Counting uncountables and measuring countables – unpreferred, not ungrammatical

English nouns are categorized as 'count' or 'mass' according to grammaticality with numerals (*one tube*/**toothpaste*). This suggests that meanings of count/mass nouns (CNs/MNs) are discrete /continuous, respectively [2,5]. One piece of evidence for this hypothesis is that in comparatives (*more tubes*/*toothpaste*), CNs (MNs) usually trigger counting (measurement, resp.). However, this pattern is complicated by many findings. Comparatives with *object mass nouns* (OMNs) like *mail* or *baggage* often support counting like the CNs *packages* or *bags*. Notably, with stimuli like fig.1 and the question *who has more mail*/*packages*, answers equally showed strong preference for counting [1]. And the puzzle goes beyond OMNs. Some CNs support non-cardinal measurement: e.g. *Anna put more oranges in the punch than Ben* may compare quantities of orange juice rather than numbers of oranges [6]. Conversely, substance MNs (SMNs) like *sand* may trigger counting, e.g. in *there are more stars in the universe than sand on earth*, which compares the number of grains of sand to the number of stars [7]. This leads us to two inter-related problems:

CN problem: To what extent can CNs compromise their count-based interpretation?
MN problem: To what extent can MNs compromise their measure-based interpretation? Specifically, do OMNs support counting as strongly as CNs?

We hypothesize that all nominal comparatives allow both measurement and counting. The choice between strategies is affected both by the discreteness (continuity) of CN (resp. MN) denotations, and by the perception of real-world objects as discrete or continuous [5], which may trigger a shift in denotations. To test this hypothesis, we study four types of contrastive pairs of comparatives:

(1) a. CN vs. OMN: *A has more packages*/*mail than B*
b. CN vs. SMN: *A has more <u>rocks</u> than clay* / *more <u>rock</u> than clay*
(2) a. CN vs. *number of*: *A needs more bananas* / *a greater number of bananas than nuts*
b. SMN vs. *volume of*: *A has more rock than clay* / *a greater volume of rock than clay*

(1a,b) test the effect of the mass/count distinction on quantity judgements, where (1a/b) favors counting/measurement, respectively. (2a,b) test the appearance of measurement with bare CNs (vs. the baseline of 'number of' CNs) and of counting with bare SMNs (vs. 'volume of' SMNs). A central methodological point in this study of "exceptional" strategies is the following assumption:

When choosing a count/*measure interpretation, a speaker needs to consider the most probable way of comparing the salient perceptions of quantities using the given noun.*

For example, let us consider the following sentences in relation to fig.1 (BrE=British English):

(3) a. Anna has more mail (BrE: post) than Ben b. Ben has more mail (post) than Anna
(4) a. Anna has more packages than Ben b. Ben has more packages than Anna

When asked on truth-value of one sentence in (3-4) in isolation, most speakers use counting as a default. Thus, judgements on fig.1 are predominantly positive/negative on (3a,4a)/(3b,4b) resp., as [1] observe. To test the presence of an (unpreferred) measurement strategy, we show a speaker <u>*both*</u> (3a) and (3b) (or (4a) and (4b)), asking her to choose between two statements:

(I) "I imagine either one of the two sentences might be used to describe the situation"
(II) "Only one of the sentences can be used felicitously"

When (II) is selected, we ask on the identity of the unique felicitous sentence. If, despite bias towards counting, OMNs allow measurement more readily than CNs, we should expect speakers to accept (3b) with fig.1 – either by choosing the ambiguous strategy (I) or by unambiguously choosing (3b) in (II) – more frequently than (4b). This guides our testing of all the cases in (1-2).

<u>*Materials & procedure*</u>. For the four sentence types (1a-b,2a-b) we selected nouns as follows:

CN vs. OMN: *packages-post, bags-baggage, instruments-equipment, sofas-furniture, weapons-weaponry, stationery items-stationery*
CN vs. SMN: *rocks-rock* (+*clay*), *chocolates-chocolate* (+*flour*), *stones-stone* (+*soil*), *ropes-rope* (+*sand*)
CN vs. *number of*: *bananas+hazelnuts*, *apples+almonds*, *cod fillets+peas, potatoes+olives*
SMN vs. *volume of*: *rock+clay, chocolate+flour, stone+soil, rope+sand*

This led to 6/4/4/4 ×2 sentence pairs as in (3) and (4). After training with choices like (I) and (II) in contrasts unrelated to mass/count, each participant was presented with one pair of sentences as in (3) or (4) together with a description of a situation where counting and measurement should lead to different answers. She was asked to choose between (I) and (II), and specify her selected sentence in case she chose (II). The four types of stimuli led to five experiments, where situations were described graphically, or, in cases where stimuli proved hard to depict, textually:

Exp1 – OMN vs. CN: graphical, e.g. fig.1 for each of the sentences in (1a)
Exp2(a) – CN vs. SMN: graphical, e.g. fig.2 for each of the sentences in (1b)
Exp2(b) – CN vs. SMN: textual, e.g. the description below for each of the sentences in (1b)
Anna bought: rock(s)-10 pieces of 3kg each (total 30kg); clay- 4 lumps of 25kg each (total 100kg)
Exp3 – CN vs. *number of*: textual, e.g. the description below for each of the sentences in (2a)
Anna needs: 300gr bananas (about 3 medium ones); 100gr hazelnuts (about 60 average nuts)
Exp4 – SMN vs. *volume of*:graphical, e.g. fig.2 for each of the sentences in (2b)

Using *Prolific*, 479/320/321/320/320 different speakers of British English (309/205/178/222/202 female, mean age 42.1/41.9/42.5/39.5/42.2, resp.) were recruited for these five experiments.

Results. In Exp1/2 the CN was expected to show less measurement than the other noun (OMN/SMN, resp.). In Exp3/4, the '*number*/*volume of* phrase was expected to show less measurement/counting than the other noun (CN/SMN, resp.). These expectations were supported by the total acceptance rates of the exceptional strategy, in terms of selecting ambiguity (I) or by selecting the exceptional strategy unambiguously (II). Rates are reported below with respective Odds Ratios and 95% Confidence Intervals and p-values according to Fisher Exact Test:

Exp1- *measure* CN (OMN) 37 (110) of 239 (240): OR=0.22 (95% CI [0.14,0.34], *p<0.00001*)
Exp2(a) - *count* SMN (CN) 58 (104) of 161 (159): OR=0.30 (95% CI [0.19,0.47], *p<0.00001*)
Exp2(b) - *count* SMN (CN) 40 (64) of 160 (161): OR=0.51 (95% CI [0.32,0.82], *p<0.01*)
Exp3 - *measure* CN (*num. of*) 105 (30) of 159 (161): OR=0.12 (95% CI [0.07,0.20], *p<0.00001*)
Exp4 - *count* SMN (*volume of*)58 (18) of 161 (159):OR=0.23 (95% CI [0.13,0.41], *p<0.00001*)

Per items significant differences appeared with 4/3/2/4/3 out of the 6/4/4/4/4 items respectively.

Conclusions. In five experiments, participants were shown a situation where both measurement and counting are pragmatically possible. The variable between participants in each experiment was the linguistic stimulus. The questions tested whether participants experienced ambiguity, or unambiguously preferred one of the strategies. The reactions show decisively that while there is considerable variability in individual responses (likely due to the ambiguity in the task), there is also a clear linguistic hierarchy in terms of tolerance towards measurement/counting. *Number of* phrases are less tolerant towards measurement than bare CNs (Exp3), which are in turn less tolerant towards measurement than MNs (Exp1). Conversely, *volume of* phrases are less tolerant towards counting than MNs (Exp4), which are less tolerant towards counting than CNs (Exp2). Obtaining these results was made possible by acknowledging that pragmatics may overrule linguistic preferences, hence testing for perceived ambiguity is the key for discovering non-salient strategies. Comparative strategies are shown to be inherently ambiguous with both MNs and CNs, though with a substantial role for the mass/count distinction in disambiguating them.

Figure 1: *more post*/*packages*

Figure 2: *more rock*/s *than clay*

[1] Barner & Snedeker 2005. Quantity judgments. *Cognition*. **[2]** Chierchia 1998. Plurality. In *Events & Grammar*. **[3]** Grimm &. Levin 2012. Who has more furniture? In *Mass/Count in Linguistics*. **[4]** Rothstein 2017. *Semantics for counting*. CUP. **[5]** Scontras et al. 2017. Who has more? *LSA*. **[6]** Snyder 2021. Counting. *L&P*. **[7]** Winter 2021. Mixed comparatives, *CSSP*, Paris.