns are necessarily followed by the postposition he ‘in’ and that container phrases are formally similar to locative phrases. The goal of the first study is to test whether container phrases can be interpreted as locative constructions that indicate the location of a substance.

Interpreted as locatives, container phrases would convey that some substance x is located in a container y. Other parameters of interpretation such as the size of the container and the amount of the substance (i.e., whether the containers are completely full or half-full, etc.) would not be determined by the container phrase itself. The first study tested this hypothesis.

Materials and methods

The participants were 20 adults and 26 children (8, 4-to-6-year-old children; 18, 7-to-12-year-old children). They were shown 16 photos in random order: 5 photos represented containers of different sizes, filled with the exact same substance (11c); 5 photos represented containers of the same size, but with different amounts of a given substance (11a); and 6 photos represented containers of the same size that included small portions of a given substance (11b) as illustrated below:

(11a) Yauda uã karaha he
two oil bottle in

(11b) Yauda awatxi'i xãã he
two rice bowl in
The study took place in a room in the central school of the Tuba Tuba village. A local professor known by the children and their parents accompanied all the tasks that involved children. Before the study began, we explained to the participants that they would see a photo and hear a sentence and they had to say whether the sentence matches the photo or not. The local professor or I read the target sentence and showed the photo to the participants. As I will show below, there was no difference in the results based on who asked the target question.

Results

All of the 26 children agreed that all photos could be described by the target phrase, which included a numeral and a container noun followed by the postposition he ‘in’. 19 out of the 20 adults, i.e., all but one speaker, gave the same answer. This shows that a locative interpretation of container phrases is widely accepted by Yudja speakers. Only one speaker (20-year-old adult, female) disagreed with this judgment. Her comments were: “because one is a half” (for similar containers with different quantities); “because the quantity is small” (for similar containers with small quantities of a given substance); and “because the quantities are different” (for containers of different sizes). At the end of the study, she explained that she expected that the containers would be full. The comments of this participant suggest that she is interpreting container phrases as measurement units. As discussed by Rothstein (2012) and Partee and Borchev (2012), when container nouns are used as measurement units, they are expected to refer to full containers. For example, when a phrase like ‘glass of wine’ is used as a unit of measurement (for example, if we are teaching how to cook something), what is counted are full glasses (Rothstein p.c. apud Partee and Borchev 2012:16 – footnote 6). Therefore, the comments of the consultant that rejected all the combinations that were tested suggest that container phrases in Yudja may be interpreted as measurement units and that this interpretation is the preferred one for this speaker.

It is important to note that this study and the two other studies on container nouns were run along other studies on different topics such as the order of constituents. The task of speakers in these other studies was also to evaluate whether the target sentence was a good description of a given picture. These items were used as fillers for Study 1, which allowed us to control that speakers who answered ‘yes’ to all questions in Study 1 were not solely answering positively for all items. The same will hold for Studies 2 and 3 presented below.

3.2 Study 2: Drawing/sentence Matching

In previous analysis of the count/mass distinction in Yudja (Lima 2012), it was shown that notionally mass nouns can be combined with numerals without intervening container/measure phrases. It was proposed that in this case, the unit of counting (i.e., the definition of what counts as an atomic portion of stuff in the extension of the noun) was determined by a covert atomic function, whose operation of atomization is context dependent. However, one may also hypothesize that the noun combines with a silent measure/container phrase that may be optionally overt and that the numeral combines with the resulting constituent. The goal of Study 2 is to falsify this alternative hypothesis. To do so, we investigate the interpretation of constructions in which a notionally mass noun is combined with an overt container phrase and a numeral, and we show that the unit of counting is independent of the meaning of the container phrase. This demonstrates that it is not the container phrase that individuates the portions in the denotation of the noun.

Let us illustrate the logic of the test with an example. Consider (12). If the unit of counting is not determined by the container phrase, speakers should judge (12) true in a scenario where the units of counting are not receptacles of the type described by the container phrase. For instance, the speaker should judge (12) true in a scenario where there are three bowls of flour in a bag.
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(12) Txabïu asa saku he
Three flour bag in
‘Three (bowls of) flour in bags’

In (12) the container phrase *saku he* ‘in bags’ indicate the location of the substance while the individuation unit is contextually salient.

**Materials and methods**

Participants were the same 20 adults and 26 children (8, 4-to-6-year-old children; 18, 7- to 12-year-old children) that participated in Study 1. In this study, 12 critical items were counterbalanced in two lists (and 10 fillers unrelated to the manipulation) consisting of a target sentence and a drawing, which were presented to the participants as illustrated below:

(13) Awïla ‘honey’
(13a) txabïu awïla wâ’ê he
three honey pan in

Two different drawings were shown to the participants, which represented two different types of scenarios. In one of the scenarios (13a), only one container was manipulated. If the target sentence is true in this scenario, then the numeral is used to count the number of containers $y$ filled with the substance $x$. This interpretation of the target sentence corresponds to the container + contents reading described by Partee and Borchev (2012). In the second scenario (as in 13b) we manipulated two containers: one that actually contained a substance $x$ (henceforth ‘substance-container’) and another one that held those containers filled with a substance $x$ (henceforth ‘container-container’). If the target sentence is true in this scenario, then the numeral is used to count the substance-containers (in 13b bottles) rather than the container-containers.

Each participant answered 6 critical items in random order. The participants had to decide whether the target sentence could describe the drawing that was shown to them. Six drawings represented the first type of scenario (13a) and six drawings represented the second type of scenario (13b). The critical items in this study are the second type of scenario. These scenarios test two predictions of the analysis summarized above (cf. Lima 2012): first, they test whether the individuation may be provided by the context independently of the meaning of an overt container phrase; secondly, following Study 1, they test whether container nouns in constructions with numerals may be used to indicate the location of a substance rather than what counts as a single portion of stuff in the extension of the noun.

**Results**

All participants answered that the target sentences could describe both types of scenarios. These results are crucial to support the context-dependent atomic function hypothesis, which predicts that context alone may determine the unit of counting with notional mass nouns. Container phrases in constructions with numerals do not necessarily determine the unit of counting with notional mass nouns.

**General discussion**

The two tasks presented above explored different interpretations of constructions with container nouns in Yudja. In Study 1, I confirmed that container nouns can be interpreted as locatives. In Study 2, taking a hint from the fact that container nouns are optional in constructions with numerals and (notional) mass nouns, I tested whether the individuation unit may be provided by the context. All participants agreed that this is possible, which reinforced the hypothesis that a logical classifier (in Chierchia’s 2013 terms) is responsible for the individuation operation as long as the individuation unit is salient in the context. In the next section, I propose a compositional analysis for the interpretation of container phrases.
Deriving a Locative Interpretation of Container Phrases

In the previous sections I have shown that container nouns in Yudja are syntactically identical to locative phrases, and can be interpreted either as locative phrases. In Maienborn (2001)’s terms, a locative phrase denotes a two-place relation (named loc) ‘between a located entity x and a landmark y’, therefore stating where x is located. I propose that the bare NP in a container phrase is interpreted existentially. Therefore, in the locative interpretation of a container phrase, the PP headed by he denotes a property of entities that are located in some receptacles of the sort described by the locative NP. To illustrate, the locative PP saku he (‘in bags’) in (14) denotes a property of entities that are located in some bags. This property is intersected with the property of individuals or portions of stuff that is denoted by the modified NP. In (14), the NP asa ‘flour’ denotes a property of portions of flour, which is intersected with a property of entities that are located in some bags. The resulting NP denotes a property of (contextually atomic) portions of flour that are located in some bags. This property is then intersected with the numeral he txabïu (‘three’). After existential closure, the whole DP denotes a quantifier over groups of three portions of flour that are located in bags:

(14) Txabïu asa saku he
Three flour bag in
‘Three (bowls of) flour in bags’
‘There are three bags of flour in the port’

(15) [DP [D A ][NumP [Num txabïu ][NP [NP asa ] [PP [DP saku ] [P he ]]]])

(16) Locative interpretation of container phrases:
[[he]] C,W = λy. λx. LOC (x, y)
[[[pp [dp saku ] [p he ]]]] C,W = λy. λx. ∃x [ x ∈ * { z : z ≤ BAG(w) & AT(z)} & LOC (y, x) ]
[[[np asa]]] C,W = λx. x ∈ * { z : z ≤ FLOUR(w) & AT (c)(z)}
[[numP]] C,W = λy. |x| = 2 & x ∈ * { z : z ≤ FLOUR(w) & AT (c)(z)} & ∃y [ y ∈ * { z : z ≤ BAG(w) & AT (z)} & LOC (x,y) ]

In Yudja bare noun phrases can be used as arguments without overt determiners. To account for this fact, I will assume that bare noun phrases of Yudja are DPs with a covert D head. This head is interpreted as a function that maps the property denoted by its complement NP to an individual (type e) or generalized quantifier (type <et,e>). I assume that a covert D head may denote at least the two functions as in (1) and (2). The function IOTA in (1) maps a property P to the unique individual that is a member of P and that satisfies the contextual restriction C. This is a partial function, which is undefined if there is more than one individual in the intersection of P and C, or if this intersection is empty. It corresponds to the iota type shifter of Partee (1987). The function A in (2) is an existential quantifier.

(1) [[ Dota ]] = IOTA = λP. λx.P(x) & C(x)
(2) [[ Da ]] = A = λP.λQ. ∃x [ P(x) & C(x) & Q(x) ]
\[
[[A \text{ NumP}]]^C_w = \lambda P. \exists x [\|x\| = 2 & x \in *\{z: z \leq \text{FLOUR}(w) \& \text{AT}(c)(z)\} \& \exists y [y \in *\{z: z \leq \text{BAG}(w) \& \text{AT}(z)\} \& \text{LOC}(x,y) \} \& P(x)]
\]

The whole phrase denotes a function from a property of objects P to a proposition that is true in w if and only if there is a plural portion of flour x that is composed of two atomic portions, and there is a bag or plurality of bags y such that x is located in y, and x has property P. Note that this analysis presupposes that LOC is a cumulative relation, i.e., for any two pairs of objects (x,y) and (u,v), if LOC(x,y) and LOC(u,v), then LOC(x+y,u+v).

Thus, in their locative interpretation, container nouns denote the location of a substance. The locative interpretation of a container noun does not entail that the container is full, and if there are several containers, these containers may be of different sizes. This was shown in Study 1. In Study 1, some scenarios described containers of the same size, but with different amounts of a given substance (17a) or containers of the same size that included small portions of a given substance (17b) or containers of different sizes filled with the same substance (17c). In all contexts, container phrases can be used to describe these scenarios:

(17a) Yauda uã karaha he two oil bottle in ‘Two (portions of) oil in bottles’

(17b) Yauda puju xãã he two beans bowl in ‘Two (portions of) beans in bowls’

(17c) Yauda awatxi‘i xãã he two rice bowl in ‘Two portions of rice in bowls’

5 Conclusions

In this paper I have discussed the proprieties of container phrases in Yudja. Container phrases are optional in constructions with numerals and they are formally identical to locative phrases. It was shown that container phrases can be interpreted as locatives. Crucially, it was shown in Study 2 that when a container phrase is used in a construction with a numeral that modifies a notionally mass noun, the unit of counting may be different from the container that is described by the container phrase. This supports the hypothesis that the individuation of portions in the extension of notionally mass nouns is performed by a covert atomic function rather than by a container phrase (Lima 2012).

References


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