Object Mass Nouns and Comparative Judgements[1]

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Abstract. The mass/count distinction is often semantically manifested in comparative judgements as a difference between counting and measurement. Thus, the count nouns in *more stones*/*packs* trigger counting whereas the mass nouns in *more stone*/*sugar* involve measuring. *Object mass nouns* (OMNs) like *furniture*, *weaponry* and *baggage* are exceptional among mass nouns in showing strong counting effects in comparatives. There is little agreement on the interpretation of this fact. Some works propose that OMNs have discrete meanings while others attribute their countability in comparatives to other reasons. Deciding between these approaches is challenging, partly because it has remained unclear if OMNs in comparatives show any semantic distinction from count nouns. In this paper we demonstrate that they do. We report experimental findings showing that in contexts that favor measurement, counting with OMNs is less frequently preferred than with count nouns. We analyze these results by proposing that although referents of both common nouns and OMNs are perceived as discrete objects, OMN denotations are continuous. The tolerant mass/count syntax of the comparative leaves the discrete perception of both kinds of nouns as the prominent factor in their interpretation. However, when the context primes measurement, the continuity of OMN denotations allows them to trigger non-discrete measures more easily than count nouns. This proposal retains the advantages of semantic theories of the mass/count distinction while employing them in a model that is also sensitive to biases coming from pragmatics and the perception of real-world objects.

Keywords: mass nouns, count nouns, comparatives.

1. Introduction

The distinction that many languages make between count nouns (CNs) and mass nouns (MNs) is most blatantly manifested with simple numerals as in the following examples:

(1) a. one tree, two trees, ...
b. #one timber, #two timbers, ...

CNs as in (1a) are primarily used for counting individual entities. Parallel MN collocations with numerals as in (1b), to the extent they are acceptable, primarily count sub-kinds of the noun category (e.g. sub-kinds of timer: oak, mahogany etc.) rather than a total quantity. Such contrasts in countability have been analyzed by postulating a semantic distinction between MNs and CNs. There are different proposals, but they all boil down to assuming that CNs denote discrete objects, while meanings of MNs are continuous or have unspecified atomic elements (Bunt 1985; Chierchia 1998; Rothstein 2017, among others).

A well-known challenge for this kind of semantic analysis comes from so-called *object mass nouns* (OMNs, Erbach 2021). These are MNs like *furniture*, *weaponry* and *baggage* that resist numeral counting like other MNs, although they intuitively refer to discrete objects. What

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is the source of the typical 'mass' behavior of OMNs in constructions like #*one/three furniture*(*s*)? Why don't they allow counting in the same way as CNs like *tables* or *chairs*? There are two approaches to this question. One approach hypothesizes that OMNs denote discrete objects, and their infelicity with numerals follows from independent morpho-syntactic mechanisms. Another approach argues that OMN meanings are continuous like other MNs, and that their intuitive discreteness does not follow from semantic mechanisms. The "discrete OMN" approach puts the emphasis on the way OMNs are pragmatically used, while the "continuous OMN" approach focuses on their syntactic status as mass terms. Deciding between these approaches on empirical grounds has proved quite challenging. Since (McCawley, 1975), various phenomena have been known to distinguish OMNs from other MNs, but without full overlap between different criteria (Erbach, 2021).

One key empirical phenomenon was experimentally studied in (Barner and Snedeker, 2005). In Barner & Snedeker's experiments, OMN-based comparatives (*more silverware*) supported counting as strongly as CN-based comparatives (*more forks*). They conclude that the "discrete OMN" approach is on the right track, as do Bale and Barner (2009) and Wellwood (2019: p.90), among others. Other works object to this line, and propose to see counting with OMNs as an epiphenomenon of measurement processes: of the functionality of objects (Grimm and Levin, 2012) or as estimations of numerosity (Rothstein, 2017). These proposals maintain the analysis of all MN meanings as continuous, hence the general semantic distinction between MNs and CNs. However, despite the centrality of the mass/count distinction for current semantic theory, no clear evidence has been shown that allows us to decide between the "continuous OMN" approach and the "discrete OMN" approach.

The aim of the present paper is to empirically distinguish the "discrete OMN" and the "continuous OMN" approaches. To do that, we are interested in the extent to which there are observable semantic differences between OMNs and CNs in comparatives. More specifically: do OMNs support counting as strongly as CNs? First, we note that although both OMNs and CNs favor counting in comparatives, both kinds of nouns also support measurement in exceptional situations. For example, Rothstein points out that the sentence *John has more furniture, so he should use the larger moving truck* primarily favors measurement of the volume of John's furniture rather than counting the number of pieces he has. Similar observations were made for CNs: when asking whether someone ate *a lot of beans* or *more beans*, we may be interested in the weight or volume of the beans, and not in their number (McCawley, 1975). Measurement-based readings of CNs were also pointed out in other syntactic environments (Snyder, 2021; Winter, 2022). Thus, the critical question for the "continuous OMN" approach is: do comparatives give us a sound empirical basis for semantically distinguishing OMNs from CNs?

We propose a positive answer to this question. In agreement with Barner & Snedeker and Scontras et al. (2017), we assume that the perception of OMN referents as discrete strongly primes counting. For example, with no special reason to measure bags, both questions *who has more baggage* and *who has more bags* primarily require attention to the number of bags. Notwithstanding, in agreement with Grimm & Levin and Rothstein, we hypothesize that a 'mass' morphosyntax boosts measurement with OMNs in contexts where it is pragmatically more likely than counting. We report experimental findings that support this view. This allows us to retain the assets of semantic theories of the mass/count distinction. The emerging picture adopts the traditional assumption that the semantic of certain environments – numeral determiners, bare

singular arguments etc. – is sensitive to the discreteness of the noun's denotation. This accounts for contrasts as in *three bags*/#*baggage*(*s*). However, the discreteness or continuity of a denotation does not fully reflect the way objects are perceived. While syntax and semantics are not sensitive to the perception of OMN referents as discrete, pragmatics is. Accordingly, mapping a continuous OMN denotation to a discrete meaning is especially easy in environments like the English comparative, which licenses both discrete and continuous meanings. This accounts for the special properties of OMNs in the class of MNs. At the same time, as MNs, the continuous denotation of OMNs allows semantic mechanisms to immediately interpret them using measurement. This accounts for the distinctions between OMNs and CNs in comparatives as shown by our experiments.

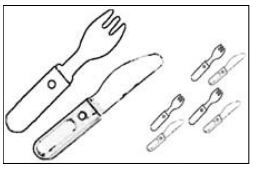
The paper is structured as follows: section 2 shortly discusses previous relevant findings, section 3 describes our experimental work, section 4 discusses the theoretical implications of the results, and section 5 concludes.

2. Previous findings

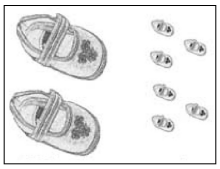
The following examples involve quantity judgements on OMNs in comparatives:

(2) Anna has more furniture/weaponry/baggage than Ben.

As McCawley (1975) observed, introspective judgements on sentences as in (2) usually favor counting. Similar judgements were shown experimentally by Barner and Snedeker (2005), who presented participants with comparative questions on visual stimuli. For instance, questions like *who has more shoes/silverware* were presented in relation to visual stimuli as in Figure 1. In these drawings, two people have shoes or items of silverware. One of the people has a smaller number of items whose total size is larger. Thus, counting and measurement should lead to different answers. The OMNs that were studied (*furniture, clothing, jewelry, silverware, mail*) all showed the same (near-unanimous) level of counting-based answers as the CNs (*shoes, candles, cups, plates*). Barner & Snedeker conclude that these results support assigning discrete denotations to both CNs and OMNs.



who has more silverware?



who has more shoes?

(Barner and Snedeker, 2005)

who has more?

(Scontras et al., 2017)

Figure 1: stimuli from previous work

This conclusion is not fully warranted by the evidence. First, comparing quantity judgements on OMNs and CNs should better rely on cases where the semantic content of the nouns is as similar as possible. However, most of the examples that Barner & Snedeker used are associated with different concepts and different visual stimuli. Pairs of nouns such as *baggage-bags* or *weaponry-weapons* might be more decisive tests, as they allow us to keep the visual stimuli constant for an OMN and the corresponding CN, thus reduce undesirable confounds. Another

factor that weakens Barner & Snedeker's conclusions has to do with effects of non-linguistic cues on comparative judgements. As has been observed in other works, judgements of counting vs. measurement are affected by the objects that are presented also without naming them (Middleton et al., 2004; Scontras et al., 2017). In Scontras et al.'s experiment, answers to the question *who has more* showed preference for measurement when the visual stimulus contained puddles of milk (Figure 1), dirt or fabric. However, when the items that were shown are commonly perceived as discrete (cups, flowers, jars etc.), the participants' tendency was to count them. These tendencies were significantly strengthened when the items were explicitly described using nouns as in Barner & Snedeker's experiments (e.g. *who has more milk/cups*). Scontras et al. did not study OMNs. However, on the basis of their results we can hypothesize that possible effects of the CN/OMN distinction on comparative judgements might have been masked in Barner & Snedeker's experiments because counting was triggered already by the visual stimuli. For further experimental work, especially on the relevance of context, see the recent review in (Gafni, 2022).

3. Experiment: counting in comparatives with OMNs and CNs

From Scontras et al.'s experiments we learn that there is a strong tendency of comparative expressions to trigger counting of certain objects and measuring of others even when these objects are not referred to explicitly. The presence of the noun was shown to strengthen this tendency across the board. How does this bear on the contrast between OMNs and CNs? Under the "discrete OMN" approach, OMNs should contribute the same discrete semantic content as CNs. This approach was advocated by Barner and Snedeker (2005), Bale and Barner (2009) and Wellwood (2019: p.90), among others, and it leads us to our null hypothesis:

(H_0) OMNs and CNs equally support counting in comparatives.

The alternative, "continuous OMN" approach maintains a semantic difference between OMNs and CNs. Thus, it expects non-cardinal measurement (of volume, size etc.) to be more easily tolerated with OMNs than with CNs, which gives rise to the following alternative hypothesis:

(H_{alt}) CNs support counting in comparatives more strongly than OMNs.
Equivalently: OMNs support non-cardinal measurement more strongly than CNs.

Our goal is to distinguish between hypotheses (H_0) and (H_{alt}). In Barner & Snedeker's stimuli (Figure 1), counting and measurement lead to different truth-value judgements. Barner & Snedeker used their stimuli for probing the discreteness of a noun's denotation. However, comparative judgements as in Figure 1 do not constitute an optimal test of hypothesis (H_{alt}). Following Scontras et al.'s results, we may also hypothesize that such drawings, which contain items that are commonly perceived as discrete, prime counting independently of the noun within the comparative. Thus, Barner & Snedeker's results may be interpreted as falsifying hypothesis (H_{alt}) only because their stimuli favored counting to begin with. Hypothesis (H_0) may be more effectively challenged by (H_{alt}) when pragmatics favors measurement. To this end, we used drawings as in Figure 2 with questions like the following:

(3) Does Ben have more baggage/bags than Anna?

In Figure 2, the female and the male characters ('Anna' and 'Ben') have the same number of bags. However, the total volume of Ben's bags that the drawing represents, as well as their assumed functionality, is reasonably larger than that of Anna's bags. Thus, similarly to

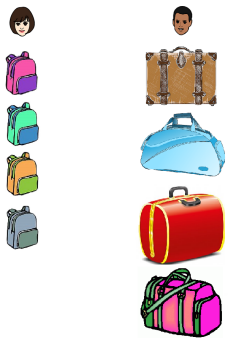


Figure 2: visual stimulus from experiment (*M,C,N,P* conditions)

Barner & Snedeker's experiments, counting and measurement lead to different answers: a 'yes' answer on question (3) unequivocally indicates measurement while a 'no' indicates counting.[2] The question in (3) primes participants to look for a contrast between the two sets of bags in Figure 2. This priming and our everyday assumptions about sizes and functionality of bags, make hypothesis (H_{alt}) expect measurement, hence 'yes' responses, to be more frequent with the OMN *baggage* than with the CN *bags*. The null hypothesis (H_0) expects no such contrast.

3.1. Materials and procedure

We selected the following ten OMN-CN pairs:

(4) *baggage-bags, clothing-clothes, dishware-dishes, equipment-instruments, furniture-sofas, housing-houses, machinery-machines, post-packages, stationery-stationery items, weaponry-weapons*

For each such pair and a corresponding drawing (Figure 5) we presented participants with questions using OMNs and CNs as in (3), where counting and measurement are expected to result in different answers. The pairs of nouns in (4) were selected in consideration of two criteria: (i) minimal referential differences between the OMN and the CN in each pair; (ii) the ease of depicting two sets of four different items, where the items in one set are of a greater size and/or of more diverse functionality. The drawings were depicted so that the nouns in each pair intuitively refer to the same objects. In seven of the ten noun pairs, the nouns are referentially synonymous, hence our assumption that in the drawing they refer to the same objects is straightforward (though not a priori certain, as explained below). In two pairs (*furniture-sofas* and *post-packages*) the OMN is a hypernym of the CN, but the CN and its hypernym OMN intuitively refer to the same entities in the corresponding drawing, since all the pieces of furniture in one drawing are sofas, and all the post items in the other drawing are packages. For one OMN (*stationery*), finding a hyponym CN suitable for the drawing proved hard, and the CN construct *stationary items* was used instead as a 'CN' correlate.

In addition to the two types of questions in (3), we also presented participants with questions

[2]Under Rothstein's or Grimm & Levin's theoretical approaches, a negative answer might also indicate non-dimensional measurement (of functionality or numerosity) whose observed effect would be equivalent to counting. However, support for alternative hypothesis (H_{alt}) would clearly indicate that any "pseudo-counting" effect with OMNs is not as strong as counting with CNs. Teasing apart different possible strategies that amount to counting is not one of our present aims.

like the following:

(5) Does Ben have a greater number of bags than Anna?

This *number of* condition is expected to hold measurement-based comparisons at a minimum despite the pragmatic pressure to answer positively. In total, three yes/no questions as in (3) and (5) were presented with each drawing, with the person having the larger and more diverse items serving as subject, e.g. *Ben* in (3) and (5) in relation to Figure 2. These three conditions per drawing were named *M*, *C* and *N*, where:

M = OMN, e.g. *baggage* in (3)
C = bare CN, e.g. *bags* in (3)
N = *number of* CN, as in (5)

We collected answers on these *M*, *C* and *N* conditions for each of the ten nouns pairs in (4) and the corresponding drawing (Figure 5). The aim of these items was to examine the null hypothesis (H_0) against the null hypothesis (H_{alt}) by comparing the reactions to the *M* and the *C* conditions, and to compare both conditions to the baseline for counting that is established using the reactions to the *N* condition.

Two additional conditions were tested as 'follow-up' conditions with seven of the nouns pairs that in a pilot showed the strongest trends in differences between the *M* and *N* conditions: (*baggage, clothing, equipment, furniture, housing, machinery* and *stationery*). One condition was similar to the *N* condition above, but instead of a CN like *bag* it involved a countable nominal with the corresponding OMN, e.g. *pieces of baggage*. Thus, participants received questions like the following:

(6) Does Ben have a greater number of pieces of baggage than Anna?

We refer to this condition as the *P* ('piece') condition. For *stationery*, where the 'CN' item was *stationery items*, this *P* condition was identical to the *N* condition. The aim of this trial was to verify our assumption about referential identity between the CN and the OMN, by comparing reactions to *P*-questions like (6) and *N*-questions like (5). If the CN and the OMN refer to the same objects in the drawing, we expect the *P* and *N* conditions to lead to similar levels of positive reactions.

Another condition involved comparative questions with OMNs and graphical stimuli similar to Barner & Snedeker's experiment. For instance, question (7) was presented together with Figure 3.

(7) Who has more baggage?

We refer to such items as the *BS* condition. The aim of these items was to replicate Barner & Snedeker's results with the OMNs tested in our main experiment. If pragmatics plays an important role in quantity comparisons, we expect that the different setup might lead to differences in the ubiquitousness of counting in the *BS* and the *M* conditions, although both conditions test counting with the same OMNs.

Using *Prolific*, we recruited 520 participants (400 female, age M=39.2), native speakers of British English. Each participant received no more than four target items in a between subject design: 1-2 mass (M/BS) comparatives and 1-2 count (C/N/P) comparatives in a pseudo-

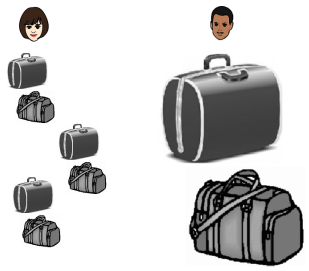


Figure 3: bags in a stimulus similar to (Barner and Snedeker, 2005)

random order. The 2-4 nouns in the target items that each participant received were all from different noun pairs in (4). After answering a training question with a simple comparative judgement,[3] each participant was requested to answer questions like (3), (5), (6) and (7) based on the corresponding drawing. In total, between 39-41 responses were collected for each condition. To distract from the goal of the experiment, each participant was also given three filler items different from the main task.

3.2. Results

For each noun pair and condition, Table 1 shows the number of positive and negative answers with conditions *M*, *C*, *N*, and *P*. Recall that a "yes" response in these conditions indicates the use of measurement rather than counting, agreeing that the character with the larger and/or more diverse items (e.g. Ben in Figure 2) has more than the other character. With respect to the *BS* condition, Table 1 shows the number of answers indicating measurement and counting, e.g. the answers *Ben* and *Anna* respectively in relation to question (7) on Figure 3.

OMN	**CN**	**M+**	**M−**	**C+**	**C−**	**N+**	**N−**	**P+**	**P−**	**BS(m)**	**BS(c)**
baggage	*bags*	16	24	8	32	0	40	0	40	1	40
clothing	*clothes*	9	31	9	31	2	37	6	34	1	40
dishware	*dishes*	4	36	4	36	4	36	-	-	-	-
equipment	*instruments*	15	25	9	31	4	36	9	32	0	41
furniture	*sofas*	13	28	2	39	4	37	6	34	0	40
housing	*houses*	15	25	1	39	3	36	4	36	4	37
machinery	*machines*	7	33	1	39	5	35	4	37	0	40
post	*packages*	3	37	0	39	2	37	-	-	-	-
stationery	*st.items*	17	24	12	28	4	36	-	-	0	39
weaponry	*weapons*	4	36	1	38	3	37	-	-	-	-

Legend: **M**+/−: OMN (e.g. *baggage*) **C**+/−: CN (e.g. *bags*) **N**+/−: *number of* CN
P+/−: *number of pieces of* OMN **BS(m/c)**: measuring/counting OMNs under Barner & Snedeker's test

Table 1: number of positive and negative answers per noun pair and condition

Table 2 shows the frequency of positive and negative responses on the questions in the main conditions *M*, *C* and *N*. As Table 2 shows, the majority of responses on each of these conditions relied on the cardinality of the two collections. However, with the OMNs in the *M* condition

[3] *is there more cereal than pasta*, where the pieces of cereal and pasta are of about the same size, and the volume of cereal is obviously larger.

the tendency to rely on measurement (26%) was considerably increased compared to the bare CNs in the *C* condition (12%). Also the reactions per item in Table 1 show a consistent trend of higher or equal frequency of measurement in the *M* condition compared to the *C* and *N* conditions. As expected, the levels of measurement in *C* and *N* conditions were low (12% and 8%), and items showed no consistent trend between these two conditions.

	Response		
Condition	**No** (%)	**Yes** (%)	**Total**
M (OMN, e.g. *baggage*)	299 (74%)	103 (26%)	402
C (bare CN, e.g. *bags*)	352 (88%)	47 (12%)	399
N (*number of* CN)	367 (92%)	31 (8%)	398

Table 2: totals of positive and negative answers per noun pair and condition (*M*/*C*/*N*)

The data on conditions *M*, *C*, and *N* were analyzed with a mixed models binary logistic regression with response ("yes" or "no") as the target dependent variable, Condition (*M*, *C* or *N*) as a Fixed Effect, and Participants and Noun Pair as random effects. The effect of Condition was significant ($F(2,1196) = 26.26$, $p < .001$). Condition *C* was taken as the baseline, compared to which Condition *M* was significantly different ($b = -.98$, 95% CI $= \{-1.37, -.60\}$, $p < .001$), and Condition *N* was not ($b = .47$, 95% CI $= \{-.01, .94\}$, $p = .056$). Figure 2 shows the 95% Confidence Interval for Odds Ratios with each of the 10 word-pairs comparing the *M* (Mass) and *N* (Number Of) conditions. Six of the text word-pairs showed significantly increased "yes" responses for OMNs (*M* condition) compared to *number of CN* (*N* condition) according to Fisher's exact test, with the remaining four showing no significant effect.

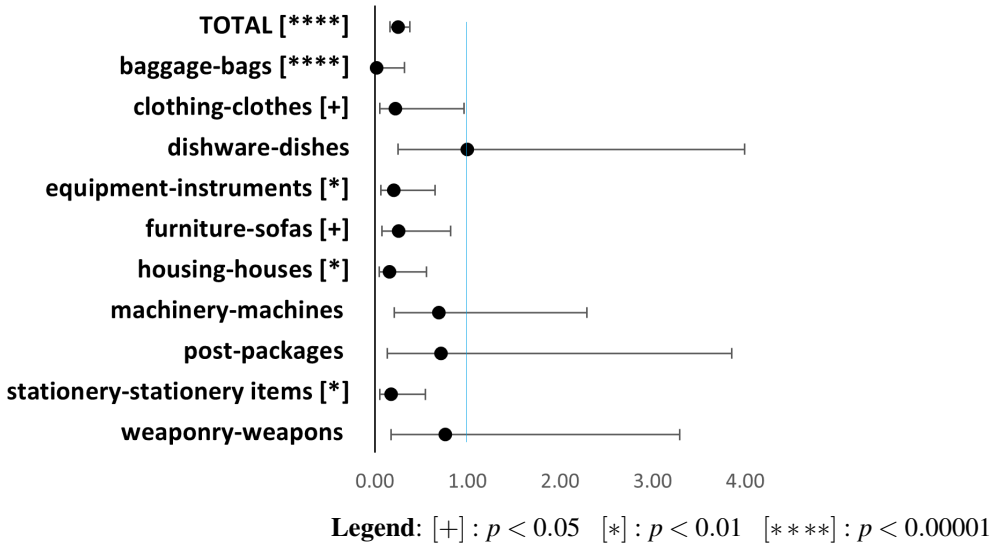


Figure 4: 95% Confidence Interval for Odds Ratios with the 10 word-pairs comparing the *M* (Mass) and *N* (Number Of) conditions

Possible differences in reference between OMNs and corresponding CNs were tested by the first "follow-up" *P* condition (e.g. *number of pieces of baggage*), which was used in comparison to the *N* condition (e.g. *number of bags*). Based on the six word pairs tested in both conditions, the *P* condition led to 29 out of 242 "yes" responses (12%), compared to 18 out of 239 "yes"

responses in the *N* condition (8%). A mixed model logistic regression comparing the two conditions showed no significant difference between these conditions ($F(1,479) = 2.682$, $p = .102$, $b = .520$, 95% CI= $\{-.104, 1.143\}$).

Possible pragmatic differences between our setup and Barner & Snedeker's experiment were tested by the second "follow-up" *BS* condition. In the *BS* condition there were 6 responses out of 283 (2%) indicating lack of counting (e.g. answering *Ben* to question (7) on Figure 3). This is compared to 92 "yes" responses out of 282 (33%) in the *M* condition, which indicate lack of counting for the same seven OMNs. A mixed model logistic regression was run with intercept included and participants and word-pairs as random effects. The fixed effect of Condition was significant ($F(1,563) = 52.07$, $p < .001$), and taking *BS* as baseline: $b = -3.119$, 95% CI = $\{-3.967, -2.270\}$.

3.3. Discussion

The results show that when measurement is pragmatically preferred, participants use it more often in comparatives with OMNs than with CNs or *number of* nominals. Bare CNs showed a similar level of counting as *number of* phrases. These results support hypothesis (H_{alt}) that counting is favored with CNs compared to OMNs. The conclusion is that some semantic or pragmatic distinction should be made between these two noun classes. Section 4 discusses the theoretical implications of this conclusion.

One possible confound that could have led us towards premature rejection of the null hypothesis (H_0) might be that we had overlooked some referential distinctions between OMNs and CNs. For instance, in a pilot study it turned out that the nouns *jewelry* and *jewels* are hard to compare since the latter term, but not the former, also refers to precious stones that may be part of jewelry items. However, among the noun pairs in (4), for no pair did our results show any significant difference between the *N* condition (with CNs) and *P* condition (with OMNs). This suggests that potential referential differences between OMNs and CNs cannot explain our results.

Another possible discrepancy might concern our selection of OMNs. Since the experiment aimed at comparing OMNs and CNs that are referentially identical, the OMNs we selected are different than those in Barner & Snedeker's experiment, which did not aim at such a comparison. These difference in our selection of nouns might be used to explain why our study showed contrasts in counting between OMNs and CNs whereas Barner & Snedeker's experiment did not. However, such an explanation would be highly unlikely. The *BS* condition involved the OMNs we selected using the same kind of stimuli as in Barner & Snedeker's experiment, and showed counting effects at ceiling similar to their results. We conclude that Barner & Snedeker's results are likely to be robust among MNs that are commonly classified as OMNs, and that the significant differences we found between the *BS* and *M* conditions result from the different pragmatic pressures that these two conditions introduce: while Barner & Sneder's stimuli do not pragmatically favor measurement over counting, our three main conditions (*M*, *C* and *N*) do.

4. General discussion

We classified two general theoretical approaches to OMN semantics. The "discrete OMN" approach takes the denotation of OMNs to be discrete like that of common nouns. The "continuous OMN" approach takes their denotation to be continuous like that of other mass nouns.

In this section we consider how each of these two approaches may account for the results of our experiments.

According to the "discrete OMN" approach, there is no denotational difference between OMNs and CNs. Syntactically, both OMNs and plural CNs are perfectly grammatical in comparatives. Accordingly, any observed distinction between the OMNs and CNs in comparatives has to be attributed to pragmatics. Let us consider a possible line for such a pragmatic account of our results. Suppose that a speaker intuitively recognizes the syntactic similarity between OMNs like *baggage* and other MNs, e.g. substance MNs like *air*. Such a speaker might be more inclined to use measurement with the OMN *baggage* than with the corresponding CN *bags*. This kind of reasoning may be used to account for our results.

According to the "continuous OMN" approach, the stronger tendency to measure denotations of OMNs can be viewed as a matter of conflicting semantic and perceptual preferences. In ordinary circumstances, the perception of OMN referents as discrete creates a strong pressure to count them. Thus, the continuous denotation of an OMN has to be "packaged" according to the discrete perception of its referents. This assumed packaging with OMNs may occur by default, when no contextual preferences go against it. It is similar to exceptional packaging processes that also happen with SMNs like *three beers*, which is interpreted as "three bottles of beer" (Wiese and Maling, 2005). The denotation of an OMN like *furniture* is as continuous as that of an SMN like *beer*, but in normal circumstances a comparative like *more furniture* is interpreted as if it meant "more pieces of furniture". Despite this default interpretation, since the denotation of OMNs is lexically continuous, measurement comes more easily with them than with CNs whenever the context favors it.

Let us illustrate how these two approaches can be formalized. In the "continuous OMN" approach, we recognize three factors that potentially prime measurement:

- A continuous lexical denotation of the noun, which by assumption characterizes OMNs similarly to SMNs.
- Perceiving the referent of the noun as continuous, which by assumption characterizes SMNs but not OMNs.
- Pressures of the linguistic context to measure quantities, which by assumption characterizes our experiment but not Barner & Snedeker's experiment.

Let us suppose that each of these factors is a binary variable that equally contributes to the decision on measurement vs. counting.[4] For convenience, let us assume that each of the three variables contributes a value of 0 or 3 towards the measurement decision. The three values are arithmetically averaged. Summarizing these assumptions, we get the situation in Table 3.

The Denotation factor in Table 3 describes whether the assumed denotation in the "continuous OMN" approach is continuous (with OMNs and SMNs) or discrete (with CNs). The Perception factor models whether the referent of the noun is by default perceived as continuous (with SMNs) or discrete (with CNs and OMNs). The Context factor models the contribution of the

[4]The assumption about binary variables is suitable when it comes to the lexical denotation of the noun (which by all accounts is either discrete or continuous), but not to perceptual and contextual factors, which are reasonably non-categorical. This however does not affect the main point of our analysis here. A similar caveat holds with respect to our tentative assumption that all three factors equally contribute to the decision.

	SMN	OMN	CN	
Denotation:	3	3	0	
Perception:	3	0	0	
Context A:	0	0	0	no priming of measurement (Barner and Snedeker, 2005)
Context B:	3	3	3	priming of measurement (our experiment)
Average Context A:	2	1	0	
Average Context B:	3	2	1	

Table 3: factors affecting measurement (3=strong bias towards measurement, 0=no bias)

linguistic context towards measurement. In Barner & Snedeker's experiments (context A), where speakers are simply asked "who has more SMN/OMN/CN", we assume that the context does not contribute any bias towards measurement. In our experiment (context B), we assume this bias is positive. These assumptions lead to the following formal results. First, in all contexts, the bias towards measurement is stronger with SMNs than with OMNs, and is stronger with OMNs than with CNs. Second, in the context of our experiment (B), the bias towards measurement with OMNs may reach a relatively high level, whereas in the context of Barner & Snedeker's experiment (A) the bias towards measurement is relatively low with OMNs. Assuming a threshold model as in (Hampton, 2007), this situation can explain the near unanimous counting with OMNs in Barner & Snedeker's experiment, and the increased tendency towards measurement with OMNs in our experiment as compared to CNs. The counting/measurement decision is a categorical decision. Let us suppose that for all speakers, the threshold value for making this decision lies between 1 and 3. Thus, for some threshold value $t \in (1,3)$, if the total average of the measurement biases is greater than or equal to t, the speaker will use measurement, and if it is below t, the speaker will count. When using this threshold, it follows from Table 3 that all speakers will equally use counting with CNs and OMNs in Barner & Snedeker's experiments (context A), since their threshold for measurement is above 1, while both OMNs and CNs have an average measurement bias that is 1 (with OMNs) or lower (with CNs). In our experiment (context B), the same model expects a difference between OMNs and CNs. With OMNs, a speaker may or may not measure quantities, depending on whether her threshold t is below 2 or not. With CNs, all speakers are expected to use counting since their threshold is above 1, thus above the measurement bias for CNs.

A similar model could be developed within the "discrete OMN" approach, but it would be less plausible. In this approach the denotations of both OMNs and CNs are discrete. Thus, the denotation of the noun aligns with the perceptual preferences for discreteness/continuity.[5] As mentioned above, in the "discrete OMN" approach any difference between OMNs and CNs can only come from pragmatically assimilating OMNs to SMNs. Adding such an "assimilation" factor would allow the "discrete OMN" approach to emulate the model that is considered above using the "continuous OMN" approach. However, this kind of account would be inelegant. It would require one to encode the syntactic difference between OMNs and CNs in the pragmatics rather than in their denotation. Contrary to what most theories would assume, the mass/count syntax in this analysis would affect pragmatic considerations without having any effect on the

[5]This alignment cannot be assumed to be complete even under the "discrete OMN" approach. As Rothstein (2017) points out, CNs like *cloud* or *fence* may have a bias towards a non-discrete perception since the borderlines between different clouds or fences are often fuzzy.

semantics. Thus, we believe that given the results of our experiment, a semantic account that is based on the overt syntactic mass/count distinctions in languages like English, as in the "continuous OMN" approach, is preferable.

5. Conclusions

With the aim of understanding better the semantics of object mass nouns (OMNs), we reported an experiment where their counting effects in comparatives were contrasted with common nouns (CNs). Our results show a stronger tendency to avoid counting with OMNs compared to CNs. The key to this result was in the use of referentially close OMNs and CNs in contexts that prime measurement. Barner & Snedeker's uniform counting effects with OMNs were replicated with the same nouns. We conclude that the context of the comparative sentence strongly affects whether it is interpreted using counting or measurement of OMN referents. We presented a model where three elements affect the counting vs. measurement decision: semantic denotation, perception of referent, and linguistic context. This type of model is easily implemented within the traditional approach, where denotations of OMNs are continuous similar to other mass terms. While it is evident that measurement effects with OMNs in comparatives are not the preferred option, they show up quite often when the context favors them, which we did not discover with CNs in the same contexts. We believe that potential measurement effects with CNs, although we did not detect them in our study, may appear in contexts that favor measurement more strongly. We also did not address potential counting effects for substance mass nouns like *flour*. However, we believe that further work might show that the syntactic flexibility of comparatives in English, which tolerate both count nouns and mass nouns, may also support this additional semantic flexibility when contextual factors favor it. Further work might be needed in order to test these hypotheses.

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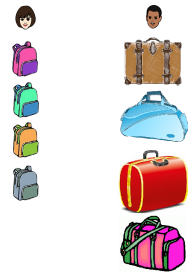
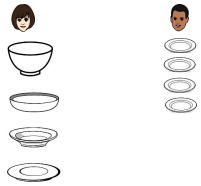


baggage-bags

clothing-clothes



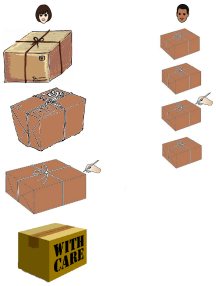
dishware-dishes

equipment-instruments

furniture-sofas

housing-houses

machinery-machines



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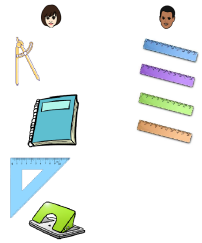

stationery-stationery items

weaponry-weapons

Figure 5: graphical stimuli in main experiment