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Sortal concepts and pragmatic inference in children's early quantification of objects

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Abstract

It is typically assumed that count nouns like *fork* act as logical sortals, specifying whether objects are countable units of a kind (e.g., that a whole fork counts as "one fork") or not (e.g., that a piece of a fork does not count as "one fork"). In four experiments, we provide evidence from linguistic and conceptual development that nouns do not specify units of quantification, but include both whole objects and their arbitrary parts in their denotations. We argue that to restrict quantification to whole objects, nominal descriptions are enriched pragmatically, via contrast with alternative descriptions: a piece of a fork is not counted as "one fork" because "one piece of fork" is a better description. Experiment 1 replicated previous findings that children count pieces of broken objects as whole objects (e.g., two pieces of fork as "two forks"), and showed that children also accept whole object labels as descriptions of object pieces (e.g., "two forks" to describe two pieces of fork). Experiment 2 showed that although children accept such descriptions in isolation, they prefer measure phrases (e.g., "two pieces of fork") when they are explicitly presented as alternatives. Experiment 3 found that children were better at excluding pieces from their counts of whole objects when measure phrases were primed prior to counting, making them accessible as alternatives to whole object labels. Finally, Experiment 4 taught children names for novel objects, and found that they do not count parts that are given unique labels or that have properties that suggest they are members of distinct object kinds (e.g., unique functions or physical affordances). Together, our results suggest that for children and adults alike, nominal concepts do not provide necessary and sufficient criteria for excluding arbitrary parts from object kinds. To specify units of quantification – and do the work of sortals – concepts are contrasted with one another and enriched pragmatically.

Keywords: Sortal Concepts; Quantification; Pragmatic Inference; Lexical Semantics.

"Only a concept which isolates what falls under it in a definite manner, and which does not permit any arbitrary division of it into parts, can be a unit relative to a finite Number."

- Gottlob Frege, The Foundations of Arithmetic

What do children learn when they acquire the meanings of nouns? Typically, it is assumed that common count nouns like *dog, table,* and *kite* are logical sortals: they not only distinguish between different kinds of things, but they also encode criteria for judging whether an object is a countable unit of a kind (see Frege, 1884/1980; Strawson, 1959; Quine, 1960; Geach, 1962; Wiggins, 1967). For example, although a request to "count the things in the room" is too vague to satisfy, a request to count "the books" or even "the pages" provides a clear specification of what should be counted. Thus, by most accounts, nouns specify units of quantification, guiding not only counting, but also the use of quantifiers and number marking in natural language. In this paper, we question whether nouns act as sortals, and thus, the role they play in quantification. Based on data from the counting behavior of 3- to 7-year-old children, we argue that the conceptual content of nouns does not alone explain how units of quantification are specified. Instead, we suggest that, to identify individual units, language users supplement noun meanings with a simple form of conversational inference, rooted in the pragmatics of lexical contrast (Clark, 1987, 1990).

There is widespread recognition that nouns play a critical role in specifying units of quantification (for discussion, see Carey, 2009; Macnamara, 1996; Xu, 2007). This is because, in the absence of conceptual constraints, almost anything can be considered an individual unit. Humans count objects ranging from planets and stars to blood cells and molecules. Even substances, events, and abstract entities can be counted, so long as they are first individuated. Nouns are important because they appear to specify which of the many candidate individuals to

consider when choosing units for quantification. This is true not just in the case of counting, but also when interpreting linguistic forms such as quantifiers, determiners, and number agreement.[1]

Despite a general consensus that nouns specify units of quantification, there is little agreement regarding how they might do so, and more generally, what form concepts take. Since Plato, discussions of concepts have begun with the intuition that they might be something like definitions, an idea sometimes called the "classical theory" of concepts (e.g., Carnap, 1932; Locke, 1690; Katz, 1972; see Clark, 1973, for an example from developmental psychology). When we ask, in conversation, "What is a car?" we expect an answer that differentiates cars from all other things, and thus which provides necessary and sufficient conditions for reference. In simple cases, like *car*, the answer might include an appeal to an object's physical constitution (wheels, seats, a protective structure), its function (rapid transportation of multiple people along streets and highways), or its origin (an artifact made by humans, either by hand or by machine; see Bloom, 1996; see also Malt, in press). These criteria offer an account of how a word like *car* might be applied to cars (but not to motorcycles), and whether an individual is the "same car" over time. Further, and most relevant to this paper, they offer an account of what counts as one whole car – e.g., why half of a car cannot be counted as "one car". For example, if a car is an object that fulfills a particular function, and half a car fails to support this function, then half a car does not count as "one car". Thus, in theory, definitions specified by concepts explain how we use words to pick out individual units that belong to members of kinds.

[1] We should note that this conclusion has been largely overlooked by recent work on the approximate number system and "numerical perception", where it is often assumed that the representation of numerosity is automatic and pre-attentive, rather than a computation over conceptually restricted sets of individuals (e.g., Dehaene, 1997; Burr & Ross, 2008; Cantlon & Brannon, 2007).

A problem for the theory that nouns act as sortals, however, and thus for theories of individuation and counting, is that finding a good definition for just about any word is notoriously difficult (Dancy, 1985; Fodor, 1981, 1995; Kripke, 1972; Putnam, 1970; Wittgenstein, 1958). Most, if not all, candidate definitions are subject to exception. For example, Fodor (1981) argues that the verb *paint* cannot mean "cover with paint" since some acts of covering with paint are not acts of painting (e.g., the explosion of a paint factory). Many paradigm cases, including concepts like *bachelor*, *game*, *truth*, and *justice*, have failed to yield agreed upon definitions, even though philosophers have discussed them for centuries. Further, even when definitions can be articulated, they often invoke concepts that are no simpler than those they seek to explain. For example, in Jackendoff's attempt to decompose the verb *kill*, he appeals to the concepts *cause* and *die* (i.e., to kill = to cause to die; see Jackendoff, 1990). The problem is how to decide when to stop: is *die* a primitive, or can it be decomposed further (e.g., cease to live)?

These problems, and others, have led some to abandon the classical theory in favor of accounts that propose statistical prototypes (e.g., Rosch & Mervis, 1975), intuitive theories (e.g., Carey, 1985; Gelman, 2003), or even a complete absence of conceptual structure (e.g., Fodor, 1998). However, these accounts also suffer from serious explanatory limitations, which are as serious, if not more serious than those faced by the classical theory (for review, see Laurence & Margolis, 1999). Thus, although existing theories of concepts offer useful frameworks for guiding empirical investigation, none currently succeed in providing a unified account of how words pick out individual kinds of things. As a result, although most researchers agree that nouns provide conceptual criteria that guide reference and individuation, there is currently no agreed

upon account of exactly how this works, and thus how nouns encode sortal structure to guide counting and quantification.

In the present paper, we explore the idea that nouns do not, in fact, act as sortals in isolation, and thus do not fully specify units for quantification. This idea, which we develop below, has its origin in the history of semantics. In the early part of the 20th century, philosophers of language including Strawson and Carnap, as well as Wittgenstein and others after him, expressed skepticism that linguistic meaning could be understood using precise definitions – e.g., using the tools of formal logic. The primary reason for their doubt was the observation that language is often imprecise and ambiguous – e.g., allowing multiple meanings to be associated with a single form (for an introduction to this issue, see Gamut, 1990; Partee, 2011). However, a key observation, made most famously by Paul Grice (see, e.g., Grice, 1969), is that a logical approach to describing linguistic meaning is tenable if such meanings are supplemented by pragmatic knowledge of how language is used to communicate. In this way, the explanatory burden of semantics is lightened: the logical meanings of sentences are not expected to fully explain their interpretation, but are pragmatically enriched in conversation. Here, we draw on Grice's idea, and argue that nouns may not have to do the work of sortals – and thus, the work of individuation – in isolation. The explanatory burden traditionally placed upon nouns may be lightened by an appeal to the pragmatics of communication.

To understand Grice's idea, consider the statement in (1a), which contains the English quantifier *some*. According to classical logic, this statement would be literally true in a context in which the boy had eaten all of the cookies (since eating *all* of the cookies entails eating *some* of them). However, in conversation, this sentence typically implies that the boy did not eat all of the

cookies. This is because, if the boy had eaten all of the cookies, a cooperative speaker would have said so (as in 1b).

(1) a. The boy ate some of the cookies.

b. The boy ate all of the cookies.

By most accounts, this inference requires that the listener (1) compute a logical meaning for the sentence (using a meaning of *some* that is compatible with all), (2) consider the stronger, alternative, statements that could have been uttered, and (3) negate these stronger alternatives, by reasoning that a cooperative speaker would have uttered them had they been true (i.e., because they are more informative). These alternative statements would be generated by replacing the word *some* with other words from the same semantic class or scale—e.g., quantifiers like *most* and *all.* For this reason, this inference is often labeled a "scalar implicature" (for discussion, see Horn, 1972).

The upshot of this idea, which has been applied not only to quantifiers, but also to logical connectives (*or, and*), number words (*one, two, three*), and a host of other cases, is that semantic theory can preserve the use of concepts and definitions from formal logic if those concepts are supplemented by pragmatic inference (for related discussions, see Horn, 1972; Levinson, 1983; Hirschberg, 1985). Listeners can infer meanings that go well beyond the logical meanings of words when they consider not only what the speaker literally said, but also what they chose *not* to say.

In the present study, we consider a similar approach to the case of nominal concepts, like *shoe* and *fork*, and argue that such concepts do only part of the work required of sortal theory – i.e., specifying units of quantification and counting. Although we do not endorse a classical theory of concepts, we argue that such an approach – or indeed any theory of concepts – may

have a better chance of explaining word meaning if the explanatory burden is lightened by an appeal to pragmatics. For example, if words encode definitions, they may be only partial in nature, and may be "filled out" by considering other words that interlocutors could have used, but chose not to. To explore this idea, we investigated a case study in which children, in contrast to adults, do not appear to use nouns as sortals – i.e., when counting broken objects.

In a seminal study, Shipley and Shepperson presented children with small sets of objects (e.g., forks) in which one of the objects was cut into several pieces. Whereas an adult will count a fork as "one fork" (or sometimes "not a fork") when it is sliced into three pieces, children as old as 7 count such broken forks as "three forks", even when the pieces are lined up carefully and spaced only an inch apart (Brooks, Pogue & Barner, 2011; Shipley & Shepperson, 1990; for related findings in event quantification, see Wagner & Carey, 2003). This behavior persists even when children are asked specifically to count "whole" objects (e.g., "count the whole shoes"), and does not differ from when they are merely asked to "count the things" in an array (Shipley & Shepperson, 1990; Sophian & Kalihiwa, 1998; for a related phenomenon regarding the counting of collections, see Huntley-Fenner, 1995). In fact, children will count the pieces of a broken object if it is broken in front of them, and even if they counted it as "one" only seconds earlier (Brooks, Pogue, & Barner, 2011). Strikingly, children make these errors despite easily reporting that the objects are broken. Children continue to make such errors until at least age 7 (see Sophian & Kalihiwa, 1998; see also Gutheil, Bloom, Valderrama & Freedman, 2004).

Subsequent studies have provided evidence that these failures are not specific to the counting routine, but also arise when children interpret other linguistic forms (Brooks et al., 2011). For example, when asked, "Who has more shoes?" in a situation in which one character had two whole shoes and another had one shoe cut up into three pieces, 4-year-olds reliably

judged that the character with the broken object had more shoes. Children also treated pieces of broken objects as individuals when producing plural morphology, and when interpreting quantity words like *some, both*, and *every* (e.g., in response to "Touch every shoe!"). Together, these studies of quantification suggest that children's nouns do not initially specify units of quantification, and thus do not act as sortals – at least not in the way that they appear to for adults. For children, half of a shoe, despite lacking a shoe's shape and function, still counts as a unit of *shoe* for the purposes of linguistic quantification.

Most significant to the present study, Brooks et al. also found conditions in which children did *not* count pieces of broken objects. Specifically, when 4-year-olds were shown broken objects whose parts had labels in English and had unique functions, they excluded those parts from their counts of whole objects. For example, when shown a bicycle with its wheels removed, children excluded the wheels when asked to count the bicycles. Similarly, they excluded ears when counting rabbits, arms when counting clowns, wings when counting butterflies, and handles when counting umbrellas.[2] Interestingly, children's exclusion of these parts was predicted by their ability to label them in a subsequent task. Children who correctly labeled wheels, ears, wings, etc. when shown these parts in isolation were also less likely to include these parts in their counts of whole objects (for related data regarding the counting of parts, see Giralt & Bloom, 2003).

This set of findings suggests a Gricean solution to how nouns might come to act as sortals. Specifically, children's nominal concepts may not be deficient, and may not differ substantially from those of adults: they may specify precisely the same criteria of individuation. However, just as adults use pragmatic inference to enrich the interpretation of quantifiers and

[2] No rabbits, butterflies, or clowns were harmed in the process of conducting these studies.

logical connectives, they may also use inference to enrich their interpretation of nouns, and to derive clear units for quantification. Specifically, a wheel may not count as a *bicycle* because *wheel* is a better description of the object part than *bicycle*. Thus, when children are asked to "count bicycles", they may exclude wheels because, if the speaker had meant for them to count wheels, then they should have said so. But although children know that words like *wheel* and *bicycle* contrast, and that *wheel* is a better description for wheels than bicycles, they may not spontaneously access better descriptions for arbitrary parts of objects. Thus, children may count half of a shoe as "one shoe" because *shoe* is the best available description of the object.

Here, we pursue this idea, and argue that nothing fundamental changes in children's knowledge of noun concepts between ages 4 and 7. Like 4-year-olds, older children and adults may *not* require that nouns specify a set of necessary and sufficient conditions. Instead, all speakers may rely on noun meanings that provide only partial criteria for identifying units of quantification – whether these are partial definitions, prototypes, or something else. Critically, however, adults may consider a broader set of linguistic expressions against which they can contrast their use of nouns. In particular, when generating alternatives to whole object labels, adults may not only consider the names of parts, but may also consider measure words that apply to arbitrary parts of things, such as *piece, part, half, slice, bit,* and *portion*. For an adult, half of a shoe may not count as "one shoe" because a better description of it would be "one piece of a shoe". Thus, although pieces of shoe may fall under the denotation of *shoe* and satisfy its conditions for kind membership even for adults, "piece of shoe" may be an even better description of such objects (for a related idea, see Hobbs et al., 1993, who treats conceptual interpretation as a form of conceptual abduction – i.e., inference to the best explanation). By this account, young children may include arbitrary broken parts in their counts of whole objects

because they fail to access better, alternative descriptions of these parts – e.g., measure words like *piece, half*, etc.

Interestingly, a similar account has been proposed to explain why children fail to compute scalar implicatures until age 6 or 7. An extensive literature indicates that young children fail to compute scalar implicatures for a variety of scalar contrasts including *some* vs. *all* (Huang, Snedeker, & Spelke, in press; Hurewitz, Papafragou, Gleitman, & Gelman, 2006; Noveck, 2001; Musolino, 2004; Papafragou & Musolino, 2003; Smith, 1980)*, might* vs. *must* (Noveck, 2001), *a* vs. *some* (Barner et al., 2009), and the distinction between inclusive and exclusive *or* (Chierchia, Crain, Guasti, Gualmini, & Meroni, L., 2001; Gualmini, Crain, Meroni, Chierchia, & Guasti, 2001). For example, when shown three horses that all jump over a fence, children accept a sentence like "Some of the horses jumped over the fence" to describe the event, while adults do not. However, when children are explicitly presented with a more informative description as an alternative – e.g., in a forced choice – they easily recognize that a sentence like "All of the horses jumped over the fence" is a better description (see Foppolo et al., 2011; see also Chierchia et al., 2001). This evidence suggests that children have difficulty with forms of pragmatic inference, like scalar implicature, because they are unable to spontaneously activate contrasting, more informative alternatives (e.g., to spontaneously activate *all* when processing *some*; for evidence and discussion, see also Barner & Bachrach, 2010; Barner, Brooks, & Bale, 2011; Stiller, Frank, & Goodman, 2011).

Our proposal is that a similar difficulty explains children's counting of broken objects. As in the case of quantifiers and other scalar items, children may learn descriptions for arbitrary parts of objects like *piece* and *half* relatively early in acquisition, but may not spontaneously activate these descriptions as contrasting alternatives when interpreting nouns for whole objects

like *shoe* and *fork*. Thus, children may fail to exclude arbitrary parts of shoes from their counts of shoes because they fail to access a better label for these objects than *shoe*. Critically, we are not suggesting that the inference young children fail to make when they count broken objects is a kind of scalar implicature. Our proposal is simply that this inference, like scalar implicature, relies on an ability to access relevant alternative descriptions, and that in both cases this ability emerges late in acquisition, around the age of 6 or 7.

The present studies test this idea by investigating how knowledge and access to part names and measure words affects children's counting behaviors. In Experiment 1 we replicate previous findings that children count arbitrary pieces of broken objects. Also, we extend this finding using a variation of the Truth Value Judgment task (see Crain & Thornton, 1998), which has been used frequently to assess pragmatic competence in studies of young children. In Experiment 2, we test when children begin to comprehend measure words like *piece* and *half,* a prerequisite to treating them as alternatives to descriptions using whole object labels. Also, we ask whether children succeed at mapping whole object labels and measure phrase descriptions to their referents when these descriptions are explicitly contrasted in a forced choice. For example, we test whether young children prefer measure phrases descriptions (e.g., "two pieces of shoe") over whole object descriptions (e.g., "two shoes") when labeling parts of broken objects. In Experiment 3, we ask whether priming measure phrases, to make them accessible as alternatives to whole object labels, leads children to exclude parts of broken objects from their counts of whole objects. Finally, in Experiment 4, we revisit the finding that younger children exclude nameable parts from their counts (e.g., wheels when counting bicycles), and explore whether this performance is truly explained by contrasting linguistic alternatives, or instead by other non-

linguistic information. To do so, we teach children labels for novel objects and manipulate whether their parts have unique labels and functions.

Experiment 1

Experiment 1 had two goals. First, we sought to replicate previous findings that children count parts of broken objects until at least age seven using our own stimulus set (also used in Experiments 2 and 3, below; see Appendix A). To do this, we tested 3- to 7-year-old children with a Broken Object Counting task. In this task, we presented children with small sets of objects (e.g., socks) in which one of the objects had been cut into two or three pieces. We then asked them to enumerate the sets using whole object labels (e.g., "Can you count the socks?"; see Figure 1b). Second, to probe the relation between children's counting behavior and previously attested failures with pragmatic inference, children also participated in a Felicity Judgment task (which was administered prior to the Broken Object Counting task). This task, which resembles the Truth Value Judgment task (see Crain & Thornton, 1998), has been used in previous studies to test children's ability to compute conversational implicatures (e.g., Chierchia et al., 2001; Papafragou & Musolino, 2003). For example, in previous studies, children were shown a scene – e.g., in which three out of three horses jumped over a fence - and were then asked to judge whether a puppet's logically correct but under-informative description (e.g., "Some of the horses jumped over the fence") was "good" or "bad". By previous accounts, children's failure to reject such under-informative descriptions results from their inability to generate better, alternative descriptions - e.g., "All of the horses jumped over the fence" (see Barner & Bachrach, 2010; Barner et al., 2011; Chierchia et al., 2001; Foppolo et al., 2011).

In our Felicity Judgment task, children watched a character describe an array containing broken objects, and then decided whether the character did a "good job" or "bad job". For

example, on one trial, children were shown two socks that had each been cut in half. They then heard a character describe the array as "four socks" and were asked whether he did a good or bad job (see Figure 1a). If children's failure to exclude pieces of broken objects is caused by factors analogous to their problems with scalar implicature – i.e., difficulty accessing more informative alternatives (e.g., "pieces of sock") – then their performance on the Felicity Judgment task should predict their performance on the Broken Objects Counting task. Experiments 2 and 3 provide a more direct test of this idea, by exploring children's acquisition of and access to measure word descriptions.

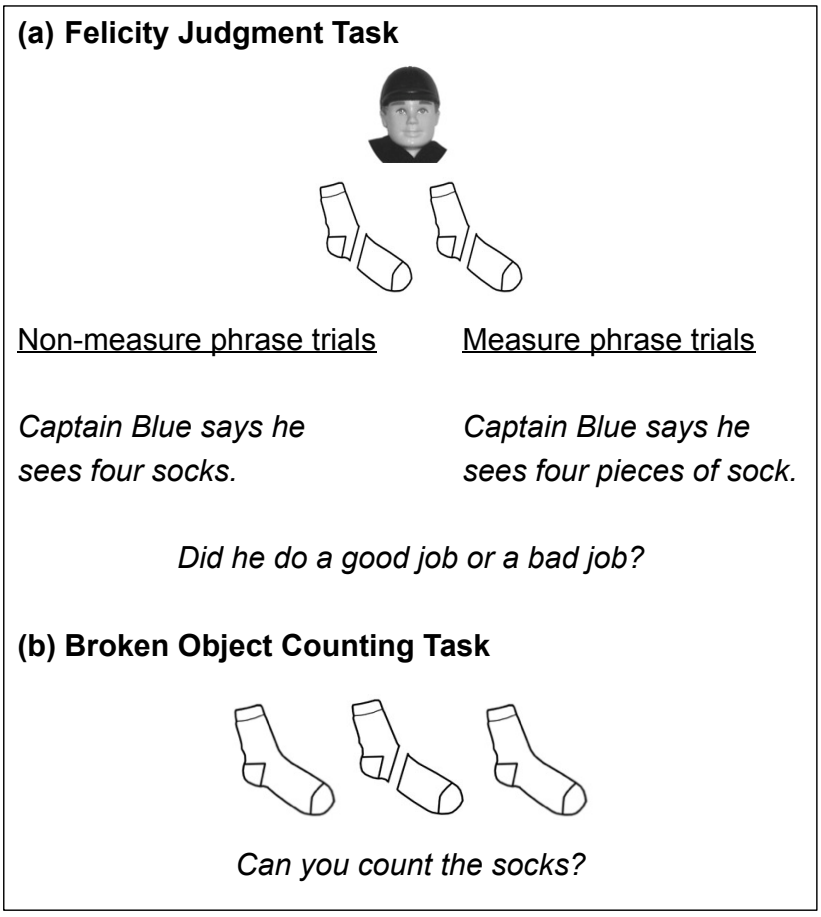

Figure 1. Sketches of Experiment 1 stimuli and procedures.

Method

Participants. The participants were 41 monolingual English-speaking children (20 boys) between the ages of 3;11 and 7;6 (M = 5;5; SD = 12 months). An additional nine children participated but were excluded because they didn't finish the task (n = 1), responded incorrectly to the two warm-up trials of the Felicity Judgment task (n = 5), or responded incorrectly to two or more of the control trials that were used to evaluate their understanding of that task (n = 3). In all experiments presented in this paper, children were recruited either by phone and brought into the lab, or at daycares and museums in the San Diego area. All children received a token gift for participating. A group of 16 students attending the University of California, San Diego also participated.

Materials and Procedure. The Felicity Judgment task was always presented first, and the Broken Objects Counting task was always presented second. For each task two item orders were created and counterbalanced across participants.

***Felicity Judgment Task*.** Participants were first introduced to a character named Captain Blue, and were told that he would describe the objects that were placed in front of him. They were told that they had to decide whether Captain Blue did "a good job" or "a bad job". Two warm-up trials ensured that participants could judge that Captain Blue did a good job when he provided an appropriate description (e.g., when he stated that he saw an apple and an apple was present) and that he did a bad job when he provided a poor description (e.g., when he stated that he saw a ball and only a cup was present). If participants responded incorrectly to either item, they were given feedback and another chance to respond.

Each participant completed eight critical trials and four control trials. The first four critical trials were non-measure phrase trials. On these trials, participants saw sets that included broken objects and then heard Captain Blue provide descriptions that incorrectly used whole

object labels – e.g., describing two socks that had each been cut in half as "four socks" (see Figure 1a). On two of the non-measure phrase trials there was one whole object and one broken object cut into two pieces. On another trial there was one broken object cut into two pieces. On the final trial there were two broken objects that had each been cut into two pieces. After the non-measure phrase trials, participants received four measure phrase trials. These items were always administered after the non-measure phrase trials, because we did not want to make measure phrases (e.g., "piece of sock") available to children as they were judging the non-measure phrase trials. On the measure phrase trials, Captain Blue correctly described sets containing broken objects by using the measure words *piece* or *half* – e.g., describing two socks that had each been cut into two pieces as "four pieces of sock" (see Figure 1a). The word *piece* was used on two of the trials, each of which contained two broken objects that had each been cut into two pieces (e.g., "four pieces of sock"), and the word *half* was used on the other two trials, each of which contained one broken object that had been cut into two pieces (e.g., "two half plates"). For both measure phrase and non-measure phrase trials, sets consisted of socks, forks, plates, or shoes (see Appendix A). In each set, the pieces of the broken object were carefully aligned and separated by approximately 2.5 cm, so that the relationship between them would be clear.

In addition to the eight critical trials, participants also received four control trials, which were interspersed with the critical trials. On these trials, Captain Blue always provided an incorrect description of a set of whole objects. On two trials, Captain Blue incorrectly described the color of the objects (e.g., saying that a set of green blocks were red), and on the other two trials, he incorrectly described the objects' location (e.g., saying that a set of oranges that are on

a table were in a box). Items included toy cars, plastic oranges, plastic lemons, and blocks. Three children were excluded for incorrectly responding to more than one of the four control trials.

***Broken Object Counting Task*.** This task was modeled after Shipley and Shepperson (1990). On each trial, a set of objects was presented to the participant, consisting of two whole objects and a third object that had been cut into either two or three pieces. The experimenter then asked the participant to count the objects on the table, using the whole object label (e.g., "Can you count the [socks]?"; see Figure 1b). Participants completed eight trials, with two trials for each of four object kinds. As in the Felicity Judgment task, the objects were forks, socks, plates, and shoes (see Appendix A). On four of these trials, one of the objects in the array had been cut into two pieces, and on the other four trials, the object had been cut into three pieces. As in the Felicity Judgment task, the pieces of the broken object were separated by approximately 2.5 cm and aligned with one another.

Results and Discussion

The dependent measure for the Felicity Judgment task was the proportion of correct responses provided, averaging across the two types of critical trials – i.e., "bad job" responses on the four non-measure phrase trials (e.g., on which Captain Blue incorrectly described two socks that had each been cut in half as "four socks") and "good job" responses on the four measure phrase trials (e.g., on which Captain Blue correctly described two socks that had each been cut in half as "four pieces of sock").[3]

Adult participants responded as expected on the Felicity Judgment task, and gave correct responses on 95% of trials. They judged that Captain Blue did a good job on measure phrase trials on 92% of trials and a bad job on non-measure phrase trials 97% of the time (both better

[3] Preliminary analyses for this experiment and for the other experiments reported here did not find significant effects of gender. We have thus excluded this factor from our analyses.

than chance, *p*'s < .05). Overall, the children also performed relatively well, responding correctly on 70% of trials, which was significantly better than expected by chance (Wilcoxon Signed-Rank $T = 47$, $n = 32$, $p < .01$). They judged that Captain Blue did a good job on measure phrase trials 68% of the time, and a bad job on non-measure phrase trials 71% of the time (both *p*'s < .05). However, children responded correctly significantly less often than adults (Mann-Whitney $U = 134.5$, $n = 57$, $p < .001$). Further, although children generally performed well when all ages were considered together, the youngest children performed poorly, often treating parts as equivalent to whole objects when making felicity judgments. Specifically, 4-year-olds ($n = 13$) responded correctly on only 57% of trials. In contrast, performance was higher in the older age groups: 5-year-olds ($n = 15$) responded correctly on 74% of trials, 6-year-olds ($n = 7$) on 73% of trials, and 7-year-olds ($n = 4$) on 84% of trials. Overall, there was a significant correlation between age and performance on the Felicity Judgment task ($r(39) = .44$, $p < .005$).

The dependent measure for the Broken Object Counting task was the proportion of trials on which participants counted the pieces of a broken object as whole objects. Adults never counted pieces as whole objects: on 12% of trials they excluded pieces from their counts entirely (e.g., counting two whole socks and a third broken sock as "two socks"), and on 88% of trials they counted the pieces of a broken object as a single, whole object (e.g., counting two whole socks and a third broken sock as "three socks"). In contrast, children counted object pieces as whole objects on 57% of trials, which was significantly more often than adults ($U = 276$, $n = 49$, $p < .001$). On the 43% of trials in which children did not count pieces as whole objects, they counted like adults, and counted the pieces of a broken object as a single whole object on all trials. Also, on these trials, children always counted whole objects like adults – they never counted a whole object multiple times (e.g., by counting its parts or double-counting the whole

object), and they never failed to count a whole object altogether. These results are similar to those of Shipley and Shepperson (1990), who found that 3- to 6-year-olds counted the pieces of broken objects on 56% of trials when pieces were aligned and closely spaced (as they were here).

A multiple regression explored whether children's counting behavior was predicted by their performance on the Felicity Judgment Task. The dependent variable was the proportion of trials on which children counted pieces of broken objects as whole objects. The independent variables were children's proportion of correct trials on the Felicity Judgment task, and their age (in months). This analysis revealed that performance on the Felicity Judgment task reliably predicted the counting of parts as whole objects (B = -.81, SE = .32, $p < .05$), while age was not a significant predictor (B = .002, SE = .007, *ns*). On 2% of the trials on which children counted pieces as whole objects, they also counted whole objects in a non-adult-like way – e.g., by counting them multiple times. To ensure that our findings were unrelated to these errors, we repeated our analysis and excluded trials on which errors were made. As before, performance on the Felicity Judgment task was a significant predictor of counting behavior (B = -.81, SE = .32, $p < .05$), while age was not (B = .002, SE = .006, *ns*).

Together, these results replicate previous findings that children count parts of broken objects when asked to count whole objects, and showed that children's felicity judgments of descriptions of broken objects were a significant predictor of adult-like counting. Critical to our hypothesis, successfully making felicity judgments requires not only an ability to correctly enumerate sets, but also an ability to comprehend measure words and recognize that they are appropriate descriptions of broken objects. In Experiment 2, we explored the acquisition of measure words, and whether access to these words might allow children to exclude pieces from their counts of whole objects.

Experiment 2

In Experiment 1, we replicated the previously reported finding that young children – at least until the age of 7 – count pieces of broken objects (e.g., pieces of a sock) when asked to count whole objects (e.g., to "count the socks"). We also provided evidence that children's understanding of descriptions of broken objects develops between the ages of 4 and 7. Although 4-year-olds were not readily able to make appropriate felicity judgments – e.g., to recognize that "four socks" is a bad description of two socks that had each been cut in half, and that "four pieces of sock" is a good description – older children were better at making such judgments. Most importantly, we showed that children's ability to make such judgments is a significant predictor of their counting of broken objects. This is consistent with the idea that children count broken pieces as whole objects because they fail to access better descriptions of them – e.g., measure words like *piece* and *half*.

Experiment 2 contrasted two possible reasons that children might fail to access measure words when interpreting whole object labels. First, children may fail to access measure words because they have not yet acquired their meanings – i.e., they may lack these words altogether, or fail to understand how they contrast with whole object labels. This, for example, could explain the relatively poor performance of 4-year-olds at making felicity judgments in Experiment 1. Alternatively, children may acquire measure words early in life – e.g., by age 4 – but fail to generate them as relevant alternatives to whole object labels. That is, children may count a piece of a shoe as "one shoe" because they fail to spontaneously activate "one piece of shoe" as an alternative, contrasting, description.

If children have acquired measure words but fail to generate them as alternatives to whole object labels, then they should perform similarly to adults when measure words are provided

explicitly as alternatives to whole object labels (for related evidence from the pragmatics literature, see Chierchia et al., 2001; Gualmini et al., 2001), and should do so prior to the age at which they succeed at broken object counting tasks (i.e., around age 7; Sophian & Kalihiwa, 1998). To test these predictions, Experiment 2 probed 3- and 4-year-old children's comprehension of measure words in three tasks (see Figure 2). In the Semantic Forced Choice task, we asked children to choose which of two sets was the referent of a single description – e.g., whether "two shoes" better applied to a shoe broken into two pieces or to two whole shoes. The Verbal Forced Choice task reversed this scenario, and asked children to choose between two alternative descriptions of a single set – e.g., whether "two shoes" or "two pieces of shoe" was a better description of a shoe broken in half. Finally, in the Measure Word Comprehension task, children were presented with four images, each of which included a different quantity or portion of an object (e.g., one quadrant depicted one whole apple, another half an apple, etc.). Children were asked to indicate which of the arrays was the best referent of a quantifying expression (e.g., "Point to an apple", "Point to half an apple", etc.).

Method

Participants. The participants were 42 monolingual English-speaking children (17 boys) between the ages of 3;0 to 5;0. There were 21 3-year-olds (*M* = 3;4, 3;0 - 3;10, 10 boys) and 21 4-year-olds (*M* = 4;6, 4;0 - 5;0, 7 boys).

Materials and Procedure. The Semantic Forced Choice and Verbal Forced Choice tasks were always presented first, and their order was counterbalanced between subjects. The Measure Word Comprehension Task was always presented last. Two versions of each task were constructed, which varied the order in which items were presented. Item order was counterbalanced across participants for each task.

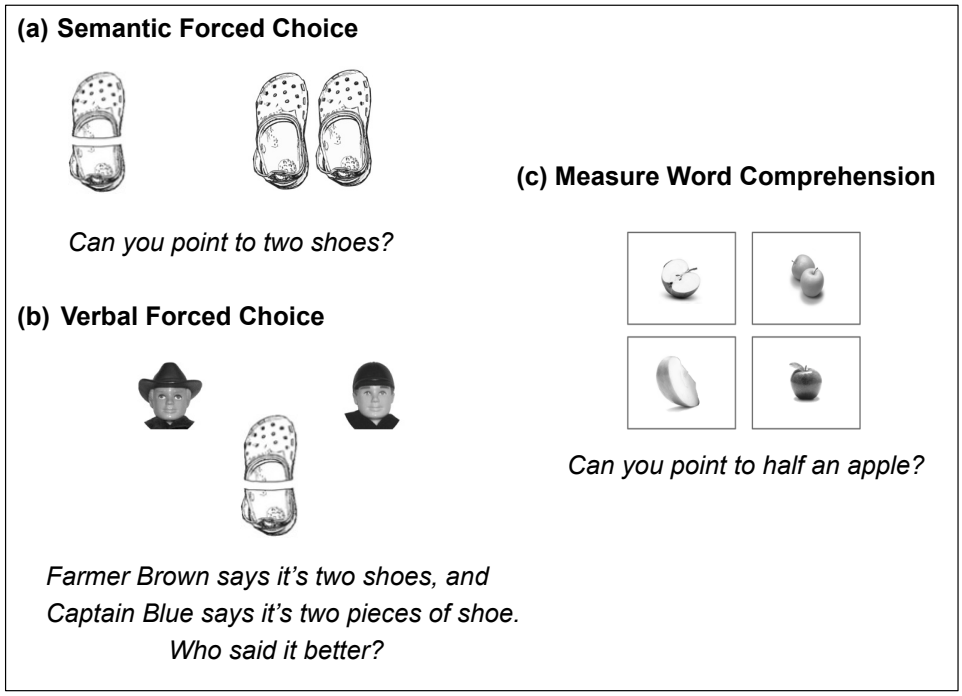

Figure 2. Sketches of Experiment 2 stimuli and procedures.

Semantic Forced Choice. On each trial, the experimenter presented the child with two sets: two identical whole objects of a single kind (e.g., two shoes) and a single object of the same kind that had been cut in half (e.g., two pieces of a shoe). As in Experiment 1, four kinds of objects were used across the critical trials: socks, forks, cups, and shoes (see Appendix A). As before, the pieces of broken objects were closely aligned with one another.

After presenting the two sets, the experimenter asked the child to indicate which set was the referent of a target quantity phrase (e.g., "Can you point to two [shoes]?"; see Figure 2a). Four target phrases were tested: "two [shoes]", "two half [shoes]", "two pieces of [shoe]", and "two whole [shoes]". Each child completed eight trials, and responded to two trials for each of the four target expressions. The side on which the correct set was presented was randomized across trials.

Verbal Forced Choice. On this task, children were presented with a single set and were asked to choose which of two different quantity expressions best described it. The sets were identical to those used in the Semantic Forced Choice task.

Prior to the task, the child was introduced to two characters: Farmer Brown and Captain Blue. The children were told that they would be shown some objects and then would have to decide whether Farmer Brown or Captain Blue described them better. On each trial, a set consisting of either two whole objects (e.g., two shoes) or one object cut in half (e.g., two half shoes) was placed in front of the child. The child then chose between a description of the set that used a whole object label and a description that used a measure phrase – e.g., "Farmer Brown says that it's two [shoes] and Captain Blue says that it's two pieces of [shoe]. Who said it better?" (see Figure 2b).

Each child completed eight trials. Four trials contrasted *whole* expressions with *half* expressions (e.g., "two whole [shoes]" vs. "two half [shoes]"), and the other four trials contrasted expressions using whole object labels with *piece* expressions (e.g., "two [shoes]" vs. "two pieces of [shoe]"). We counterbalanced whether Farmer Brown or Captain Blue provided the correct description across the trials.

Measure Word Comprehension. On each trial, the children were shown a powerpoint slide including four images organized into quadrants (see Figure 2c). Each image depicted a different quantity or portion of a particular object type: a whole object (e.g., an apple), a half of the same kind of object (e.g., half of an apple), a small piece of the same kind of object (e.g., a slice of an apple), and a plural set containing more than one instance of the whole object (e.g., two apples). On each trial, children were asked to indicate which image was the referent of a target quantity phrase (e.g., "Can you point to half an [apple]?"; see Figure 2c). The four phrases

used were: “half an [apple]”, “a whole [apple]”, “a piece of [apple]”, and “an [apple]”. Four object types were used: eggs, tables, envelopes, and apples (see Appendix B for images of all slides). There were 16 trials, which fully crossed object type with quantity phrase. Across trials, we randomized the quadrant in which the correct quantity was depicted.

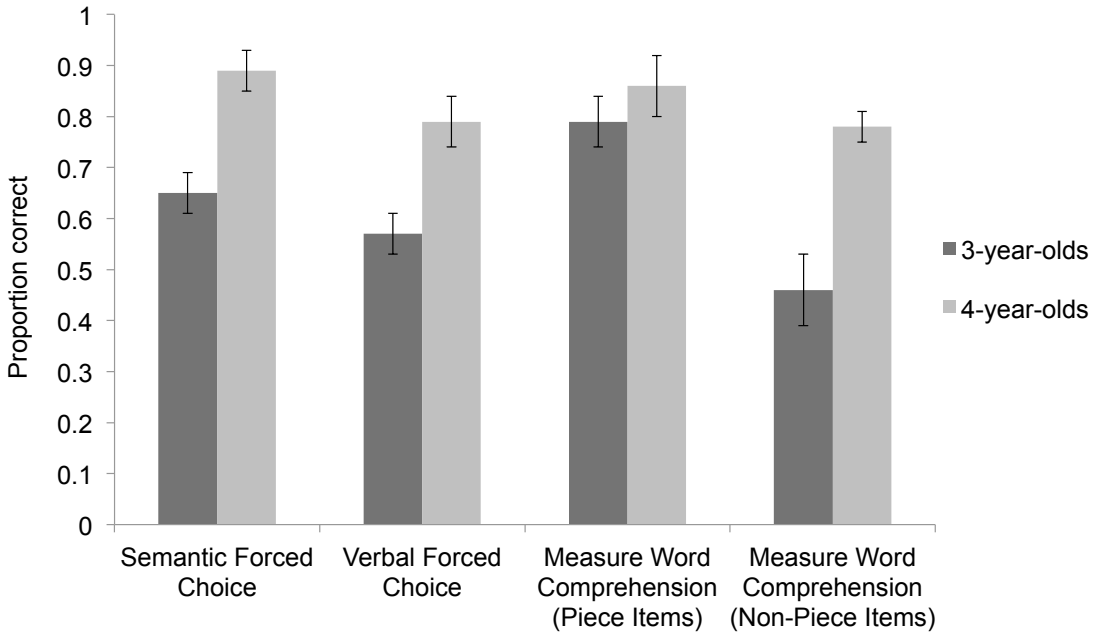

Figure 3. Proportion of correct responses by 3- and 4-year-olds on the tasks of Experiment 2.

Results and Discussion

Our dependent measure for each of the three tasks was the proportion of children’s responses that were correct (see Figure 3). For the Semantic Forced Choice and Verbal Forced Choice tasks, we defined chance responding as 50%, because there were always two possible responses on these tasks. For the Measure Word Comprehension task, we defined chance responding as 50% for the items that tested understanding of the *piece* phrase, because two of the four possible answers were acceptable for these items (i.e., *piece* can apply to half of an object or to a small piece of that object). However, for the rest of the items of this task, we defined chance as 25%, because only one of the four answers could be considered correct.

The 4-year-olds demonstrated a relatively sophisticated understanding of measure phrases across the three tasks. They responded correctly reliably more often than chance in the Semantic Forced Choice task ($M = .89$, $SE = .04$; Wilcoxon $T = 0$, $n = 20$, $p < .01$), in the Verbal Forced Choice task ($M = .79$, $SE = .05$; $T = 2.5$, $n = 18$, $p < .01$), and in the Measure Word Comprehension task, for both the *piece* items (M = .86, $SE = .06$; $T = 10.5$, $n = 18$, $p < .01$) as well as the other items ($M = .78$, $SE = .03$; $T = 0$, $n = 21$, $p < .001$).

Our data indicate that even 3-year-olds have some understanding of measure phrases. The 3-year-olds were reliably above chance in the Semantic Forced Choice task ($M = .65$, $SE = .04$; $T = 7.5$, $n = 21$, $p < .01$), and in the Measure Word Comprehension task—for both the *piece* items ($M = .79$, $SE = .05$; $T = 3.5$, $n = 16$, $p < .01$) as well as the other items ($M = .46$, $SE = .07$; $T = 28.5$, $n = 18$, $p < .01$). However, they did not perform reliably above chance in the Verbal Forced Choice task ($M = .57$, $SE = .04$; $T = 30$, $n = 14$, *ns*).

The results suggest that significant changes occur in children's understanding of measure phrases between the ages of 3 and 4. The 4-year-olds responded more accurately than the 3-year-olds in the Semantic Forced Choice task (Mann-Whitney $U = 363$, $n = 42$, $p < .001$), and while 13 out of 21 4-year-olds responded correctly to all of the items of this task, only 2 out of 21 three-3-olds did so, $\chi^2(1, n = 42) = 12.55$, $p < .001$. The 4-year olds also performed better than the 3-year-olds on the Verbal Forced Choice task ($U = 337.5$, $n = 42$, $p < .005$), and while 8 of 21 4-year-olds responded correctly to all of the items of this task, only 2 of 21 3-year-olds did so, $\chi^2(1, n = 42, p < .05) = 4.73$. Finally, although the 4-year-olds did not outperform the 3-year-olds on the *piece* items of the Measure Word Comprehension task ($U = 267.5$, $n = 42$, *ns*), they did on the other items of the task ($U = 347$, $n = 42$, $p < .001$).

These findings suggest that children's counting of parts as whole objects is not due to an ignorance of measure phrases or how they contrast with whole object labels. Four-year-olds clearly understand words like *piece* and *half* and have little difficulty mapping them to their referents. Further, when measure phrases are explicitly offered as alternative descriptions of broken objects, 4-year-olds strongly prefer them over whole object labels. Thus, although 4-year-olds have difficulty rejecting infelicitous descriptions when they are presented in isolation (e.g., to recognize that "three forks" is a bad description of three pieces of fork; see results of the Felicity Judgment task of Experiment 1), they choose better alternative descriptions when they are explicitly provided (e.g., "three pieces of fork"). This is consistent with the idea that the exclusion of broken objects from counts of whole objects depends on an ability to spontaneously access relevant, contrasting alternatives – an ability that, for both measure words and scalar words (e.g., *some* and *all*), might emerge at around the age of 7 (see Chierchia et al., 2001, for a similar pattern of results for scalar implicature). To further explore this idea, in Experiment 3 we asked whether 4- and 5-year-old children are more likely to exclude pieces from their counts of whole objects when measure word descriptions are provided in a prior task, thereby priming them for use when counting.

Experiment 3

Experiment 3 tested the idea that access to measure word descriptions for broken objects allows children under age 7 to count sets like adults. To explore this, we tested 4- and 5-year-old children with a broken object counting task but preceded this with a task designed to facilitate children's access to measure phrase descriptions. Before each counting trial, children in the Forced Choice Priming condition were asked to make a series of forced choices regarding the referents of a whole object label and measure phrase (modeled after the Semantic Forced Choice

task of Experiment 2). For example, children were presented with a sock and a piece of a sock, along with alternative descriptions of those objects (e.g., "Look! I have here a sock and a piece of a sock"). They were then asked, "Can you point to the sock?" and "Can you point to the piece of a sock?". After children responded to each question, they were asked to count a set of whole and broken socks (as in Experiment 1; see Figure 4b). If children under age 7 fail to exclude parts of broken objects because they are unable to spontaneously consider better, alternative descriptions, then counting should become significantly more adult-like when alternative descriptions have been made salient in the context. To test this possibility we compared the counting of children in the Forced-Choice Priming condition to that of children in a Baseline condition, who did not receive the priming manipulation (see Figure 4a).

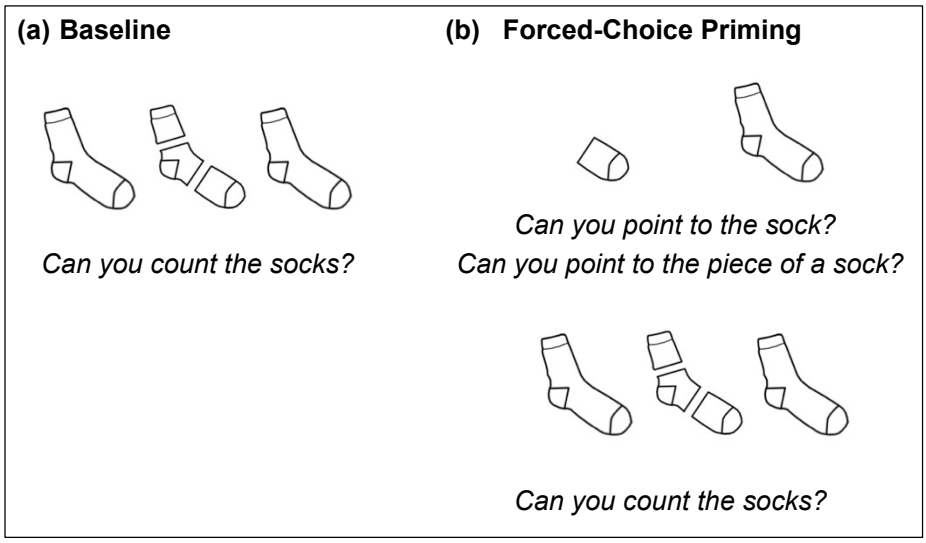

Figure 4. Sketches of Experiment 3 stimuli and procedures.

Method

Participants. The participants were 64 monolingual English-speaking children (30 boys) between the ages of 4;0 and 5;11 (M = 4;11). A total of 32 children were tested in the Forced-Choice Priming condition (M = 4;11, 4;0 - 5;11, 14 boys), and 32 were tested in the Baseline

condition (*M* = 4;11, 4;1 - 5;11, 16 boys). One additional child participated, but was excluded because he could not complete the task.

Materials and Procedure. Children either participated in the Forced Choice Priming or Baseline conditions. Two item orders were constructed for each task and counterbalanced across children.

Forced Choice Priming Condition. At the start of each trial, children were presented with a whole object (e.g., a sock) and an arbitrary piece of that kind of object, along with their alternative descriptions (e.g., "Look! I have here a [sock] and a piece of a [sock]"). Then, they were asked to choose which was the referent of the whole object label (e.g., "Can you point to the [sock]?"), and which was the referent of the measure phrase (e.g., "Can you point to the piece of a [sock]?"; see Figure 4b). The order of these questions was counterbalanced across trials, and critically, children were not given feedback. After completing the forced choice, children were shown a set containing two whole objects of the same kind (e.g., socks), and a third object that was broken into two or three pieces (e.g., a sock cut in three). The children were then asked to count the set, using the whole object label (e.g., "Can you count the [socks]?"; see Figure 4b). The objects were forks, shoes, and socks, and each object type was presented on two trials, for a total of six trials (see Appendix A).

Baseline Condition. In this condition, children received only a counting task, which was identical to the Broken Object Counting task of Experiment 1 (see Figure 4). The trials were identical to those in the Forced Choice Priming condition, except that there were two additional trials, which tested sets of plates (see Appendix A). This difference arose because the two conditions were initially conceived as separate studies. Below, we report analyses both for the

full sets of counting trials included in each condition, as well as for the subset of trials that were identical between conditions.

Results and Discussion

At the start of the trials in the Forced Choice Priming condition – e.g., when children had to indicate the referents of "the sock" and of "the piece of a sock" – children correctly chose the referents of whole object labels 90% of the time, and of measure phrases 97% of the time. Each of these responses was significantly better than the chance level of 50% (both *p*'s < .001), consistent with the strong performance of 4-year-olds on the Semantic Forced Choice task of Experiment 2.

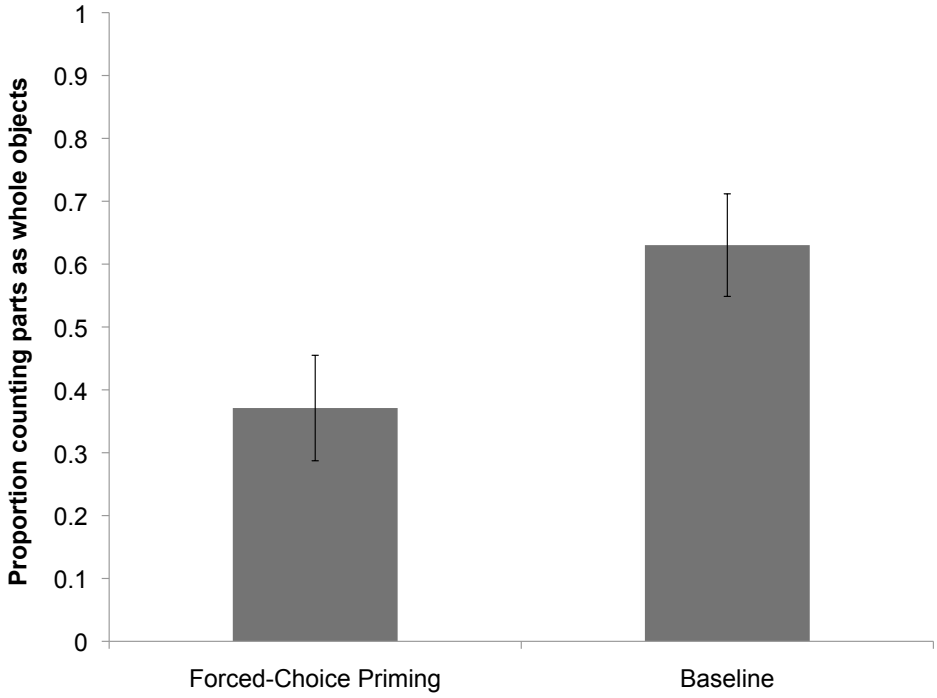

Figure 5. Proportion of trials on which children counted pieces of broken objects as whole objects in Experiment 3.

Our dependent measure for the counting task was the proportion of trials on which children counted the parts of a broken object as whole objects (see Figure 5). A univariate

ANOVA explored the effect of condition on part counting, with age (in months) as a covariate. Children counted parts of broken objects as whole objects on 63% of trials in the Baseline condition, but counted parts as whole objects significantly less often in the Forced Choice Priming condition, on only 37% of trials (F (1, 60) = 5.62, $p < .05$). There was no effect of age (F(1, 60) = 2.29, *ns*). A parallel analysis found identical results when the two additional trials in the Baseline condition were excluded from the analysis.

On the 63% of trials in which children in the Forced Choice priming condition did not count pieces of broken objects as whole objects, they counted like adults, counting the pieces of a broken object as a single whole object on 69% of trials, and excluding pieces from their counts entirely on 31% of trials. When children in the Baseline condition did not count pieces as whole objects (on 37% of trials), they counted the pieces as a single whole object on 75% of trials, and excluded the pieces altogether on 25% of trials. Across the two conditions, children always counted whole objects like adults: they never counted a whole object multiple times (e.g., by counting its parts) or failed to count a whole object altogether.

In sum, asking children to use their existing knowledge to categorize objects as either parts or wholes – and thus to access alternative labels for these things – was sufficient to significantly increase adult-like counting of sets in a subsequent task. These results are consistent with the idea that children count like adults, and exclude parts from their counts of whole objects, when they are better able to access alternative part descriptions. Still, it is worth noting that children who received our priming manipulation did not exclude parts nearly as consistently as adults do (e.g., adults in Experiment 1 never counted pieces as whole objects). Thus, although the forced choice task may have made both measure phrases and whole object labels accessible to children, some children may still not have treated these descriptions as relevant, contrasting

alternatives. As noted by Brooks, Barner, and Bale (2011), simply accessing descriptions, in isolation, may not be sufficient for recognizing them as relevant, contrasting alternatives. This knowledge may also require experience hearing expressions contrasted, or may depend on a developing ability to attend to relationships between sentences in the discourse (e.g., their relevance relations; for discussion see Grice, 1969; Levinson, 1983).

Critically, our priming manipulation did not train children to respond correctly – i.e., children were not given feedback regarding which objects were pieces and which were wholes. Thus, it is unlikely that children's *conceptual* representations (e.g., of shoes, forks, socks, etc.) changed during the experiment. Instead, children's nominal concepts may be quite broad – so broad that they allow arbitrary parts of objects to be included as members of object kinds. Children may restrict their broad concepts and count like adults only when they access better, contrasting descriptions of parts. Consequently, our results raise the possibility that adult nominal concepts are also broad, and do not provide criteria for excluding arbitrary parts from object kinds in the absence of contrasting part labels. We return to this idea in the General Discussion.

Experiment 4

Together, Experiments 1 through 3 provide evidence that young children exclude arbitrary parts of broken objects from their counts of whole objects when they can access better alternative descriptions for them – i.e., measure phrases. Accessing part descriptions could be especially important for the exclusion of arbitrary parts, like the pieces of a shoe. Although arbitrary shoe pieces may not form a natural, cohesive, non-linguistic category, measure words allow any arbitrary grouping or portion of stuff to be labeled and counted as a kind of individual – e.g., as "pieces of shoe". By individuating these units and categorizing them as distinct from

whole objects, measure words may provide a mechanism for excluding parts from counts of whole things.

Although breaking objects into parts can result in arbitrary pieces, it can also result in non-arbitrary pieces that have their own labels in English (e.g., wheels, arms, ears, etc). Recall that in the study by Brooks et al. (2011), 4-year-olds did not count nameable parts of familiar objects as whole objects (e.g., wheels as bicycles). On the face of it, these data are consistent with the idea that excluding a part depends on accessing a better description: children could have inferred that wheels shouldn't be included in a count of bicycles, because the best description of these things is *wheels* not *bicycles*. However, it's also possible that children excluded wheels independent of their labels, because they have a discernable function of their own and thus belong to their own artifact kind (see, e.g., Keil, 1989, Malt & Johnson, 1992; Kemler Nelson, 1995, 1999, for evidence that functional information plays a role in defining artifact kinds). Indeed, although Brooks et al. (2011) found a broad correlation between the labeling of parts and their exclusion from counts of whole objects, children correctly labeled parts less often than they excluded them. Thus, children may be more likely to learn names for parts – *and* exclude them from their counts of whole objects – when they have distinct functions.

Consistent with this idea, Kemler Nelson and colleagues have shown that when children as young as 2 learn a label for an artifact kind, they accept the use of that label to refer to an artifact whose function has been accidentally disabled (e.g., because the object is broken), but *not* to refer to an artifact whose function has been intentionally altered (Kemler Nelson, Herron, & Morris, 2002; Kemler Nelson, Holt, & Egan, 2004; but see Gutheil et al., 2004). Thus, although objects may remain category members when they are broken and dysfunctional, they are seen to belong to distinct artifact kinds when their functions are intentionally transformed.

Together, these results, and those of Brooks et al., suggest that excluding parts from counts of whole objects may depend on recognizing that parts belong to different object kinds than whole objects – an inference that could be signaled either by accessing contrasting labels for parts (demonstrated in Experiments 1 through 3) or by recognizing their unique functions (see also Booth & Waxman, 2002; Waxman & Markow, 1995).

Experiment 4 explored this idea by teaching 3- to 5-year-olds labels for novel objects, and manipulating whether their parts were given their own labels and functions. After teaching children these words, we asked them to count using the novel whole object label, as in the preceding experiments (see Figure 6). In the first two conditions, the functions of the novel objects were demonstrated, and the objects were then broken into functional parts. In one of these two conditions, the functional parts also received unique labels (the Labeled Functional Parts condition) and in the other they did not (the Unlabeled Functional Parts condition). In the third and fourth conditions, the functions of novel objects were not demonstrated, and these objects were broken into *arbitrary* parts, which either received their own labels (Labeled Arbitrary Parts condition) or did not (Unlabeled Arbitrary Parts condition). Finally, in the fifth condition, novel objects were broken into functional parts, but the functions of these objects were not explicitly demonstrated (Undemonstrated Functional Parts condition). This condition was motivated by previous research which suggests that the functions of objects can be inferred on the basis of their physical affordances alone. For example, Prasada, Ferenz and Haskell (2002) found that subjects are more likely to perceive novel stimuli as functional – and categorize them as kinds of objects – if they have complex, regular, structures (see also Barner, Inagaki, & Li, 2009; Li, Dunham, & Carey, 2009).

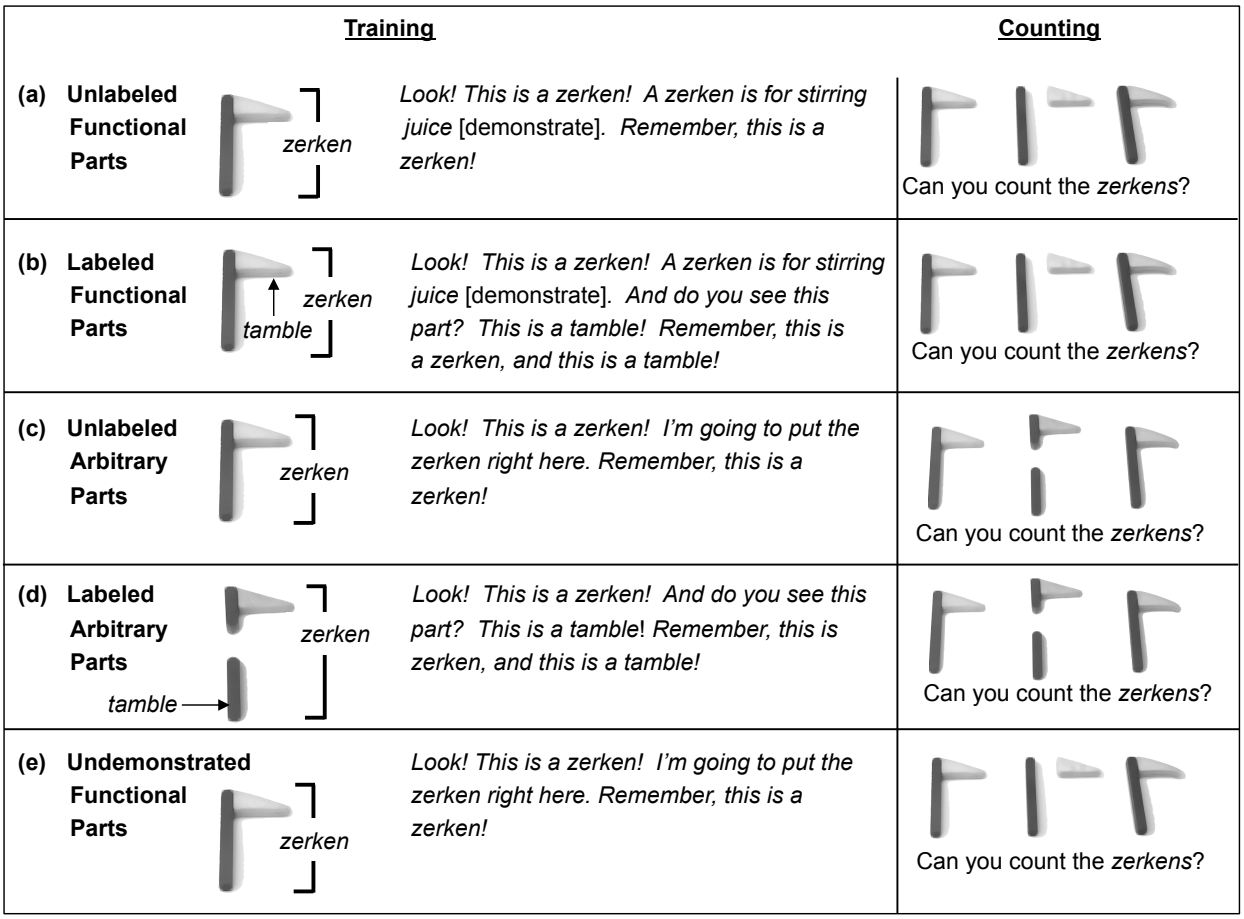

Figure 6. Sketches of Experiment 4 stimuli and procedures.

Methods

Participants. The participants were 80 monolingual English-speaking children (33 boys) between the ages of 3;3 to 5;4 (M = 4;3). Of these, 16 children participated in the Labeled Functional Parts condition (*M* = 4;4, 3;6 – 5;3, 7 boys), 16 in the Unlabeled Functional Parts condition (*M* = 4;1, 3;3 – 5;4, 5 boys), 16 in the Labeled Arbitrary Parts condition (*M* = 4;3, 3;7-5;2, 3 boys), 16 in the Unlabeled Arbitrary Parts condition (*M* = 4;4, 3;4 – 5;4, 9 boys), and 16 in

the Undemonstrated Functional Parts condition (*M* = 4;4, 3;4 - 5;2, 9 boys). An additional seven children participated, but did not complete the task.[4]

Materials and Procedure. Children were tested in one of five conditions: (1) Unlabeled Functional Parts, (2) Labeled Functional Parts, (3) Unlabeled Arbitrary Parts, (4) Labeled Arbitrary Parts, or (5) Undemonstrated Functional Parts. The same novel objects were used in each condition (see Appendix C). There were six critical trials in each condition. There were two item orders.

***Unlabeled Functional Parts Condition*.** This condition tested whether children exclude functional parts from their counts of whole novel objects when they have not learned labels for those parts. Prior to each of the six trials, the child was presented with a novel object which was labeled by the experimenter, who then demonstrated its function – e.g., "Look! This is a *zerken*! A *zerken* is for stirring juice (while demonstrating with a cup of juice). Remember, this is a *zerken*!" Critically, the functions of each of the object's parts were evident in this demonstration – e.g., one part of the *zerken* extended into the juice, and the other part rested on top of the cup (see Figure 6a; see Appendix C for information about the other items). The experimenter then laid out an array that included two or more instances of the novel object. One of those objects had been broken into two parts (on three trials) or three parts (on the other three trials), and each of those parts were functional (see Figure 6a; Appendix C). The experimenter then asked the child to count the set, using the label for the whole novel object – e.g., "Can you count the

[4] Because 3-year-olds often fail to understand the principles of counting (Wynn, 1990), we assessed children's counting abilities using Wynn's "Give -a-number" task (see Wynn, 1990) after they had completed the broken object counting task. A total of 32 children (Mean age = 3;8) were excluded for failing to give the correct number of objects for requests of 5–8 objects. Thus, by Wynn's criteria, all of the children included in the study were "Counting Principle Knowers".

zerkens?" (see Figure 6a). Across the six trials, the novel labels used were *zerken*, *tupa*, *tibbit*, *modi*, *rapple*, and *blicket*.

Labeled Functional Parts Condition. In this condition, we tested whether children would be more likely to exclude functional parts from their counts of whole novel objects when they had learned labels for those parts. The materials and procedure were identical to the Unlabeled Functional Parts condition, except that labels were assigned not only to the whole objects, but also to their functional parts. On each trial, after the experimenter labeled the novel object and demonstrated its function, she pointed to one of its parts and added – e.g., "And do you see this part? This is a *tamble*" (see Figure 6b). The experimenter then repeated the whole object and part labels, while pointing their referents – e.g., "Remember, this is a *zerken*, and this is a *tamble*." The novel labels used for parts were *tamble*, *zivvin*, *fengle*, *feppet*, *zuni*, and *toma*.

Unlabeled Arbitrary Parts Condition. In this condition, we tested whether children would exclude arbitrary parts from their counts of whole novel objects when they had not learned labels for these parts or functions for the whole objects. At the start of each trial, the experimenter showed the child a novel object and provided a label for that object, but did not describe its function: e.g., "Look! This is a *zerken*! I'm going to put the *zerken* right here. Remember, this is a *zerken!"* The experimenter then laid out an array of whole objects and objects that had been broken into arbitrary parts and asked the child to quantify it (see Figure 6c; Appendix C). Arbitrary parts were defined as parts that did not themselves have natural boundaries on unbroken objects and did not have their own apparent function. For example, in the case of a familiar object like a bicycle, cutting the object in half down the middle would result in two arbitrary parts, whereas cutting off wheels, handlebars, the seat, etc., would result in functional parts.

Labeled Arbitrary Parts Condition. In this condition, we tested whether children would exclude arbitrary parts when they had learned unique labels for those parts. The materials and procedure were identical to the Unlabeled Arbitrary Parts condition, except that labels were assigned not just to the whole novel objects, but also to one of their arbitrary parts (see Figure 6d). On each trial, after the experimenter showed the novel object to the participant and labeled it, she pulled it apart and pointed to one of its arbitrary parts and labeled it – e.g., "Do you see this part? This is a *tamble*." The experimenter then repeated the labels for the whole object and the arbitrary part while pointing to each – e.g., "Remember, this is a *zerken*, and this is a *tamble*." The novel labels were the same as those used in the Labeled Functional Parts condition.

Undemonstrated Functional Parts Condition. In this condition, we tested whether children would exclude functional parts from their counts of whole novel objects, even if they had not explicitly learned about the functions of the objects and their parts. The materials and procedure were identical to the Unlabeled Functional Parts condition, except that the experimenter did not describe or demonstrate the functions of the novel objects (see Figure 6e). At the start of each trial, the experimenter showed the child a novel object and provided a label for that object, but did not describe its function: e.g., "Look! This is a *zerken*! I'm going to put the *zerken* right here. Remember, this is a *zerken*!" The experimenter then laid out an array of whole objects and objects that had been broken into functional parts, and asked the child to count it.

Results and Discussion

Our dependent measure was the proportion of trials on which children counted the parts of a broken novel object as whole objects (see Figure 7). A univariate ANOVA explored the effect of condition on part counting, with age as a covariate. The test yielded a significant main

effect of condition (F (4, 74) = 2.51, $p < .05$), but no effect of age (F(1, 74) = .96, *ns*). Six planned contrasts further explored the effects of condition on part counting. Four of these contrasts treated the Unlabeled Arbitrary Parts condition as a baseline measure of part counting (e.g., because it is parallel to the paradigm case of counting a set of whole objects and arbitrary object parts), and compared counting behavior in that condition to counting in the other four conditions. The other two contrasts explored the role of labels and explicit functional knowledge in the exclusion of functional parts.

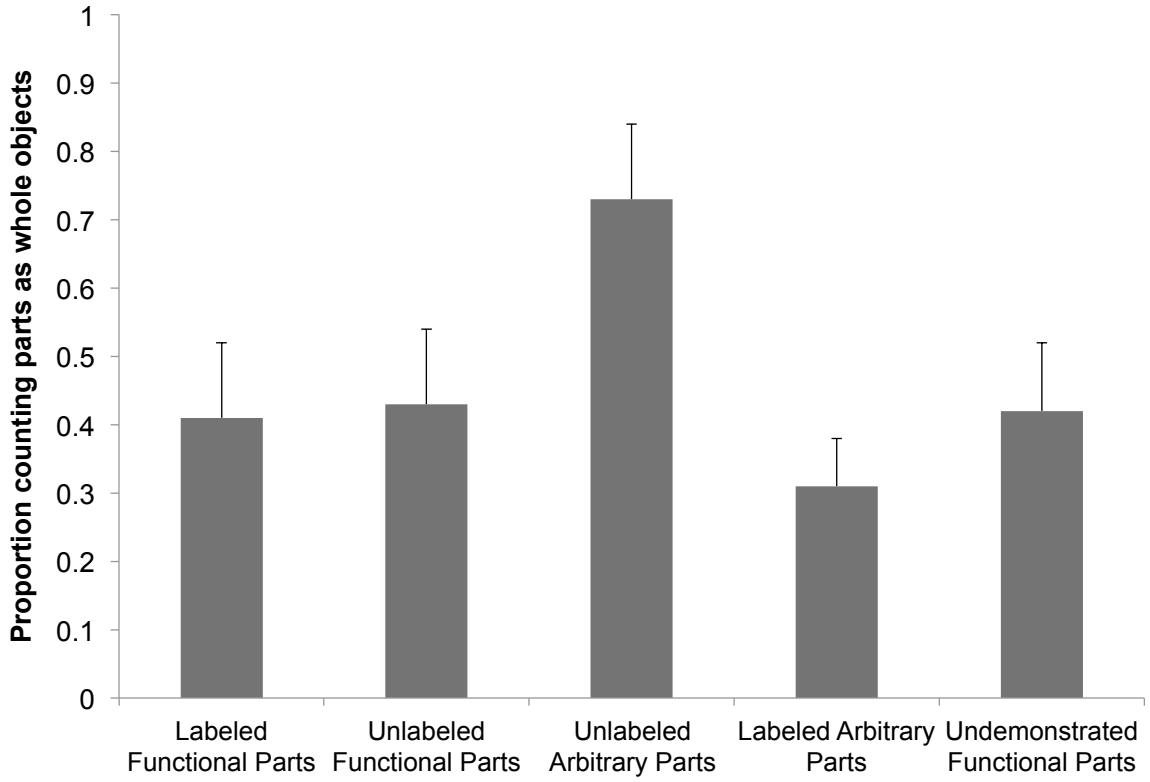

Figure 7. Proportion of trials on which children counted pieces of broken objects as whole objects in Experiment 4.

These analyses indicate that children more often exclude functional parts than arbitrary parts, and do so whether or not they have learned labels for functional parts. Children more often counted parts as whole objects in the Unlabeled Arbitrary Parts condition (M = .73, SE = .11), in

which the parts were arbitrary and unlabeled, than in the Unlabeled Functional Parts condition (M = .43, SE = .11) or in the Labeled Functional Parts condition (M = .41, SE = .11), in which the parts were functional (Labeled Functional Parts vs. Unlabeled Arbitrary Parts: $t(74) = 1.96$, $p = .05$; Unlabeled Functional Parts vs. Unlabeled Arbitrary Parts: $t(74) = 2.25$ $p < .05$). These results are consistent with those of Brooks, Pogue and Barner (2011), who showed that children more often exclude functional, nameable parts of familiar objects (e.g., wheels) than arbitrary parts (e.g., pieces of a shoe).[5] Our findings extend these previous results by showing that functional parts like wheels can be excluded whether or not they have received unique labels: children were no better at excluding functional parts when they had learned their labels than when they had not (Labeled Functional Parts vs. Unlabeled Functional Parts, $t(74) = .31$, *ns*). Thus, children may exclude parts that have labels more frequently not because they have labels, per se, but because they clearly belong to their own unique kinds. Parts that clearly belong to their own categories may be both more likely to be counted separately, and more likely to be lexicalized in language.

Our results also indicate that children exclude functional parts even when they have not explicitly learned their functions: children counted parts as whole objects more often in the Unlabeled Arbitrary Parts condition than in the Undemonstrated Functional Parts condition (M = .42, SE = .10; $t(74) = 2.20$, $p < .05$). Indeed, children were no better at excluding functional parts when they had explicitly learned their functions, compared to when they had not (Unlabeled Functional Parts vs. Undemonstrated Functional Parts: $t(74) = .06$, *ns*). This is consistent with previous evidence that parts can be deemed functional – and members of their own object kinds – on the basis of their physical affordances alone (see Prasada, Ferenz & Haskell, 2002; see also

[5] In their study, children excluded functional parts at a higher proportion (M = .88) than did children here, probably due to greater experience with familiar objects like wheels.

Barner, Inagaki, & Li, 2009; Li, Dunham, & Carey, 2009). It is also consistent with previous findings that perceptual cues like object shape provide cues to kind membership (see, e.g., Bloom, 2000; Landau, Smith & Jones, 1988).

Finally, our findings provide evidence that labels are sufficient for the exclusion of arbitrary parts: children counted parts as whole objects more often in the Unlabeled Arbitrary Parts condition than in the Labeled Arbitrary Parts condition (M = .31, SE = .07; $t(74) = 2.85$, $p <$ .01). This is consistent with the results from Experiments 1 to 3, which suggest that generating a unique description for an arbitrary part (e.g., "three pieces of fork") supports its exclusion.

Across the five conditions, when children counted like adults they either combined the pieces of an object to treat them as a whole (93% of trials), or excluded them from their counts entirely (7%). When children incorrectly included pieces of a broken object in their counts, they also counted whole objects in a non-adult way on 32% of trials (e.g., by counting the parts of a whole object). They also made errors 2% of the time when counting whole objects on trials on which they correctly counted broken objects. These behaviors were more frequent than in Experiments 1 and 3, presumably because children were unsure how to individuate the novel stimuli. To ensure that our findings were not driven by these errors, all analyses reported above were repeated with these error trials excluded, and the identical patterns of significant and non-significant effects were found.

In sum, Experiment 4 suggests that children likely use multiple sources of information to exclude parts. In particular, while children may exclude parts when their labels contrast with those of whole objects – e.g., *piece of shoe* vs. *shoe*, *toma* vs. *blicket*, etc. – they can also exclude parts when they lack unique labels, but have obvious distinct functions. Although language may be one clue to category membership, functional information may also differentiate object kinds,

even in absence of labels (see Booth & Waxman, 2002). Thus, the existence of part labels may restrict counting not because labels themselves are critical, but because they indicate the existence of distinct artifact kinds, which can be contrasted with the kinds denoted by whole object labels to define units of quantification.

General Discussion

We began this study with Frege's observation that, for the purposes of counting and mathematical reasoning, units must be specified by concepts in a definite manner, and must not permit any "arbitrary division" into parts. Children, we noted, fail to respect Frege's principle, and often count arbitrary parts of objects as though they are instances of whole object kinds. For children as old as 7, a shoe cut into three pieces is "three shoes", and is therefore "more shoes" than two whole shoes (Brooks et al., 2010; Shipley & Shepperson, 1990). In our experiments, we sought to understand children's behaviors and their significance to sortal theory, and in particular, how nouns specify units for counting and quantification. Our hypothesis was that children's errors may not reflect immature nominal concepts, but may instead be the product of a less accessible lexical inventory. In particular, children may count a piece of a shoe as "one shoe" because they are unable to access better alternative descriptions of such objects, like "piece of shoe." Thus, calling a piece of a shoe "one shoe" may be consistent with the conceptual criteria provided by *shoe* even for adults, but may not be the best description available, given an adult lexicon that includes measure words like *piece* and *part.* Consequently, the intuition that nouns supply necessary and sufficient conditions for defining units, as expressed by Frege, may reflect the structure of the lexicon as a whole, rather than the conceptual content of individual nouns like "shoe" and "fork".

In support of this idea, we showed that although children count pieces of broken objects and accept whole object labels to describe them (Experiment 1), they strongly prefer measure word descriptions when they are explicitly provided (Experiment 2). For example, when shown an object broken into two pieces, 4-year-olds readily judged that "two pieces of shoe" was a better description than "two shoes" (Experiment 2), although they often judged that "two shoes" was a felicitous description in isolation (Experiment 1). This suggests that children's errors stem not from a misunderstanding of measure phrases but instead from an inability to generate them as alternatives to whole object labels. Indeed, children were significantly more likely to exclude pieces from their counts of whole objects when they had first judged the meanings of whole object and measure phrase descriptions – making such descriptions more accessible during counting (Experiment 3). Finally, by teaching children names for novel objects, we showed that although children count unlabeled, arbitrary parts of objects as whole objects, they do not count parts that have their own functions, or that have their own labels (Experiment 4). Part labels may allow children to exclude parts from counts of whole objects because they signal the presence of object kinds that are distinct from those that are encoded by whole object labels. Such categories, however, can also be inferred by observing a part's unique function, its physical affordances and shape, the intentions of its creator, and so on (see, e.g., Bloom, 1996, 2000; Booth & Waxman, 2002; Gutheil et al., 2004; Kemler Nelson et al., 2002; Kemler Nelson, et al., 2004; Landau et al., 1988; Prasada et al., 2002; Waxman & Markow, 1995).

Our studies help explain a long-standing puzzle in the counting literature, and begin to address fundamental questions regarding the nature of lexical concepts. Specifically, how do we reconcile our intuition, expressed by Frege, that lexical concepts should supply necessary and sufficient conditions for identifying units, with the widespread recognition that such conditions

are almost always impossible to specify? Why is it so hard to specify the structure of concepts, given the strength of our intuitions – e.g., that half a shoe is surely not a shoe? One possibility is that concepts aren't alone responsible for these intuitions. But if they aren't, then what is? Our proposal, drawing on Grice's theory of pragmatics, is that concepts do not act as sortals – and thus, do the work of individuation – in isolation. The explanatory burden traditionally placed upon a theory of concepts – be it a classical theory, prototype theory, or intuitive theory – is lightened by an appeal to human pragmatic reasoning, and the ability consider not only what a speaker says, but also the alternative expressions that they could have said, but did not.

An important consequence of this claim, and of our findings, is that children's early counting behaviors cannot be explained by a change in nominal concepts, like *shoe* and *fork*. Adult concepts may not be so different from those of 4- and 5-year-old children: they may appear different only because adults interpret words in pragmatically sophisticated ways, and have access to a full inventory of lexical alternatives. The most direct evidence that children's concepts are adult-like is that their counting becomes more like that of adults when their access to alternative descriptions is facilitated. If children's early counting behaviors – i.e., the counting of pieces as whole objects – were explained by deficient nominal concepts, we would not expect the results of Experiment 3, where priming alternative descriptions changed how children interpreted whole object labels. Rather, if adult-like counting required conceptual change, children should have needed extensive training to overcome their errors, which they did not receive. An appeal to deficient concepts also has difficulty explaining past findings. For example, when Brooks et al., (2011) presented 4-year-old children with broken objects and asked children if there was anything wrong with them, children almost always stated that they were

broken. Children clearly understand that half a shoe is a deficient kind member, but nevertheless count it as "one shoe" when lacking a better alternative description.

A second consequence of our findings is that children's reasoning about alternatives is importantly tied to – but not limited to – language. Although we couched our proposal in the Gricean theory of conversational implicature – which treats linguistic utterances as the alternatives over which reasoning is conducted – we were concerned primarily with the structure of sortal concepts, which need not be thought of as purely linguistic in nature. In particular, while sortals may be derived pragmatically by contrasting nominal descriptions with one another, they can also be derived by contrasting concepts for which children do not yet have labels. Thus, counting may be restricted not only by children's ability to consider alternative linguistic descriptions, but also by their ability to categorize objects and their parts as members of distinct artifact kinds, on the basis of non-linguistic criteria. This conclusion is supported by Experiment 4, in which children excluded unlabeled parts from their counts of whole objects when those parts had distinct functions (or physical properties that suggested distinct functions). However, in keeping with previous studies (e.g., Waxman & Markow, 1995), Experiment 4 also found that labels invite children to infer conceptual categories. When arbitrary pieces of novel objects received unique labels, children excluded them from their counts of whole objects, despite failing to exclude them when they were unlabeled. In sum, whether suggested by labels or inferred non-linguistically, concepts are contrasted and enriched pragmatically to do the work of sortals and define units of quantification. Concepts may be contrasted to not only allow objects to be distinguished from their parts – e.g., by contrasting *shoe* and *piece of shoe* – but, by extension, to allow different kinds of objects to be distinguished from one another – e.g., by contrasting *bowl* and *plate*.

Left unsettled by this study, and indeed by studies of pragmatic development more generally, is why children's ability to reason about alternatives changes as slowly as it does, and only becomes adult-like by the age of 6 or 7. Strikingly, children's ability to count broken objects in an adult-like fashion emerges around the same time that they begin to reliably derive scalar implicatures – e.g., to recognize that "The boy ate some of the cookies" likely implies that he did *not* eat "all of the cookies" (see references in the Introduction). If, as we have argued, these two abilities are related, and each relies on computing inferences over alternative descriptions, the question remains as to why such inferences are difficult for young children, and so late to emerge in development.

One possibility is that children are able to reason about alternatives from an early age, but fail to do so for specific classes of words – e.g., for quantifiers like *some* and *all*, and for object descriptions like *piece of shoe* and *shoe* – because they fail to group these words into common classes of alternatives (see Barner & Bachrach, 2010; Barner, Brooks, & Bale, 2011). In support of this idea, previous evidence suggests that children are readily able to compute Gricean inferences over words they are likely to learn as being part of a common class. For instance, Wynn (1992) has argued that even 2- and 3-year-olds draw inferences about the meanings of number words by treating them as contrasting alternatives. In her study, children who knew the exact meaning of only *one* were shown one object (e.g., a balloon) next to a larger set (e.g., three balloons) and were asked to indicate the larger set – e.g., "Point at *three* balloons". Despite not yet knowing the meaning of the larger number word, children were readily able to select the larger set, despite choosing randomly when asked to "Point at *blicket* balloons". Thus, children may have restricted the meaning of *three* but not the meaning of *blicket* because they treated *three* – but not *blicket* – as an alternative to *one*.

Children may readily recognize that number words are alternatives because they learn, early in life, that such words are part of a common class – i.e., when they memorize the count list "1, 2, 3, 4 …" around age two (for additional evidence of this, see Shatz, 1993, who argues that children group number, color, and time words into classes before acquiring meanings for each; see also Tare, Shatz, and Gilbertson, 2008). In contrast, children are never explicitly taught that quantifiers like *some* and *all* – or object descriptions like *shoe* and *piece of shoe* – are relevant alternatives. This could explain why children fail to compute inferences over such categories until later in life. Learning what counts as a relevant alternative to a particular description may involve not just learning the meanings of individual words and phrases, but also experience hearing alternatives used contrastively in conversation.

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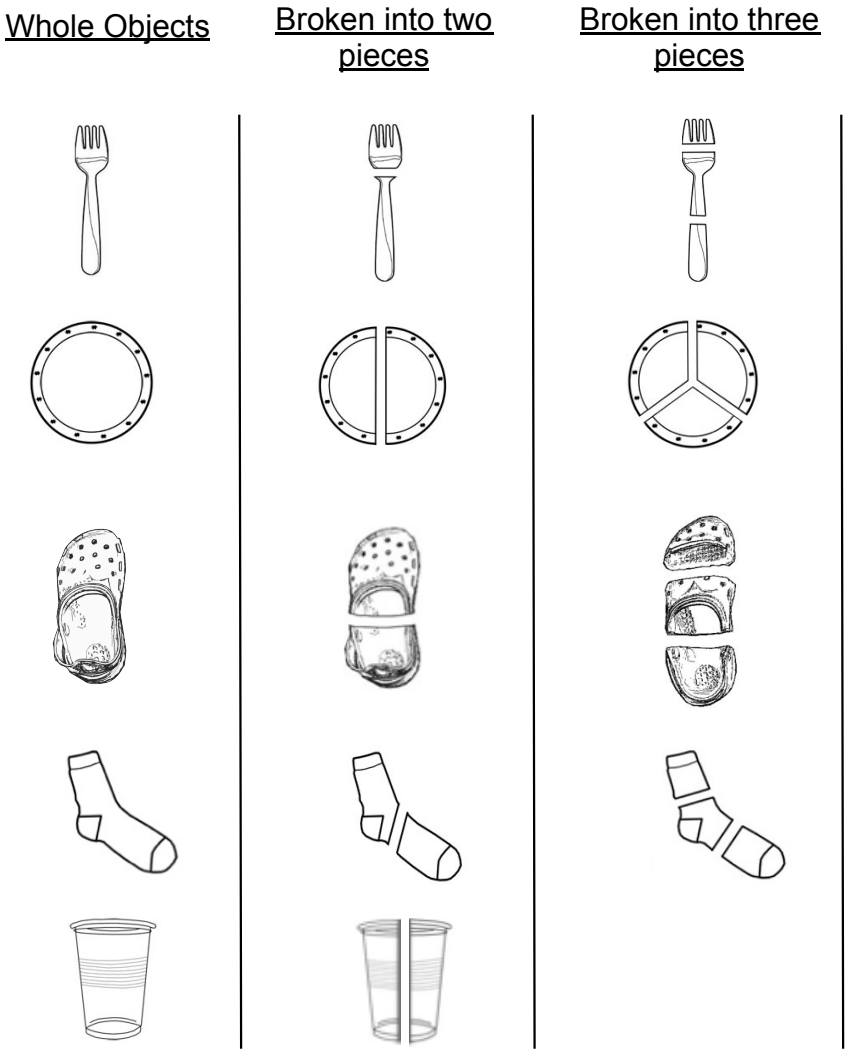
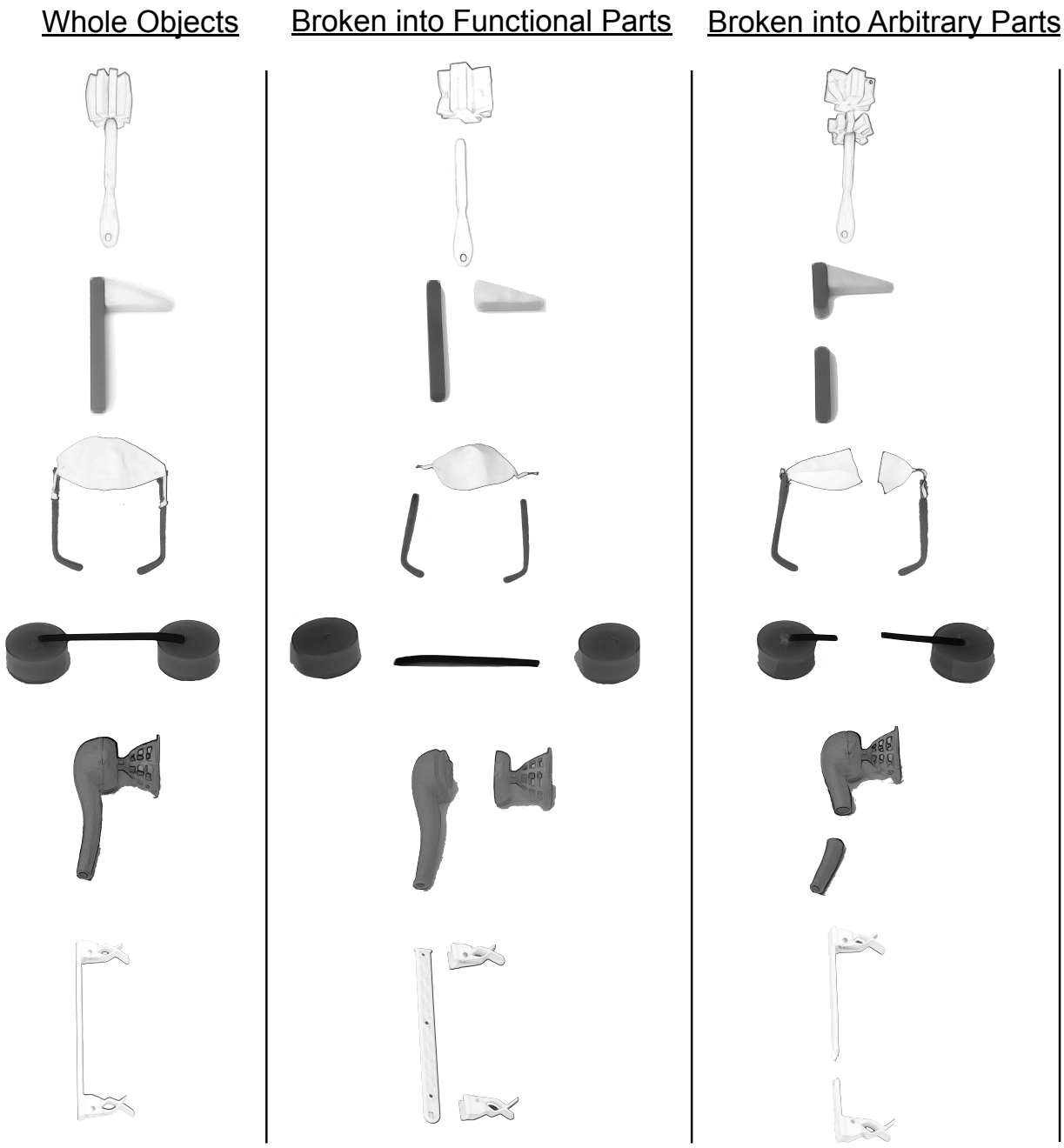
Appendix A. Sketches of stimuli used in Experiments 1, 2, and 3.



Appendix B. The four sets of slides used in the Measure Word Comprehension Task of Experiment 2

Appendix C. Sketches of stimuli used in Experiment 4.



On the lexical OR syntactic sources of *furniture*-type denotations

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This talk will focus on the hybrid properties exemplified by the English noun *furniture*—taken as a class prototype—whose syntactic distribution echoes that of substance-denoting nominals (e.g. *water, mud*), while its semantic properties seem akin to pluralities. *Furniture*-noun-denotations are discussed in many works on the Mass/Count distinction, and have been given various labels, e.g. 'Count Mass' (Doetjes 1997), 'Unsorted Stuff' (Müller & Oliveira 2004), 'Object Mass' (Barner & Snedeker 2005, Bale & Barner 2009), 'Fake Mass' (Chierchia 2010); we shall adopt the latter (FM) here. After a brief introductory recap of relevant empirical tests identifying FM nominals, our talk will be divided into two parts.

Part I will examine more closely the class of English FM nouns and argue that their special denotational properties are not lexical idiosyncrasies, but are predictable from their morphological make-up—they are all derived nominals, formed through a restricted set of derivational patterns, primarily associated with event nominal forms. A brief excursion into Hebrew and French further suggests that *furniture*-type nouns in these languages result from similar types of morphological derivations.

Part II will deal with a type of DPs productively attested in Non-Standard (Hexagonal) Modern French but so far unacknowledged in the linguistic literature, which makes the FM denotational pattern available for any Count noun: such DPs crucially exhibit neutralised number, spelt out by singular morphology, combined with an overt D. Although they contain an overt D (bare nominals are unlicensed in Modern French), French DPs construed as FM may be shown to share relevant properties with the *bare singular* arguments of Brazilian Portuguese, as described and analysed by Munn & Schmitt (1999), Schmitt & Munn (1999), Müller & Oliveira (2004).

Why are FM denotations freely available in Brazilian Portuguese (to bare singulars) and in Non-Standard French (to non-bare singular DPs), while they are restricted to *furniture*-type lexemes in English, Hebrew, as well as in Standard French and, it seems, in other Standard Romance languages? We tentatively assume that what crucially brings together Brazilian Portuguese and Non-Standard French is the possibility of removing number inflection from the head noun, in the DP (cf. Barra Jover 2010). This change in the grammar makes Number Neutralisation a lexically-free, syntactic option, while it remains lexically-dependent in languages where number inflection must be spelt out on the Noun.

Our results, if correct, do not challenge Chierchia's (2010) assumption that FM denotations can only arise in Number Marking languages, but they call for a revised definition of 'Number Marking Languages': English, Hebrew, Brazilian Portuguese, Standard and Non-Standard French all 'mark number' in the DP, but only a subset of them mark it obligatorily on the noun. On the other hand, the data from Brazilian-Portuguese and Non-Standard-French seem problematic for Chierchia's (2010) claim that FM denotations are *necessarily* reserved for specified lexical items.

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Words and Concepts:
the object-concept and the matter-concept

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ABSTRACT*

This work contrasts two *semantic* categories – those of concrete, so-called 'mass' and count nouns – with the *ontic* categories, or highly general concepts, which these nouns express; these underlying concepts I shall call the *object-concept* and the *matter-concept*. Typically, the problems in this area are seen as chiefly problems about mass nouns and the matter-concept; but this itself is a mistake. The categories of mass and count nouns, although mutually exclusive, are internally related, and the central problem is not one of mass nouns. The difficulties over mass nouns stem in the main from difficulties over count nouns, or equally, from problems with the ontic category or concept that these nouns express, the category of objects, units, individuals or things. And Frege's question – the question of 'what we are here calling an object' – is not, I will suggest, well put.

Concepts are distinct from their semantical embodiments, and complexities surround the different modes in which the object-concept is linguistically embodied or expressed. General concepts in themselves, of course, are never *referential*; reference enters only in their use or application in constructing sentence-types and tokens. But as it happens, the range of sentence-types which standard logic recognises is restricted, in ways which block expression of, and therefore access to, the matter-concept and the object-concept almost equally. On the other hand, the blockage can be turned upon its head: the matter-concept represents an ontic category which simply falls outside the scope of logic, in the form in which it is at present understood.

One central feature of the modern 'concept-script' consists in its well-founded rejection of the subject / predicate sentential form as universal. On the model of language that comes to us from Frege, sentences are instead divided into two broad categories. On the one hand are fully-fledged, directly referential sentences which do exemplify the subject/predicate model (semantically, the object/concept model), and on the other hand are quantified sentences which do not, but are constructed on the basis of the former group. This second group is indirectly referential; bound variables take directly referential terms as their substituends.

But an understanding of the categories with which we are concerned requires the recognition of a commonplace and yet quite different group. This group consists of existential sentences which are unquantized, neither indirectly nor directly referential. At the end of the day, the basic mode in which the object-concept and the matter-concept are linguistically embodied is non-referential. For the object-concept, this mode is ontically though not semantically supervenient on the possibility of references to things; but at least for central classes of the matter-concept, the possibility of underlying forms of referential contact with the world does not exist.

**Consumer caution: contents may contain traces of invalidity and falsehood.*

Words and Concepts:
the object-concept and the matter-concept

Introduction

Otto Jespersen famously marks a contrast between what he calls 'thing-words (countables) and mass-words (uncountables)'.[1] And of this latter group he writes:

> There are a great many words which do not call up the idea of some definite thing with a certain shape or precise limits. I call these 'mass-words'; they may be either material, in which case they denote some substance in itself independent of form, such as ... **water, butter, gas, air,** etc., or else immaterial, such as ... **success, tact, commonsense,** and ... **satisfaction, admiration, refinement,** from verbs, or ... **restlessness, justice, safety, constancy**, from adjectives (198).

Now Jespersen here makes contrasts of two kinds. On the one hand, he marks a *semantic* contrast of two categories of nouns: those that are countables, or count nouns, and those that are not, uncountables or non-count nouns. On the other hand, he contrasts two kinds of ontic concepts or *ideas*, which he claims these categories of nouns express. Jespersen calls count nouns *thing*-words, but non-count nouns 'do not call up the idea of some definite thing'; and this 'negative' idea is then illustrated with a few 'positive' examples, both concrete and abstract. Nevertheless, Jespersen gives no positive characterisation of the *ideas* that mass nouns express, although his chosen appellation for the semantic class of non-count nouns *itself* is positive. These nouns are not simply characterised in negative semantic terms, *as* 'uncountables', but in a way that seems suited to the concepts that at least the *concrete* non-count nouns express – that is, of course, as *mass* nouns – and the semantic and conceptual levels are thereby conflated.

Count nouns do, I think, express, reflect, or correspond to one particular and highly abstract category or concept: as Jespersen suggests, the concept they express is that of *objects*, *units*, *individuals* or *things*.[2] But now this highly abstract category or concept is not directly mirrored in the words and sentences by which it is expressed. The expressions are semantically diverse, the concept in itself is only one. Here, my focus is on (uses or occurrences of) *concrete* nouns exclusively. I take it as a condition of concreteness in this context that direct reference should be possible; we may literally *point* at something as *this wood*, but not as *this misery* or *that satisfaction*; we may meaningfully talk about *amounts* of cotton and *pieces* of wood; such talk is at best frivolous with *happiness* or *mercy*. Containers can be *filled* with cash or cotton; this too is a condition of concreteness.[3] Semantically, we cannot rule out collective nouns

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[1] Jespersen, *Essentials of English Grammar*, Holts, 1933 p. 207.

[2] 'Object' is uniquely suited to the phrase '__ of reference' ('thing', e.g., is not appropriate).

[3] Paula Broadwell, friend of US General Petraeus, said she was '*filled* with guilt and shame'; this was *merely* metaphorical.

like ‘furniture’: though closely related to a plural noun, this (English) word is not itself a plural.[4] Informally, I adopt the terminology of ‘stuff’ or ‘matter’ to denote that which concrete NCNs apply to. In idiomatic English, ‘stuff’ can apply to almost anything, while ‘matter’ is much narrower, so what I have in mind is something vaguely in between the two.[5] The entirely general *mot juste*, however, is probably *continuum* – and it is suited to *both* abstract and the concrete cases (indeed, one could distinguish between *punctuated* and *unpunctuated* continua).

There is unquestionably much of value in Jespersen’s ground-breaking work. At the same time, there is a way of reading what he writes in which its implications and assumptions can be questioned. In particular, it is possible to understand his work as making four assumptions. I do not say that they are made by Jespersen, but they are, I believe, very commonly derived from Jespersen’s semantic and conceptual taxonomy, and it does not seem unreasonable so to do. These assumptions are as follows. (i) In semantic terms, the properties associated with these categories of nouns are mutually exclusive. (ii) There is just *one* essential semantic contrast between the classes; do they involve countability, or not? (iii) This semantic contrast corresponds to or reflects the contrast in the *concepts or ideas* that these categories of nouns express. And lastly: (iv) Conceptually or metaphysically, the ideas associated with these categories are mutually exclusive: one concept is of something intrinsically bounded and discrete, the other concept is of something which is not.

All four assumptions, I suggest, are false, and almost all the writing which has followed Jespersen’s distinction makes the same mistakes. The underlying concepts are not directly embodied or reflected in the words and sentences by which they are expressed, and the relationships between the categories are complex. But their *commonalities* – semantic and conceptual alike – are deeper than their differences; the features which the two groups *share* run deep. In semantic terms, the relationship between these categories of nouns is an *internal* one involving commonalities along with contrasts; and it is precisely because of an undue focus on the *contrasts*, that the semantic and conceptual internalities are blocked from view.

1. *Mereology and singularity*. How are words for *stuff* or *matter* to be understood? What do they denote? We speak for instance of *this* water, the water in my glass; of *that* sugar, the sugar in that bag, and so on. To what are we referring here? These references, so it is sometimes said, are references to discrete *instances* of stuff; this water is one instance of the concept *water* and that water is another. Such things are objects of a special ‘formless’ type; they illustrate Quine’s principle of mereology; any sum of parts which are water is water. CNs typically denote enformed or

[4]There are sub-classes of the NCNs; ‘furniture’ belongs to one such class. See ch.1 of *WWO* for the taxonomy.

[5]For discussion of this set of issues, see Mark Steen’s 2012 ‘The Metaphysics of Mass Expressions’ entry in the *Stanford Encyclopedia of Philosophy*.

structured objects – dogs, cats, chairs, tables – objects which do not sum or aggregate as sugar, salt and water do (call these 'substances' for short). What NCNs denote, by contrast, are often dubbed as 'parcels' or 'quantities' of stuff.[6] And much as this water is a discrete quantity of water, so too the term 'this water' is a *singular* expression which refers to it. It is commonly observed, in fact, that 'mass nouns lack a plural form', or 'do not pluralize'; and this is understood to mean that these nouns *cannot but* be singular – *invariably* singular, in a semantic sense. In a majority of cases, nouns have occurrences of singular and *also* plural forms; but since mass nouns are syntactically incapable of being pluralized, it is concluded that they are always and only singular. This, then, is an influential view.[7]

But now conceived as singular, NCNs are syntactically anomalous in the extreme. In non-generic contexts, it is true, grammar rules out *plural* talk of 'waters' and of 'salts'. However concrete *singular* constructions, 'a water' and 'a salt', are also counted out; and based upon the *quantifiers* they accept, mass nouns are largely on a par with plural nouns. Along with 'all dogs', 'some dogs', 'more dogs' and 'most dogs', constructions like 'all water', 'some water', 'more water' and 'most water' are well formed – whereas the singular constructions 'each water', 'every water' and 'a single water' are ruled out. On the other hand, 'this water' and 'that water' seem just fine. Considered as semantically *either* singular or plural, the syntax of mass nouns seem remarkably anomalous. But it is precisely from *within* a certain paradigm – the semantic paradigm of count nouns – that mass nouns seem anomalous.[8] When rightly understood, the syntax of these nouns does not appear anomalous, and our agenda should not involve massaging facts to fit the pre-existing theory. From the premise that 'mass nouns do not pluralize', to the conclusion that they are invariably singular, there is a key implied assumption – that nouns or their occurrences quite generally must be semantically *either* singular or plural. But this assumption, so I mean to urge, is false.

Mass nouns are, of course, opposed to *count* nouns or *CNs*. And the very opposition of these groups implies that however mass nouns are defined, these nouns fall within the class of nouns which are non-count. These two wide-ranging groups then constitute mutually exclusive, semantically more or less exhaustive categories of

[6]There are many other contrived terms, including 'portions', 'bits', and 'masses'. Concepts of this sort seem elusive; the most systematic attempts to grasp them have been by European linguists, invoking the mathematics of non-atomic Boolean algebras - specifically, join semi-lattice structures. These attempts strike me as akin to the theory of planetary epicycles formulated by Ptolemy.

[7]Lasersohn notes that Bloomfield (1933) 'introduced a shift in terminology, stipulating that mass nouns "have no plural" ... the idea that mass nouns are always singular has been part of conventional wisdom ever since'. (Lasersohn, P. 2011. 'Mass Nouns and Plurals'. In: von Heusinger, et al., eds., *Semantics: An International Handbook of Natural Language Meaning*, DeGruyter, vol. 2, pp. 1131-1153.)

[8] Benardete contrasts what he calls the *mass noun ontologies* of the early pre-Socratics with the view of the subsequent 'count nouns ontologists who came to dominate the field forever after' (*Metaphysics: The Logical Approach*. New York, Oxford University press, 1989, 36-7).

nouns.[9] Furthermore, CNs are themselves semantically either singular or plural: these two sub-categories exhaust the general category of CNs. It seems to follow, then, that *qua* non-count, the category of NCNs is *neither* singular nor plural, and given this, the basic shape of the relationships of these two groups is very simple, and is represented in the following tableau:[10]

Table I

	1. SINGULAR ('one')	**2. NON-SINGULAR** ('not one')
3. PLURAL ('at least one')		**'Objects'**
4. NON-PLURAL ('not at least one')	**'Object'**	**'Stuff'**

2. *Quantification and demonstratives*. Table I reflects the mutually exclusive nature of the categories of NCNs and CNs, and it is evident that there is not a single contrast between these categories, but rather *two*. As indicated earlier, however, to think *primarily* in terms of contrast on this basis would be a serious mistake. The table also shows that some semantic commonalities are no less fundamental than the differences: NCNs share with plural CNs the semantic feature of *non-singularity*; and share with singular CNs the feature of *non-plurality*.[11] Insofar as their common non-singularity is concerned, the kinship of NCNs and plural CNs is nicely mirrored in Quine's semantic *cumulative reference* principle, which works equally for both: adding water to water results only in more water; just so, adding apples to apples results only in more apples. We have also seen the non-singularity of NCNs to be reflected in their quantifiers. In the nature of the case, non-count sentences never involve essentially singular

[9]Some nouns are plausibly classified as neither as *count* nor as *non-count*, such as 'scissors', 'pyjamas' and 'trousers' – nouns that require numeral classifiers to be involved in counting.

[10] This tableau is derivative from others; see Laycock (1998, 2005, 2006). There are numerous contexts in which occurrences of plural nouns can be read as 'at least one' instead of 'many'; but this reading cannot apply within the context of plural or collective predication. There, the plural must be understood as 'many' (next note...).

[11]There is a question as to how the plural is *defined*. 'Plural' here is used in a linguistic or *semantic* sense, as against 'multiplicity' or 'many' as involving existential matters. Existentially, it is a truism that many things are merely *many-ones*. Adding a passenger to a car containing only a driver doubles the number of people in the car; add one to the first one and you get two. The semantic contrast between singular and plural is an altogether different sort of contrast from the concrete existential contrast. Unlike the plural, multiplicity or many call for *more than one*; these are not to be conflated. Such sentences as 'No dogs barked', 'There are no dogs here', 'She did not hear any dogs', etc., involve plural NPs (and these would be false if even a single dog barked, was present or was heard).

quantifiers ('each', 'every', etc.); but those non-singular quantifiers which are not essentially *plural* are thereby shared by NCNs and CNs alike. Unlike '*many*', 'all', 'some', and 'most', and in most of its occurrences, 'any', are shared. But insofar as referential determiners are concerned, the question must be addressed of why mass reference should not count as *singular* in a semantic sense: 'this water' looks exactly like 'this dog'. Now Geoffrey Leech notes that syntax 'is much less rich in dimensions of contrast than is semantics'; and the point is illustrated in this syntactic isomorphism.[12] *Semantically* there are three categories here – singular, plural, and non-count – but the *syntax* of demonstratives has only *two*. To understand the taxonomy of demonstratives, then, we need a bifold contrast only of the plural and *non-plural* – a class encompassing the singular *along with* the non-count. Since 'water' is itself *non-plural* – but not thereby semantically *singular* – the water in a glass can *only* be referred to as 'this water'. Quantificational differences are sharply marked in English, but English syntax makes no distinction, in typical referential contexts, between the singular and the non-plural – potentially thereby inviting a conflation of the two.[13] These observations are summed up in Table II:

Table II

	SINGULAR	**NON-SINGULAR**	***reference-determiners (definite articles) and verbs***
PLURAL		*apples*	*these / are*
NON-PLURAL	*apple*	*water*	*this / is*
quantity-determiners (quantifiers, indefinite articles)	*a, an, each, every, any*	*some, all, any, most, more many / much*	*XXX*

[12] *Semantics*, Penguin.

[13] Corresponding to the threefold semantic contrast of singular, plural and non-count, there are *two pairs* of semantic contrasts among determiners which are syntactically marked in English. There is the referential contrast of plural and non-plural in the form of 'these' and 'this'; on the other hand there is the quantifier-contrast of singular and non-singular – 'each', 'every' and 'a', *versus* 'all', 'some' and 'most' ('the' and 'any' are all-purpose determiners).

Table II systematically displays both the orthogonal character of the relationship between the two types of determiners, and the manifest functional differences between them – quantifiers bearing upon the singular / non-singular contrast, referential determiners (including demonstratives) bearing upon the plural / non-plural contrast. However, both the first and second tables have a substantial limitation. They offer a semantical taxonomy for occurrences of noun-types, CNs and NCNs alike – but defined *only* by reference to the semantics of *CNs*. Even CNs themselves, as a unified semantic category, apart from their semantically distinct *occurrences* as singular or plural – are nowhere to be seen. The sole semantical properties which figure here are those of their occurrences. In this sense, the tables do not even reflect the inner unity of the object category – presenting it as two semantically distinct occurrence-types, related to one another much as either is, in its own way, to NCNs. In fact, neither in the case of CNs *nor* in that of NCNs, is the relevant semantic category itself identified as such, in its own right; and it is vital to an understanding of these categories, that they be clearly distinguished from their diverse semantical occurrences. But perhaps the most fundamental and ironic lesson to be learned, from these diverse occurrences, is that it is not the contrasts but the commonalities between the categories that are key to grasping the semantics of NCNs and the nature of the underlying matter concept.

A taxonomy is then called for in which these indirect characterisations give way to direct expressions of the categories themselves. There is, in fact, no unique way of doing this – there are two asymmetrical ways of representing them, each of which is incomplete. One or the other aspect of the *singular / plural* contrast disappears in the process and the determiners are divided between the two. Quantity-determiners including quantifiers are carried by the singular / non-singular (*sns*) contrast, reference-determiners by the plural / non-plural (*pnp*) contrast (which orthodoxy mistakes for a singular / plural contrast). The tables hence reflect two aspects of the matter concept, akin to the two faces or embodiments of the object concept – but, of course, they do not show syntactically in the character of the term itself.

Semantic tableaux for the categories themselves

Table III/sns

	1. Singular (‘one’)	**2. Non-singular (‘not one’)**
3. Non-count		**‘Stuff’**
4. Count	**‘Object’**	**‘Objects’**

Table III/pnp

	1. Plural ('at least one')	2. Non-plural ('not at least one')
3. Non-count		'Stuff'
4. Count	'Objects'	'Object'

Yet even if equivalent, these representations are not strictly symmetrical. As Table II records, the scope of the plural / non-plural contrast is limited to definite referential determiners, while that of the singular / non-singular contrast covers both matching quantifiers and indefinite articles.

3. *Underlying categories and concepts*. Speaking of 'the mass / count *contrast*' is potentially misleading; and looking at it *chiefly* as a contrast, so I've urged, is just a plain mistake. Singular occurrences of CNs are non-plural, and the plural occurrences are non-singular, hence all occurrences of CNs share a crucial feature with NCNs. However, the mistake runs deeper, and the tables all reflect it. The contrasts in the tables are *semantic*, and there are at least three such contrasts. But there are not three concepts to be contrasted: there are only two – the matter concept and the object concept.

Concepts, unlike word forms, elude direct inspection; I speak of them as having semantical *embodiments* or modes of embodiment (*MEMs*) in various word- and sentence-forms, or as being expressed in the use of such sentences. Concepts cannot be expressed *other than* in their modes of embodiment – they can be expressed only in the use of words, but in philosophy it is the concepts that are the central objects of enquiry. One and the same concept can be expressed in different forms of words; in different languages and within one and the same language. So although 'happy', the adjective, and 'happiness', the noun, have distinct semantic *functions*, they do not express different *concepts*. The point is equally applicable to 'object', 'unit', 'entity', and so forth: whether we speak of *objects* or *an object*, of *units* or *a unit*, one and the same underlying concept is expressed. Singular and plural are semantically distinct, but the corresponding concept, that of *things* or *objects*, can be *neither* singular nor plural (neither 'one' nor 'many', so to say), although it is expressed semantically in *either* singular or plural form. And since the category as such is neither singular nor plural, it may dubbed numerically *neutral*. The object concept is, of course, the concept of a single unit; and insofar as objects do, in fact, exist, there cannot fail to be at least a single *one*. It might then seem that the concept *cannot* be numerically neutral. The objection begs the question; while objecthood and unity are not distinct, the fact is

that exactly as *an* object is *a* unit, so *objects*, equally, are *units*; and units may be *either* one or many. So here too, one and the same concept appears in *both* singular and non-singular semantic form.

That NCNs are neither singular nor plural – the matter concept involves neither *one* nor *many* – is, of course, a truism of sorts. However, this is no *less* true, so I have urged, of the object concept in itself. The *concepts* of both stuff and things are equally at home in that same corner box of the original tableau: they simply coincide. The result might seem, initially, surprising, but the point, it must be stressed, is one about a *concept* – that which *underlies* the semantics of both singular and plural. Just so, in the case of NCNs, the matter concept underlies the language of both non-singularity and non-plurality. The object concept *differs* from the matter concept, having as it does two faces – looking to both singular and plural boxes from its home base in what is, for it, the neutral corner box. In contrast, and in the very nature of the case, the matter concept cannot express itself *outside* the corner box.

In short, *singularity* is just no feature of the matter-concept *or* the object concept. And the notion that the object-concept is the concept of *an object* or *a single unit* (and is thus intrinsically *referential*) is perhaps the deepest error in the whole debate. If that were, *per impossibile* the case, then instead of being deeply kindred concepts, the concepts could have nothing whatsoever in common (perhaps as some believe, in fact, to be the case). Frege's question, of 'what we are here calling *an object*', fatally reduces the underlying concept to its semantically singular expression. The following tableau depicts some major features of the situation, including concept-designations and the referential applications of the noun forms.

Table IV: boxed concept script and *referential* embodiments

	1. SINGULAR ('one')	**2. NON-SINGULAR ('not one')**
3. PLURAL ('many')		***these objects*** ***some objects***
4. NON-PLURAL ('not many')	***an object*** ***this object***	⇑ ***some stuff*** ⇑ ⇑ ⇐ **Objects Stuff** ⇓ ***this stuff***

4. *Three major sentential semantic categories: preliminary comments*. Now reference is no feature of a general term or concept in itself, but arises at the level of its use or *application*; and fundamentally, its application to something *in particular*. But concepts are applied in different ways; and only sometimes are they used in a directly referential context. As everyone knows, a central advance of Fregean logic consists in its rejection of the subject / predicate sentential form as universal; and the rejection of that earlier view is a central feature of the modern conception of quantification.[14] On the new model of language here at issue, sentences are divided into just two broad categories. On the one hand are singular, fully-fledged referential sentences, sentences which exemplify the subject/predicate, object/concept model, and on the other hand are quantified sentences, which do not, but are constructed on the basis of the former group. On the one hand are singular sentences whose simplest form is just "Fa"; on the other hand there is "$(\exists x)(Fx)$". Many sentences which are syntactically of NP/VP or SVO form lack subjects in the fully referential sense, as Russell's Theory of Descriptions vividly attests. *Bona fide* logical or ontic subjects are found only among fully referential grammatical subjects. In the Frege / Russell framework, non-referential grammatical subjects such as 'a dog', 'some dogs', and 'the present king of France' are understood in terms of existential quantification. In an existentially quantified utterance, a variable may take a directly referential term as a substituend; and the form of such an utterance could be said to be *indirectly* referential.

But now assertions of existence which are *quantified* are simply one sub-group of the overall category of such assertions, and there is a further semantic category of non-generic sentences, over and above the 'standard' pair. Pre-theoretically, the category is as familiar and commonplace as any; it is the class of general, existentially committed, bare non-singular sentences (both plural and non-count).[15] These sentences, I suggest, are neither directly referential, nor are they quantified or indirectly referential. This category is the true home base of both the matter-concept and the object-concept. Examples of the class include the following (open-ended, non-determinate) plural sentences with syntactically traditional NP / VP form:

Ripe mangoes are falling from the tree,
Resistance fighters are besieging the base,
High-powered assault rifles are streaming across the border into Mexico,
Meteorites are bombarding the Moon,
People are starting to complain,

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[14]Frege's own departure from this taxonomy is relatively modest, in that logical subjects are displaced by quantified variables – 'mere' stand-ins for those subjects or their designators. Singular reference is generalised in the form of individual variables. The values of the variables cannot be other than individual objects, and their linguistic *substituends* are, after all, traditional grammatical subjects for which the predicates are either true or false.

[15]The category is nowadays sometimes recognized – and more often in linguistics than in philosophy – as a distinct syntactic form, but little if any significance is usually attributed to it (at least, within philosophy). The terminology of 'bare' nouns and noun phrases originates with Chomsky. See his 'Questions of form and interpretation', *Linguistic Analysis* I, 75-109, 1975.

and so on. Evidently, most but not all of this group involve collective predications. There are also what it's natural to call *explicitly* existential statements like

There are ripe mangoes in the orchard,
There were disturbances during the meeting,
There are assault rifles on special at the local gun shop,
There are neo-nazis among us,

and so on. Some of these are relatively complex; and many of them have analogs (involving what might be called 'aggregate' or 'bulk' predications) among non-count sentences. There are, for example, the following:

Traffic is flowing smoothly on the 401,
Cheap imported furniture is flooding into the Canadian market,
Crude oil poured over the levee
Water is dripping steadily from the ceiling,
Smoke billowed from the chimneys,

and so on. Many if them, too, raise issues associated with the lexical semantic category of *aspect* (as distinct from tense).[16]

I begin however with one of the very simplest sentence of this kind – 'Dogs are barking'. [perhaps along with 'Dogs are milling around the cat'?] To understand this particular sentence, we need to contrast it with the following two cognate sentences:

(a) A dog is barking,
(b) Some dogs are barking.

In a sense to be explained, both (a) and (b) are indefinitely referential, numerically determinate, or what I shall call *identity-involving*, and (a) in particular is semantically distinct from its truth-conditional equivalent in the predicate calculus.[17] However the bare sentence

(c) Dogs are barking

is not indefinitely referential, not numerically determinate, and not identity-involving. The difference comes into view, if we suppose that (a) is coupled or conjoined with the matching singular, discourse-anaphoric

It has been barking all night,

and that (b) and (c) are coupled with the matching plural

They have been barking all all night.

Now the implication, with both (a) and (b), is that the *same* dogs have been barking all all night; but no such identity results from the anaphor involving (c). And when I say that (a) and (b) are indefinitely referential, whereas (c) is not, just this is what I mean.

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[16]Grammatically, the lexical aspect of activity corresponds to so-called *imperfective* as against perfective aspect. There are five widely recognized aspectual classes of verbs (or more precisely, forms of predication), four of which belong to the so-called Vendler set of verbs denoting 'activities, achievements, accomplishments, and states'; the other is the class of semelfactives (see Bernard Comrie, *Aspect*). Aspect plays an *ontic* role in understanding many such bare sentences.

[17]That truth-conditional equivalence does not imply semantical equivalence is evident from such uncontroversial cases as the equivalence of 'Trudeau is Canadian' with 'Fermat's last theorem is true and Trudeau is Canadian'.

It is not to deny that the *truth-conditions* of (a) are given by its quantified equivalent,

(a') At least one dog is barking

or

(Ex)(Dx & Bx).

Rather, it is to say that the semantics of the natural language 'indefinite article', 'a' or 'an', carry a numerically determinate force which their quantified equivalent does not, the latter being instead numerically neutral.[18] From the standpoint of truth-conditions alone, (a), (c), and (a') in particular are all equivalent. None is quantified *in the sense of delimiting or specifying* quantity or number; none is *quantized*, as it is sometimes put. If, as with (c), there are said to be barking dogs, then there must of course be at least one (or in other words, one or more) for there to be any at all. But like (a'), the statement itself supplies no information whatsoever regarding numbers; it is numerically neutral.

Eytan Zweig opines that like *non*-bare plural sentences, bare plural sentences require *at least* two objects for their truth, even though – as he somewhat obscurely remarks – 'the plural noun itself does *not* assert more than one ...'.[19] But the plural form of the bare sentence notwithstanding, it is I suggest *not* rendered false if there is just one object of the appropriate kind. The sense that bare plural sentences require at least two objects for their truth is not simply a consequence of their plurality, but seems largely the result of pragmatic rather than semantic factors. The statement 'There are snipers in this area', for instance, would not be regarded as false, if there were a lone sniper in the area. It is possible that one who utters the sentence *believes* that there are or might be a number of snipers in the area; but this has no impact on the truth of what they *say*.[20]

It is highly significant, *from the standpoint* of the canonical first-order predicate calculus, that this third category should be invisible; and there is nothing at all surprising in this fact.[21] In the case of (c), the category is invisible, simply because in truth-conditional terms, the sentence is *equivalent* (or 'reducible') to the neutral use of the existential quantifier, as in (a'). And much the same can be said for

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[18]This neutrality is *the* central feature of the existential quantifier; see now **Appendix**.

[19]'Number-neutral bare plurals and the multiplicity implicature' *Linguistics and Philosophy*, 2009, emphasis mine.

[20]Among the more unfortunate quasi-conventions in the domain of logic is the tendency to represent universal and existential quantification in the curious form of 'All F is G' and 'Some F is G', where given that CNs are in play, the sentences should be plural, and so involve 'are' instead of 'is' – in which case 'Some F is G' must turn out to mean 'At least *two* Fs are G', rather than the appropriate reading of the quantifier as 'At least one F is G'. See Geach, *Logic Matters*, p.69.

[21]It is now generally recognised that in the standard predicate calculus, singularity is the sole semantic category. The point however was made long ago; in his *Introduction to Logical Theory*, Peter Strawson wrote: 'The curious assumption implicit in regarding the quantificational logic as adequate for the analysis of ordinary categorical statements is ... the assumption that the only subject-predicate statements are statements in the singular' (182).

(d) There are dogs in the street.[22]

Like (a'), both (c) and (d) are numerically neutral. Purely from the standpoint of truth-conditions, (a), (a'), and (c) in particular are all equivalent. But it is *only* in the context of distributive predication that this reduction to the canonical quasi-singular form is possible. By contrast, with most of the bare sentences above, involving as they do essentially non-singular predications, no such reduction is possible, and the issue I wish to consider thereby comes more clearly into view. It is here, in fact, that the third category itself ceases to be invisible. The question then concerns the relationship between bare plural sentences like these, and the matching *non-bare* plural sentences.

Nevertheless, and in spite of this major difference over distributive and collective predication, there are key features of (c) which apply to bare sentences in general – features which carry over into the *essentially* plural (or irreducible) bare sentences. Consider then the NP in

(e) Dogs have been barking all night.

There is a manifest sense in which (e) has a predicate of which *nothing* need be true: like (c) it is truth-conditionally equivalent to a singular sentence, indeed, but as it stands, *qua plural*, it lacks a directly or indirectly referential subject; it has no non-grammatical subject/s. By changing the structure of the grammatical predicate, it is reducible to an indirectly referential or quantified singular sentence, involving quantification over dogs and times, precisely because the predicate is distributive: very roughly, (e) is truth-conditionally equivalent to

(f) At any time during the night, at least one dog was barking.

But the semantically plural structure is no idle feature of the sentence form – were 'barking' replaced by 'gathering', or 'milling about', there could be no such reduction; and the fact remains that as it stands, there is nothing of which the predication 'have been barking all night' has to be true; there is here a predication which does not require a subject.

I conclude this part by briefly recapitulating the main semantic contrasts between the three types of existentially committed sentences which I have represented by (a), (b) and (c). In (a), there is determinate talk of an *individual* object; in (b), determinate talk of a *number* of objects. Neither MEM is numerically neutral; both are identity-involving. Syntax notwithstanding, (c) is numerically neutral, and also non-referential; here, there is mere 'undifferentiated', numerically indeterminate talk of *objects*. (c) is a semantically distinctive MEM which is not, as such, identity- involving. In indicating the involvement of a number of individuals, and laying a semantic basis for plural identity-statements, the presence of the indefinite non-singular determiner 'some' constitutes the introduction of an element which is *adventitious* from the standpoint of the kind or ontic category itself. The information that there are a certain number of things of a certain kind which are thus-and-so is both taxonomically and

[22]It is natural to call (e) an *explicitly* existential statement ('There is / are ...') while (d) is of traditional NP / VP form.

ontically irrelevant. The sole categorially or ontically salient fact consists merely in the information that there are *things of the kind* which are thus-and-so, in a given context; and there is of course a parallel thesis for the case of NCNs. The *amount* of stuff that there may be, of whatever kind or kinds, is no part of the ontology; what matters categorially or ontically is just that there is *stuff of one or another kind*; this is a more basic form of thought than those involving '*some*' (*identity*, or *reference*), which introduce amounts. There are arguments for these claims in the sequel, and the overall taxonomy is reflected in the following tableau:

Table V: OVERALL TAXONOMY

	GENERIC	**existentially significant =**	**'instantiation' =**	**embodiment of concepts**
OCCURRENCE TYPES:	***Non-existential*** *Category / Concept / Kind*	***Existential*** *ontic / neutral unquantized / indeterminate*	*non-neutral / quantized / indefinite*	***Referential*** *definite*
CN	'Objects'	'objects'	'some objects' 'an object'	'these objects' 'this object'
NCN	'Stuff'	'stuff'	'some stuff'	'this stuff'

5. *Six subcategories of the third major semantic category of sentences.* **(i)** Consider now the sentence-pair

(g) Dogs were barking all night,

(h) Some dogs were barking all night.

Two features of (g) are worth remarking. First, although (g) is not identity-involving, it is, we may say, *identity-compatible*: that is, its truth is consistent with the truth of (h). And unlike (g), but like (b), (h) carries an implication of identity: it is indefinitely referential or numerically determinate. To say that *some* objects are thus-and-so is to say that a certain determinate *number* of objects are thus-and-so; to say that *objects* are thus-and-so is not (it is, again, numerically neutral). The truth-conditions of (h) are given by

(h') *At least two* dogs were barking all night.

In other words, (h) is equivalent to 'A number of dogs were barking all night'; and the

idea of a number of objects is essentially the idea of determinate *multiplicity* – one thing alone is not enough to count.[23] Now the fact that (e) is reducible to the quantified and quasi-singular (f) is, of course, a function of the distributive predicate; but a further sub-category of of this third bare group lacks such distributive predicates.

(ii) For example, the sentence-pair

(i) Resistance fighters are besieging the base,

(j) Some resistance fighters are besieging the base

have no singular or quasi-singular truth-conditional equivalents; besieging is an essentially collective activity. On the other hand, although (i) is not identity-involving, it is certainly identity-compatible; its truth is consistent with the truth of (j). But laying a siege is a time-consuming collective activity, and does not requires the persistence of a number of besiegers – it is compatible with the constant change, replenishment or rotation of the individuals involved. Whereas (j) involves the idea of numerical identity, (i) does not. The multiplicity of (i) is that of *indeterminate* or unquantized multiplicity. However, although (i) is not only unquantized or unquantified, but is also irreducible to quasi-singular form, it may seem reducible to a quantified *non-singular* sentence; 'At any given moment, *some* resistance fighters are besieging the base.' The issue calls specifically for an understanding of predications expressing *process*-concepts. For insofar as a process-concept applies *only* to temporally extended and essentially unbounded episodes, truth values have to be assigned to sentences relative to *intervals* of time, rather than to temporal 'points' or dimensionless 'moments' – themselves, arguably, objects which are 'ideal' or abstractions (and so, like much of mathematics, incapable of featuring in a realistic analysis).[24] And in that case, no such reduction will be possible.

(iii) Unlike the foregoing sentences, however, many of the listed sentences are *not* identity-compatible; this is so, whether they are reducible or not. Contrast, for example, the unquantized and quantized sentences

(k) Ripe mangoes have been falling from the tree all week,

(*l) Some ripe mangoes have been falling from the tree all week.

(k) is reducible; it is open to quantified non-plural paraphrase broadly parallel to that of (g); asserting that during any appropriately brief portion of the week, at least one mango was falling from the tree. On the other hand, the very introduction of the plural determiner, as in (l), is distinctly problematic. An implication of (l) is that the *same* ripe mangoes, at least two, have been falling from the tree all week. But this is peculiar indeed, and would seem incoherent, since what is involved in fruit falling from trees is that individual pieces of fruit come to be detached from the branches and

[23]The claim that I have written *some* books, or *a number of books*, may be misleading although not false, if I have written only two; but the claim is outright *false*, and not merely misleading, if I have written only one. As Strawson notes in *Introduction to Logical Theory*, it is a distinctive feature of 'some' that it 'carries an implication of plurality' (178).

[24]On this issue, see especially Prat and Bree's 'The expressive power of the English temporal preposition system', *Technical Report Series* UMC-93-1-7.)

so drop – each mango thereby falling but once, not repeatedly. The kind of continuous process which the predicate represents is in open conflict with the identity implicated by the non-bare plural subject-expression.[25]

Far from being identity-compatible, (k) may be said to be *identity-hostile*. The identity-hostile group of sentences – neither identity-compatible nor reducible – would include

High-powered assault rifles are streaming across the border into Mexico,
Meteorites are bombarding the Moon,
Traffic is flowing smoothly on the 401,
Cheap imported furniture is flooding into the Canadian market,
Crude oil poured over the levee
Water is dripping steadily from the ceiling,

and

Smoke billowed from the chimneys.

Much as people in a panic may be pouring from a building, water may be pouring over a levee, or smoke billowing from a chimney These sentences, which essentially involve non-distributive predicates of an open-ended or unbounded, temporally extended nature, could perhaps be said to be *temporally* collective or aggregated, as against the essentially spatial form of collectivity involved in

The village is surrounded by trees.

Lexical aspect commonly has an *ontological* dimension: predicates often denote what may be called 'doings' as opposed to 'beings'; and some predicates denote doings which have built-in end-points, limits or boundaries ('break', 'arrive', 'hit', and in a certain sense, 'cough') while others do not ('run', 'stream', 'eat', 'rain'). For the former group, the so-called *accomplishments* and *achievements*, to do it is to have done it; for it to happen is for it to have happened. For the latter group, this is not the case. The concept of activity applies to doings in this second group: 'activity' in this sense denotes no range of numerically distinct *activities*, and individuates no such activities.[26]

(iv) Using verbs of activity such as 'pour', there are pairs of plural sentences like

(m) Ants are pouring from cracks in the walls
(*n) Some ants are pouring from cracks in the walls

[25]A similar issue is addressed in Greg Carlson's work: in *Bare plurals as the names of kinds*, this kind of talk is explicated as referring to what he calls 'stages' of the kind itself. In my view, however, this somewhat obscure notion of *stages* of a kind is an attempt at a metaphysical description of nothing other than the simple idea of *individuals* or *objects* of a kind.

[26]Such verbs as 'fall', 'walk', 'run', 'rain', 'stream', 'eat', 'pour' and 'flood' all signify essentially continuous, unbounded or open-ended processes of one sort or another, process with no built-in end-points or limits. But the category of aspect can be still further sub-divided: some activity verbs denote only the doings of discrete individuals, and so can accompany both singular and plural subject-expressions: 'walking' and 'eating' denote just such doings. Our interest here however is centrally in verbs which accept or require bare plural subject expressions; as with 'rain' and 'besiege'; these apply only to collections of individuals or to 'aggregates'.

which are not only identity-hostile, but also logically impossible (and trivially so) to reduce to a standard quantified singular format or to any indirectly referential format, as long as they retain their distinctively collective predicates – or in other words, their meaning.

(o) Refugees are flooding across the frontier.

(*p) Some refugees are flooding across the frontier.

In sentences of this genre, not only can there be no singular paraphrase, but as with the mangoes, the introduction of a (*referential*) determiner will generate paradox.

Where a count noun is involved, the continuous nature of such a process involves different individuals at different times, as in (o), such sentences cannot be reduced to a standard quantified singular format; and as Boolos and others have urged, it is misguided and to attempt reduction via the posit of sets or plural objects. On the other hand, it is prima facie reasonable to suppose that the truth of such sentences supervenes in some way on truths concerning individuals and their relationships

It goes without saying that none of this denies the obvious – and obviously truistic – point that any such processes described in count noun sentences are *ontically* supervenient upon the existence of individual objects of one sort or another. So far at least as count *nouns* are concerned, the issues here addressed are essentially semantic and not ontological.[27]

(v) Much as with group **(ii)**, there are sentence-pairs such as

(q) Water has been sitting in the basement all week,

(*r) Some water has been sitting in the basement all week,

and it is evident that (q) is identity compatible.

(vi) On the other hand, much as with the mangoes sentences, in the pair

(s) Water has been pouring over the levee all morning,

(*t) Some water has been pouring over the levee all morning,

(s) is clearly unproblematic, but as with (l), the matching indefinitely referential (*t) is not. Where a distributive predicate is employed in the description of a continuous, open-ended process which involves a CN – as with ‘Ripe mangoes are falling from the tree’ – there is typically a singular quantified sentence which is the truth-conditional equivalent, but no indefinitely referential plural equivalent, precisely because of the open-ended character of the continuous present. And in the case of a cognate non-count sentence such as ‘Water is dripping from the ceiling’, then on the one hand, there is *ex hypothesi* no possibility of a singular equivalent or reduction; and there is no indefinitely referential non-singular equivalent, for the very same reason as in the plural case.

[27] On the other hand, distinctions such as that between activity and semelfactive *predications* is ontological, between continuous and punctuated processes.

In this case as in others, the introduction of a period of time, though dramatic, is unnecessary; since the verb phrase, like most such phrases, is itself essentially time-consuming. Here, since the noun is not semantically plural, there can be no paraphrase in terms of moments and 'at least one'. But at the same time, the truth-conditions of (s) cannot require that at any particular point in time, *some* water is pouring over the levee. While it is possible to quantify the rate of flow for any given unit of time, no amount is small enough to cross the levee at any particular point in time. All that is required is that at any particular point in time, *water* is pouring over the levee. With bare sentences involving count nouns, there must always be an underlying level of identity; but with non-count nouns, that level of identity has gone. NCNs and the concept of matter involve no built-in notion of identity.But neither is there the semantic basis for a conception of supervenience here; there are no constituent units on the basis of which the process might perhaps be further understood. Sentences having this form, I suggest, constitute *pure* embodiments of the matter-concept – ones in which the concept appears, unmarked and unmodified by the presupposition of quantitative elements, identity or the possibility of reference. The fundamental mode in which both the object-concept and the matter-concept are linguistically embodied is a mode which is in no sense referential. For the object-concept, this modes is *ontically* supervenient on (the possibility of reference to) things; but for the matter-concept, there is no such possibility of underlying modes of referential contact with the world.

APPENDIX

The nature of what is *called* 'the existential quantifier' is widely misunderstood, and the fact that it *is* so called is partially to blame. What the operator ∃ represents is quantification *in name only*, precisely because its role is to be numerically *neutral*. Given the considerable limitations of the predicate calculus, Quine is exactly right when he declares: 'Existence is what existential quantification expresses'. He continues – seemingly without noticing the very revealing semantic form of his remark – 'There are *things of kind F* if and only if $(\exists x)(Fx)$'. For here, plainly, the bare plural form is used, and this is *the* precise way of expressing numerical neutrality in natural English. *The* existential quantifier (as we may call it) is indeed an ontological device, as Quine insists, and a contrast is not infrequently recognised between it and what is called *numerical* quantification, as in 'There are at least five rabbits in the garden', 'There are exactly two prime numbers between 1 and 4', and so on. (See, for example, 'In so many possible worlds', K. Fine, *Notre Dame Journal of formal logic*, 1972; SC Shapiro (1979): 'Numerical quantifiers and their use in reasoning with negative information', in: *Proceedings of the 6th International Joint Conference on Artificial Intelligence*, Tokyo, 791-796). Numerical quantifiers are typically used to convey *empirical* rather than ontic or category-related information. Nevertheless, the confusion of these two ideas is by no means unusual. We are told, for example, that

> A quantifier is a word or expression that specifies which or how many of some kind of things have some property.

James McCawley, *Everything that Linguists have always wanted to know about Logic*,

Chicago 1993, p.23. Likewise, Sarah-Jane Leslie writes ‘Generics are sentences ... which express generalizations concerning kinds. Quantified statements ... also express generalizations, but unlike generics, they specify how many members of the kind have the property in question’. See her ‘Quantified statements are recalled as generics: Evidence from preschool children and adults’. Furthermore, of course, the existential quantifier is used to represent natural language *singular* assertions of existence, and in this sense has unwanted connotations of non-neutrality. It is far better thought of as the formal representation of the neutral bare plural ‘There are things of kind F’, as in Quine’s remark: unlike its relationship with a singular assertion, here the formal and informal statements are semantically *identical*.

That this logic is envisaged by its founder as a *concept-script*, and not a mere reflection of natural-language constructions, is generally recognised. It is ironic in the extreme that its cardinal mistake is to identify the object-concept with its linguistically *singular embodiment* – in effect, to identify the concept with the notion of *the one*, or to see it principally embodied in talk of *this one* or *that one*. The error is obscured, but not eliminated, in the neutralisation or replacement of this talk through the use of the existential quantifier, *so-called*, whereby talk of *this* one or *some* one is replaced by talk of *at least* one. This only works, of course, if we are already in the game, and many sentences remain impossible to represent in the notation.

LIST OF THE FEATURED SENTENCES

(a) A dog is barking
(a') At least one dog is barking
(b) Some dogs are barking
(c) Dogs are barking
(d) There are dogs in the street
(e) Dogs have been barking all night
(f) At any time during the night, at least one dog was barking
(g) Dogs were barking all night
(h) Some dogs were barking all night
(h') At least two dogs were barking all night
(i) Resistance fighters are besieging the base
(j) Some resistance fighters are besieging the base
(k) Ripe mangoes have been falling from the tree all week
(*l) Some ripe mangoes have been falling from the tree all week
(m) Ants are pouring from cracks in the walls
(*n) Some ants are pouring from cracks in the walls
(o) Refugees are flooding across the frontier
(*p) Some refugees are flooding across the frontier
(q) Water has been sitting in the basement all week
(*r) Some water has been sitting in the basement all week
(s) Water has been pouring over the levee all morning
(*t) Some water has been pouring over the levee all morning

Numeral Classifiers and The Mass/Count Distinction

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Abstract

Classifier languages regularly use *numeral classifiers*, special expressions without counterparts in non-classifiers languages in numeral noun phrases relating to the number (e.g., counterparts of 'three cows'). To explain the use of classifiers, many linguists and philosophers hold that all classifier language nouns are mass nouns (the *mass noun thesis*), while taking classifiers to have the same semantic function as measure words (the *measure word account*). This paper argues against this dominant view, and presents an alternative conception of classifiers and classifier language nouns. It argues that classifier languages, too, have count nouns as well as mass nouns (the *count noun thesis*), and that classifiers are *paranumerals* for *one*, namely, cousins of numerals for one figuring as syntactic peers of measure words (the *paranumeral account*).

The full paper is available at: http://philosophy.utoronto.ca/people/faculty/byeong-uk-yi

ACCEPTED ABSTRACTS

RE-EXAMINING THE MASS-COUNT DISTINCTION

In this talk, we argue that the mass-count distinction has limited scientific value, especially in term of cross-linguistic application. The ontological distinction just reflects our conceptual system and hence is universal. The grammatical distinction, defined as a cluster of distributional and semantic properties, does not divide languages into two classes (i.e., those with a count-mass distinction and those without). Rather, empirically it defines a gradation of languages, from those that have all the properties to those that have none. It would be better to concentrate on the individual properties that constitute the gradable classification rather than focus on the mass-count distinction as a categorical divide.

Background: The mass-count distinction was originally described as an ontological division between substance-like and countable referents (see Jesperson, 1924). More recently, this divide has been recast as a difference between denotations with and without minimal parts (see Link, 1983), where minimal parts are determined by the individuation criteria inherent in the noun. The fact that this ontological divide exists should be unsurprising. Independent of language, it is clear that some concepts individuate and others do not. Hence, the ontological divide is just a reflection of our conceptual system. As pointed out by Bloomfield (1933), what is more significant about the mass-count distinction are the corresponding semantic and syntactic patterns that are, in principle, separable from the ontological divide:

(1) a. There is a class of nouns (called *count*) that denote a set of singulars (i.e., set of atoms).
    b. There is a class of nouns (called *count*) that combine with plural markers.
    c. There is a class of nouns (called *count*) that directly combine with numerals.
    d. Certain quantifiers can only combine with one class of nouns (e.g., *several*, *each*, *every*, *a*).
    e. Certain quantifiers have different forms depending on the class of noun (e.g., *many* vs. *much*).

These five properties establish count and mass as grammatical categories. In fact, such categories are not always faithful to the ontological divide. Some nouns with denotations that have minimal parts (e.g., *furniture*) pattern like those with substance-like referents (Gillon, 1992; Chierchia, 1998; Bale & Barner, 2009).

Cross-linguistic Application: When asking whether another language (besides English) has a mass-count distinction, it is important to know exactly what is being asked and whether such a question is relevant. If the question is about whether a language has the ontological distinction, then the answer will most likely be yes. All people have concepts that individuate and concepts that do not, and it would be shocking if the nominal system was not able take advantage of both types of concepts when determining the denotation of certain nouns. A more pertinent question is whether another language has the grammatical categories of mass and count. There are two ways that this question can be posed: a strong version and a weak one.

Strong Version: The strong version of the question asks whether a language has all five of the properties listed in (1), or alternatively whether it has none. We call this a "strong version" due to its *all* or *nothing* structure. The relevance of this question depends on the nature of the answer. If languages consistently divide into those that have all five properties and those that have none, then this would demonstrate that these properties tend to cluster together cross-linguistically: that the grammatical mass-count distinction "carves nature at its joints" and thus represents a significant way of categorizing languages. English is the prototypical example of a language with all five properties. Mandarin chinese is a prototypical example of a language that has none. Purportedly it does not have a class of nouns with singular denotations, nor a productive plural marker, nor morphological variations based on certain noun classes, nor quantifiers that combine with only certain classes of nouns. Furthermore, it does not allow numerals to combine directly with any noun. (There are some exceptions to these reported claims, which will be discussed in detail in the talk.) Unfortunately, languages do not exclusively pattern like English or Mandarin. Rather, they form a gradual spectrum between these two poles. Furthermore, there is evidence that some of the properties listed in (1) are independent of the others, and in some cases completely independent of the nominal system.

For example, there are many languages where the presence of a plural morpheme (property b) is independent of singular denotations (property a). In Western Armenian, there is a productive plural marker (*-ner*) that is used to express quantification over groups of two or more individuals. However, unlike English, the bare-noun counterparts to the plural nouns do not denote a set of singulars. Rather, they are underspecified for number and hence are used to refer to groups as well as individuals (see Bale et al., 2011a). Similar facts hold for Korean (see Kang, 1994) and Turkish (see Bale et al., 2011b).

A similar disassociation of properties holds for numeral modification (direct vs. mediated). As discussed in Wilhelm (2008), in Dëne Suliné, a northern Athapaskan language, numerals can combine directly with bare nouns even though this language lacks plural morphology and does not have a class of nouns that denote a set of singulars (all nouns are underspecified for number). Thus, direct combination (property c) does not correlate with singular denotations or plural marking (properties a and b). Perhaps even more significant, there is evidence that direct vs. mediated numeral modification has more to do with the semantic nature of the numerals themselves than the nature of the nominal system. For example, in Mi'kmaq, a northeastern Algonquian language, certain numerals require a classifier to combine with nouns but others do not, even when combining with the exact same nouns. Consider the examples in (2) and (3).

(2) a. na'n-ijig jinmug
five-AGR men

b. * na'n **te's**-ijig jinmug
five CL-AGR men

(3) a. * asugom-ijig jinmug
six-AGR men

b. asugom **te's**-ijig jinmug
six CL-AGR men

The numeral *na'n* (five) cannot appear with the classifier *te's*, rather it modifies the noun *jinmug* (men) directly. In contrast, the numeral *asugom* (six) requires the presence of the classifier in order to modify *jinmug*. Since the noun is the same for the two numerals, it cannot be the semantic or syntactic nature of the noun that determines the presence or absence of classifiers. It must be the numerals themselves. Similar facts hold for Chol, a Mayan language spoken in the south of Mexico (Coon, 2007).

In summary, the properties in (1) do not always cluster together. Empirically speaking, languages vary on which properties are present and which are not. (For space reasons, we have left out a discussion of properties d and e, but similar dissociations occur with them as well, e.g., French does not have property e even though it does have a-d.) Thus, the answer to the strong version of the question diminishes the relevance of the mass-count distinction. There is less of a distinction than a gradation.

Weak version: The weak version of the mass-count question asks whether languages have some subset of the properties listed in (1), or whether there is any other kind of grammatical distinction that loosely correlates with the ontological distinction. If so, such languages are often labelled as having the mass-count distinction. There are two reasons that this "weak version" of the question is not useful for linguistics. First, it raises unanswerable questions, such as, *how many of the properties in (1) would constitute a mass-count distinction*. The choice of number seems arbitrary. Furthermore, one could give up the pretence of the mass-count distinction all together, and just concentrate on the properties in (1) without arbitrarily classifying a language as count or mass. The result would be just as scientifically fruitful and would lack any vagueness in classification. Second, it is possible that certain distributional facts might just be a reflection of the ontological distinction, which as discussed above, every language should have. For example, if a certain quantifier (such as a quasi-numeral determiner) relies on the presence of atomic minimal parts, then such quantifiers will not be able to combine, semantically speaking, with nouns that do not have such minimal parts. But, this does not establish the existence of grammatical categories. It just reflects a division in our conceptual system. **Selected References**: **Bale, A. M. Gagnon & H. Khanjian**. 2011a. On the relationship between morphological and semantic markedness. Morphology 21(2): 197–221. **Chiechia, G.** 1998. Plurality of mass nouns and the notion of 'semantic parameter'. Events and Grammar 70: 53–103. **Gillon, B.** 1992. Towards a common semantics for English count and mass nouns. L&P 15: 597–640. **Wilhelm, A.** 2008. Bare nouns and number in Dëne Suliné. NALS 16: 39–68.

Who Has More Furniture? An Exploration of the Bases for Comparison

Nouns like *furniture*, *jewelry*, and *mail* have presented an ongoing challenge for theories of the mass/count distinction: morphosyntactically, they pattern like mass nouns, yet their denotations are constituted of countable objects. In fact, Barner & Snedeker (2005) argue that this property is what sets them apart from substance mass nouns like *water* or *mud*. McCawley (1975), instead, argues that they are better characterized by referring to the function associated with the nouns, e.g. furnishing a room for *furniture*. In this talk, we argue for recognizing both constituent objects and function in the meaning of these nouns. The presence of an "associated event" designating the function is a key property of all artifact nouns (Nichols 2008)—but for *furniture*-nouns the associated event, e.g. furnishing, implies multiple participants, an important additional dimension of meaning for their countability status. We support this position with three experimental studies.

Expanding the Comparative Judgement Task. Barner & Snedeker (2005) advance our understanding of *furniture*-nouns by examining various noun types in a "comparative judgement task". For substance mass nouns, participants judge one large portion of, say, toothpaste to be "more toothpaste" than three smaller portions. In contrast, comparative judgements are based on cardinality for count nouns: three small chairs are judged to be "more chairs" than one large chair. *Furniture*-nouns, despite their mass morphosyntax, pattern with count nouns: comparison is based on cardinality, e.g. three small forks are judged to be "more silverware" than one large fork.

We present three experiments which together demonstrate that other factors influence comparative judgements with *furniture*-nouns, namely heterogeneity of constituent entities and associated function—both properties that we argue are critical to the characterization of such nouns. The experiments were conducted via Amazon's Mechanical Turk, with each item rated by at least 20 participants. (50% or more of the items were fillers.)

Our experiment 1 investigates how the heterogeneity of constituent entities that is characteristic of *furniture*-nouns affects comparisons. Participants evaluated which of two sets qualified as more furniture: (i) five chairs or (ii) a sofa, two chairs, a coffee table, and a bookcase. If comparison for these nouns is based solely on set cardinality, then the responses should be random, since both sets have five items. However, if a set with heterogeneous items better exemplifies furniture, then participants should favor the second option, and, in fact, they unanimously did. While this result is difficult to accommodate under the view that *furniture* is simply equivalent to its constituent entities, this result can be understood if other dimensions of comparison matter, e.g. the degree to which a set of furniture can be said to furnish a space.

Experiment 2 demonstrates that a set of entities referred to by a *furniture*-noun which better fulfills the associated function may be judged as "more" than a set with greater cardinality. Participants were presented with a context involving two different sets of objects which could be named by the same *furniture*-noun, e.g. *jewelry, luggage, mail*. One set had a greater number of pieces, but the other set was designed to be greater in terms of fulfilling the function associated with the nouns. (Heterogeneity was controlled for by making both sets equally diverse.) For example, the *jewelry* stimulus presents two women attending a gala event and asks who is wearing more jewelry: the woman wearing two gold bracelets, a diamond tiara, and a ruby and emerald necklace or a second woman wearing three gold rings, a pearl necklace, and a silver bracelet. The first set plausibly has higher ornamental and monetary value, while the second set has more pieces (5) than the first set

(4). Barner & Snedecker's account clearly predicts that the second, more numerous, set should be chosen as "more"; however, the responses were split: some participants chose the set with more ornamental value as "more jewelry" (55%), while others based their judgement on cardinality (45%). The same results were found with the other *furniture*-nouns. They indicate that having more items is not always enough to count as "more"; rather, multiple dimensions of comparison are at play, including both number of pieces and the degree to which the noun's associated function is fulfilled.

Experiment 3 strengthens this conclusion, showing that judgements along the "fulfillment of function" dimension are sensitive to the immediate context. This experiment used the same sets of constituent objects as experiment 2, but contrasted two different contexts relative to each noun. For instance, one group of participants would see the gala event context for jewelry, while the context for a second group would be two different display cases inside a jewelry store. Participants preferred different bases of comparison depending on the context: when the jewelry was being worn, participants more often chose the more valuable and impressive set of jewelry rather than the more numerous (55%), but when comparing two sets of jewelry in display cases, participants mostly chose the set with greater cardinality (80%). Similar results were found with the other *furniture*-nouns.

Implications for the Semantics of *furniture*-Nouns. Our results indicate that the semantics of these nouns must provide information about both the constituent elements and their function, i.e. the associated event. We take the semantics of artifacts to encode a relation between entities and a predicate designating an associated event. *Furniture*-nouns are a special type of artifact noun in that their associated event permits, and typically implies, the involvement of a set of entities. This contrasts with countable artifacts, such as *hammer*, where each minimal hammering event is in a one-to-one relation with a single entity. Thus, the associated events of count artifact nouns imply single entities, while the associated events of *furniture* artifact nouns imply multiple entities. For example, the denotation of *mail* is just those entities participating in the associated event of *being in the postal system*, as in (1).

(1) *mail*:= $\lambda w \lambda x[\text{In-the-postal-system}(x)(w)]$

This analysis guarantees properties associated with mass morphosyntax, such as *cumulativity* or *closure under event participation* (Schwarzschild To appear). It also accounts naturally for the connotation of heterogeneity of constituent entities found with these nouns: although the entities must all participate in the same associated event, they need not be the same type of entity.

Crosslinguistic Outlook. Placing part of the explanatory burden on the associated event provides insight into some of the oft-noted crosslinguistic variation in the morphosyntactic status of *furniture*-nouns, e.g. *furniture* is mass in English, but *meuble* is count in French. These artifact nouns have different etymologies: the English term comes from 'to furnish' while *meuble* comes from 'movable object'. Thus, the nouns have different associated events, and, hence, different countability behaviors.

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A Comparison of Abstract and Concrete Mass Nouns in Terms of Their Interaction with Vague Quantificational Determiners

In this paper, I compare concrete mass nouns such as *rice*, *water* etc. with abstract mass nouns such as *understanding*, *generosity* etc. in terms of their interaction with vague quantificational determiners such as *a lot* and *little*. I show that apart from many similarities there are also crucial differences which are a consequence of the fact that while in the case of concrete mass nouns, the relevant entities can only be measured and compared in quantitative terms, in the case of abstract mass nouns a qualitative dimension is available as well (at least in many cases). Consider the contrast between (1a) and (2a), on the one hand, and (1b) and (2b), on the other:

(1) a. I ate lot of rice yesterday evening.
b. I ate a lot of rice during my holiday.

(2) a. When I talked to Peter yesterday evening, I experienced lot of understanding for my problems.
b. During my stay in France, I experienced a lot of understanding for my problems.

In both (1a) and (1b), the speaker asserts that the amount of rice she ate during a certain period of time is quite high/higher than what would have been expected. The question of whether there is a single event which resulted in the relevant amount being consumed or several events such that the relevant amount is reached just by the mereological sum of the amount of rice consumed on each event is only indirectly relevant – what counts as a lot might be relative to the length of the respective time interval or the number of events. Crucially, however, it need not be the case that the amount of rice that was consumed on each occasion is considered *a lot* with respect to that occasion – it might even be the case that on each single occasion a very little amount of rice was eaten, but that there were more such events than expected, thus resulting in a large overall amount of rice being eaten during the time interval under consideration.

Concerning (2a) and (2b), in contrast, there seems to be a crucial difference in the way *a lot* is interpreted (on the most salient readings): In the case of (2a), what is said to be high with respect to some standard/exceed expectations is the intensity of Peter's understanding, i.e. the sentence basically seems to mean the same thing as *Peter understood my problems very well* (cf. Nicolas 2010, Yi ms.). In the case of (2b), there is a prominent reading according to which what is said to be high/exceed expectations is not the intensity of one or several persons' understanding for the speaker's problems, but rather the number of occasions on which the speaker experienced understanding. Consequently, *a lot* seems to be understood in qualitative terms in the case of (2a) and in quantitative terms in the case of (2b).

Now, at first sight an analysis which assumes abstract mass nouns to denote abstract stuff/abstract substances seems to be able to give a unified account of (2a) and (2b): In the case of (2a), there is a large amount of the relevant substance/stuff transferred to the speaker on a single occasion, while in the case of (2b) what counts as *a lot* is just the overall amount of the substance/stuff transferred to the speaker during the relevant time interval, analogously to the case of (1a) vs. (1b). What an analysis along those lines cannot account for, however, is the following contrast between (1b) and (2b): While (1b) can even be true in a situation where the amount of rice consumed on each occasion is very small (see above), (2b) cannot be true in a situation where the speaker got just a little bit of understanding from each of the persons that she talked to, but where the number of people she talked to was high/exceeded expectations. It need not be the case that on each occasion the degree of understanding was particularly high, but what is definitely excluded is that events are counted where the degree of understanding was so low that it would just count as a little bit of understanding. Intuitively, what is required in the case of (2b) is that on each relevant occasion the degree to which the speaker experienced understanding was at least high enough to be in the denotation of the bare noun *understanding* or the unmodified verb (*to*) *understand*. In other words, on its most salient reading, (2b) is true in the same situations in which the sentence *During my stay, I often experienced*

understanding for my problems or the sentence *During my stay, there were many people who understood my problems* would be true.

This contrast excludes the possibility of analyzing sentences like (2a,b) completely analogously to ones like (1a,b), since if it was just (overall) quantities of either concrete or abstract stuff/substances that were compared to some expected value in each case, *a lot* should work in exactly the same way in each case. I therefore follow Moltmann (2004, 2009) and Nicolas (2010) in assuming that nouns derived from gradable adjectives or verbs denote instantiations of properties in individuals, and assume that the core semantics of *a lot* just expresses that some (singular or plural) entity can be mapped by some salient (not necessarily metrical) measure function to a value that counts as high in the context where the sentence is uttered (cf. Nicolas 2010). Now, in the case of plural entities or concrete substances, the only salient measure functions are ones mapping the respective entities to cardinalities/quantities. In the case of abstract individuals such as tropes, in contrast, which can be compared and ordered according to the intensity to which the respective property is instantiated in each case, an additional measure function is available which maps the respective trope to some value on a (presumably non-metrical, but rather ordinal) scale which can be construed on the basis of forming equivalence classes of the tropes under consideration.

It is well-known that gradable adjectives in their bare form (i.e. without any comparative or degree morphology) make reference to some standard of comparison which (depending on the nature of the relevant scale) is either fixed or determined by the context (Kennedy 2007). This can be accounted for by assuming that a covert morpheme *pos* is combined with the bare adjective stem in such cases. *Pos* requires the instantiation of the respective property in the individuals which are mapped to the value *true* by the combination of *pos* and the respective adjective to be ranked at least as high as the relevant standard of comparison (which can be given in the form of a possible trope or trope interval; see Moltmann 2009). I assume that the unmodified forms of gradable verbs such as (*to*) *understand* are combined with *pos*, too.

Now, in order to account for contrasts like the one between (2a) and (2b), I assume that when gradable adjectives or verbs are turned into nouns, it may either be the bare stem or the combination of the stem and *pos* that is nominalized. If it is just the bare stem, however, an indication of the position occupied by the respective trope as compared to other tropes instantiating the same property (in terms of the intensity to which they instantiate the respective property) must be given in some other way. Consequently, in cases where the nominalization of a bare stem is combined with *a lot*, the natural setting for the measure function associated with *a lot* is one that orders tropes according to the intensity to which the respective property is instantiated. Now, in the case of (2a), where it is plausible (in terms of general world knowledge) to assume that just a single trope is involved, assuming that *a lot* applies to the nominalization of the bare stem is the most natural choice, since mapping a single trope to its cardinality would yield a value that does not count as high in any conceivable context. In the case of (2b), in contrast, it is plausible (in terms of general world knowledge) to assume that there is a plurality of tropes involved (recall that the distinction between singular and plural individuals is neutralized in the case of mass nouns). Consequently, a natural setting for the measure function associated with *a lot* is the one mapping plural individuals to the cardinalities of their atomic parts. In order for this to be possible, however, the position on the intensity scale occupied by the atomic parts of the "plural trope" must be indicated in some other way. Consequently, it has to be assumed that what *a lot* combines with in that case is the nominalization of the combination of *pos* and the verb stem. This explains why the individual tropes counted cannot be understood as occupying a low position on the intensity scale.

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Sujet : Les limites de l'opposition singulier / pluriel dans la systématisation des emplois des classificateurs en tagbana.

Résumé

L'opposition singulier / pluriel constitue l'un des fondements de la stratégie descriptive de l'approche morphosyntaxique des classificateurs dans les langues africaines en générale, et en particulier en Tagbana[1]. Ainsi, Grinevald et Seifart affirment que : «the classification observed in African languages is a classification of noun forms, *not of the the referents* and the most obvious function of commutations between class markers is to express number » (2004: 252- 253). Dans cette perspective, le genre **li/ké** en tagbana, selon Gundrun et Kerstin, a pour fonction de marquer, dans le discours, les noms appartenant à la classe **li**, c'est-à-dire l'ensemble des noms dont la composition morphologique fait apparaître la présence d'un suffixe composé de la consonne latérale *[l] + une voyelle*, et dont l'opposition singulier / pluriel est infléchie par les morphèmes de classe **li / ké.** Soit l'exemple suivant :

1.

a) *kotolo* ***li***

Balle CL → une balle

b) *kotoolo* ***ké***

Balles CL → plus d'une balle (cf. Gundrun & Kerstin 2007: 454)

Cependant, il y a lieu de faire remarquer que la commutation entre deux classificateurs en tagbana n'a pas pour fonction principale d'exprimer l'opposition singulier / pluriel, mais peut s'inscrire dans l'ordre du qualitatif comme le montre l'exemple suivant :

2.

a) *kotolo* ***li*** *nã hɛ̃ɛ̃ kpun*

Balle CL AP. gens tue → une balle, ça tue les gens.

b) *b) kotolo* ***la*** *nã hɛ̃ɛ̃ kpun*

Balle CL AP. gens tue → Il y a un type de balles qui tuent les gens

On peut constater, à travers la commutation entre les morphèmes de classe **li** et **la** dans l'exemple 2, les limites de l'opposition singulier / pluriel, puisque dans 2a, nous avons un

[1] Le Tagbana est une langue Gur de la famille Niger-Congo, parlé dans le nord de la Côte D'Ivoire, précisément à Katiola (cf. Clamen 1952 : 1403); (Gaber 1991 : 3); (Gudrun & Kerstin (2007))

singulier générique, le prédicat *nã hɛ̃ɛ̃ kpun (tuer les gens)* est attribué à toute entité perçue comme étant une balle. Alors que dans 2b, il est question d'une sous-catégorie de balles. D'où la nécessité d'une conception du nombre qui transcende la simple opposition singulier / pluriel dans le cas des emplois des classificateurs en Tagbana.

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Water and _boy_ in Mandarin: an ontological distinction only

This paper makes a critique review of Doetjes (1997) arguments about mass/count distinction in Mandarin ("mass mass nouns" *versus* "count mass nouns") and suggests that the contrast between *shui* 'water' and *nanhai* 'boy' in Mandarin be recast as an ontological distinction only.

In view of that all nouns in Chinese cannot be modified by numerals directly, Doetjes (1997) claims that Chinese nouns are mass nouns from the syntactic perspective. However, she further argues that the property of being syntactically mass does not prevent us from proposing a semantic distinction between "mass mass nouns" and "count mass nouns": the former, such as *shui* 'water', do not provide us with minimal parts, and the latter, such as *nanhai* 'boy', do. This suggests that Doetjes (1997) assumes that there is a lexical distinction between mass and count nouns in Mandarin.

Doetjes suggests that compatibility of noun with the general classifier *ge* be a diagnostic for the presence of count structure. Assuming that "Num+individual Cl+N" implies a set of countable individuals, Doetjes argues that "the general classifier *ge* does not contain any information about what counts as a 'unit' and its use depends on the presence of minimal parts in the denotation of the noun it combines with". She (1997:34) thus said, "a noun can be combined with *ge*, it must have a count structure…"

In this research, we argue against the view that the contrast between *shui* 'water' and *nanhai* 'boy' in Mandarin is characterized as a mass/count distinction (count mass nouns *versus* mass mass nouns). First of all, we show that the general classifier *ge* is not a legitimate criterion for the existence of counting structure in the denotation of N. This is because in addition to nouns denoting discrete entities, *ge* can also modify abstract nouns or nouns denoting entities without minimal parts, as in (1). We suggest that the classifier *ge* doesn't indicate a counting structure but denotes a counting unit, namely, it individuates entities from the mass denotation of nouns (see Borer 2004 for a syntactic account).

(1) a. *yi* *ge* *jingxi* — *b. yi* *ge* *xiaoxi* — *c. yi* *ge* *pi*
one CL surprise 'a surprise' — one CL news 'a piece of news' — one CL fart 'a fart'

Secondly, assuming that 'mass/count' is a morpho-syntactic criterion, to do with whether or not an N can be directly modified by a cardinal, this is the wrong terminology to use. Doetjes is really pointing at the real world difference between discreteness (with minimal parts) and homogeneity (without minimal parts). It is an ontological distinction between "naturally atomic" and "non-naturally atomic" entities in Rothstein (2010). As Rothstein shows, it cuts across the count/mass distinction, since, for example, although *furniture* is a mass noun, its referents are naturally atomic. For instance, we can say 'big furniture', which makes reference to individual entities.

Contra Doetjes (1997), we claim that the so-called mass mass nouns and mass count nouns in Mandarin should be recast as an ontological distinction between naturally atomic and non-naturally atomic entities. We provide the following three pieces of evidence to show that the ontological distinction of natural atomicity is a grammatical relevant phenomenon in Mandarin.

The first piece of evidence comes from the use of size adjectives as adnominal modifiers, such as *da* 'big' and *xiao* 'small'. Rothstein (2010) notes that in English, nouns denoting entities with salient individual unit can be modified with adjectives like *big* or *small*, and those denoting homogeneous entities reject adjective modification of *big* and *small*. Such a contrast cross-cuts the distinction between mass and count nouns.

(2) a. Don't buy big furniture. The stairs are too narrow to carry it up. b. * a glass of big water

This generalization is also applicable to Chinese. Although nouns like *pingguo* 'apple' and *shu* 'tree' cannot be directly counted without a classifier in Mandarin, they denote naturally atomic entities whose unit can be modified by dimensional adjectives, as in (2). In contrast, nouns like *shui* 'water' and *yun* 'cloud' denote non-naturally atomic entities. For example, there is no inherent counting structure associated with *yun* and it can be modified by different classifiers according to its

shapes, e.g. *yi duo yun* 'one blossom of cloud', *yi pian yun* 'a piece of cloud' and *yi tuan yun* 'a ball of cloud' etc. It rejects the modification of adnominal adjectives, e.g. *da/xiao* 'big/small', as in (4b).

(3) a. *yi ge hen da de pingguo*
one CL very big Mod apple
'a very big apple'

b. *yi ke hen xiao de shu*
one CL very small Mod tree
'a very small tree'

(4) a. * *yi bei hen da de shui*
one CL_{-glass} very big Mod water

b.* *yi duo hen da de yun*
one CL very big Mod cloud

The modification of adjective as a test is understandable if we take into account that discrete entities denoted by N come with an inherent structure, which can be measured along a certain dimension, while homogeneous entities have no such stable structure.

Secondly, in Chinese, some classifiers and quantifiers are sensitive to the natural atomicity of Ns: some modify nouns denoting naturally atomic entities only and others non-naturally atomic entities.

Doetjes (1997) suggests that the compatibility of group classifiers, such as *da* 'dozen' and *qun* 'crowd, flock', be another piece of evidence to show that there are count nouns in Chinese. She (1997: 34) said that these classifiers are "semantically used for a group or a collection of individuals". The example provided by Doetjes is *yi da/qun baima* 'a dozen/group of white horses'. We argue that the nouns that can be taken as complement by group classifiers simply require denoting atomic entities but they are not necessarily count nouns. Nouns like *rice* and *furniture* are mass nouns but they denote naturally atomic entities, and they can be modified by group classifiers, as in 'a handful of rice' and 'a pile of old furniture'. In Chinese, it is also possible to say *yi da shui*, which means 'a dozen of packs of water' only, in which the noun *water* are forced to denote atomic entities.

The quantifier *yi dian-er* 'a bit' takes nouns denoting homogeneous entities, e.g. *yi dian-er shijian* 'a bit of time', *yi dian-er shengyin* 'a bit of sound'. It is inappropriate to say #*yi dian-er ren* 'a bit of people', in which the noun complement is naturally atomic. Under some circumstance, the naturally atomic denotation can be shifted into a non-naturally atomic reading as triggered by *yi dian-er*, e.g. *yi dian-er pingguo* means 'a bit of apple(*s)'.

Thirdly, Chinese bare nouns are equally open for an individual or a stuff reading, but the stuff (universal grinding) reading can be blocked by stubbornly naturally atomic entities in Chinese.

In English, universal grinding results from the syntax-semantics mismatch, e.g. there is *apple* all over the floor. However, in Chinese, in most cases, bare nouns are equally available for stuff and individual readings in appropriately constructed contexts, regardless of the noun denoting naturally atomic entities or not. As shown in (5), the shifting from naturally atomic entities to non-atomic entities or from non-naturally atomic entities to atomic entities is rather free in Chinese.

(5) *a. Zhuo shang dou shi pingguo.*
table on all be apple
'There is apple all over the table.'
Or 'There are apples all over the table.'

b. zhuo shang dou shi shui.
table on all be water
'There is water all over the table'
Or 'There are bottles of water all over the table.'

Cheng et al (2007) observe some exceptional cases. They note that some Mandarin 'count' nouns, such as *gou* 'dog', resist the "universal grinding" operation to get a mass reading. For example, (6a) is only felicitous to describe the scenario that a wall has been decorated with many little dogs. To get a mass reading, some lexical device is employed, such as the suffix *-rou* 'meat/fresh', as in (6b).

(6) a. *qiang shang dou shi gou.*
wall on all be dog
'There are dogs/#There is dog all over the wall.'

b. *qiang shang dou shi gou-rou.*
wall on all be dog-fresh
'There is dog(meat) all over the wall.'

Those special nouns are mainly restricted to animal nouns, which are stubbornly naturally atomic. The universal grinding operation can be blocked by stubbornly naturally atomic nouns.

L'interprétation de la sémantique de 'nom propre–*men*' en chinois

Deux interprétations pour nom propre-*men* Le chinois a été considéré, par certains auteurs, comme une langue sans distinction massif-comptable (Chierchia 1998), et qui ne possède pas de marqueur de pluriel 'additif'. Néanmoins, il possède un marqueur 'associatif', le suffix '*-men*' (Nakanishi et Ritter 2008, Zhang 2008). '*Men*' peut être suffixé aux noms communs, aux pronoms (1) ainsi qu'aux noms propres (2). Ce sont ces derniers cas que nous allons étudier.

(1) **Xueshengmen/women** zai paidui.
étudiant-men / je-men ASP faire la queue
'Les étudiants sont/ nous sommes en train de faire la queue.'

(2) **Xiaoqiangmen** zai paidui.
Xiaoqiang-men ASP faire la queue
(i) 'Xiaoqiang et les autres de son groupe sont en train de faire la queue.'
(ii) 'Les personnes qui s'appellent toutes Xiaoqiang par coincidence sont en train de faire la queue.'

Le nom propre-*men* (désormais NPr-*men*) dans (2) peut recevoir les deux interprétations (i) et (ii) (Iljic 1994; Li 1999). L'interprétation (i), où *–men* est un marqueur collectif, est plus commune, par rapport à (ii) qui est considéré comme un cas rare (auquel nous ne nous intéresserons pas ici). Finalement, nous remarquerons une troisième interprétation de NPr-*men*, - cf. (3):

(3) **Xilakemen** juezhong le.
Chirac-men éteint-ASP
(iii) 'Les Chiracs sont éteints.'

L'interprétation (iii) n'indique pas les individues du groupe ni le nombre indéterminé de personnes ayant le même nom, mais elle renvoie au trait.

Notre but En nous appuyant sur ces deux interpretations (i) et (iii) de NPr-*men*, le premier but de notre travail est d'en étudier les caractéristiques sémantiques à l'interface syntaxique, en faisant recours à la théorie de la classification du prédicat (Corblin 2008). Ensuite nous nous proposons aussi de comparer (2) et (3) pour discuter des caractéristiques sémantiques et syntaxiques de NPr-*men* qui reçoit l'interprétation (iii), qui n'est pas évoquée dans des études précédentes.

(a) ***Prédicats holistiques et atomiques*** Le GN pluriel défini NPr-*men* peut s'employer avec une typologie des prédicats lexicaux qui conduisent aux interprétations de '*ensemble*'[1] et '*groupe*'[2]. Par exemple, dans le cas d'une combinaison avec le prédicat holiste *xuanchu* 'élire' dans le (4)a, le sujet *Xiaoqiangmen* 'Xiaoqiang et les autres de son groupe' est interprété comme un groupe vu en tant qu'un seul individu. Cela est dû au prédicat de groupe holiste qui s'applique obligatoirement à des groupes, et stipule qu'ils ne s'appliquent à aucune partie de ce groupe.

(4) a.Xiaoqiangmen **xuanchu**le xueyuan daibiao.
Xiaoqiang-men élire-ASP école représentant
'Xiaoqiang et les autres de son groupe ont élu le représentant de l'école.'
b. Xiaoqiangmen **bing**le.
Xiaoqiang-men être malade-ASP.
'Xiaoqiang et les autres de son groupe sont malades.'

En contraste avec (4)a, 'Xiaoqiangmen' dans l'exemple (4)b est un GN qui dénote un ensemble atomique car le prédicat atomique *bing* 'être malade' doit être prédiqué de façon distributive. D'autre part, la phrase (5), qui comporte le prédicat mixte *jiao* 'rendre', est ambigüe, car le GN pluriel peut dénoter un groupe non atomique et un ensemble atomique (C'est-à-dire que la phrase est vraie lorsqu'un seul rapport collectif est rendu, ainsi que lorsque chacun a rendu son rapport personnel).

(5) Xiaoqiangmen **jiao**le yifen baogao.
Xiaoqiang-men rendre-ASP un CL rapport
'Xiaoqiang et les autres de son groupe ont rendu un rapport.'

[1] Ensemble : Collection d'individus semblables.
[2] Groupe : Un ensemble d'individus de même type, vus comme un seul individu (comme un tout).

(b) ***Prédicats d'individus et d'espèce*** Ensuite, puisque (2) diffère de (3), nous cherchons leur distinction en examinant (6) et (7):

(6) a. Xiaoqiangmen zhexieren zai paidui.
Xiaoqiang-men ces personnes ASP faire la queue
'Xiaoqiang et les autres de son groupe sont en train de faire la queue.'

b. *****Xiaoqiangmen zhe**zhong**ren **juezhong**le.
Xiaoqiangmen ce-type-personne éteint asp

(7) a. Xilakemen zhexieren zai paidui.
Xilake-men ces personnes ASP faire la queue
'Chirac et les autres de son groupe ces personnes sont en train de faire la queue.'

b. Xilakemen zhe**zhong**ren **juezhong**le.
Chirac-men ce-type-personne éteint asp
'Les Chiracs ce type de personnes sont éteints.'

Alors que le NPr-*men* sujet dans l'exemple (6)b n'est pas compatible avec l'expression *zhe zhong ren* 'cette sorte de personnes', ni avec un prédicat d'espèce comme *juezhong* 'éteint'. Par contre, comme on le voit dans l'exemple(7), le NPr-*men* 'Xilake*men*' a non seulement les mêmes emplois que (6)a, mais aussi la possibilité de s'employer avec le prédicat d'espèce comme *juezhong* 'éteint', et avec une expression comme *zhong* 'sorte'. Dans ce cas, il désigne une sorte de personnes ayant le même trait ou le même caractère. Dans le dernier cas, NPr-*men* ne renvoie pas sémantiquement à des individus du groupe, mais il contribue à exprimer le trait d'une catégorie, par exemple, si l'individu *Chirac* est connu pour sa corruption, *Xilakemen* 'les Chiracs' indique ceux qui possèdent la même caractéristique d'être corrompus.

Au même temps il faut noter que la propriété de *Xilakemen* 'les Chiracs' dont nous parlons est distincte de *lei* 'espèce' en chinois, comparons (7)b et (8) (*Zhong*, classificateur sortal, qui peut apparaître après le démonstratif, catégorise des entités, il peut être nommé comme <zhong 'sorte' catégorisant>. Mais pour lei 'espèce', il désigne plutôt un ensemble d'entité espèce. (Yuan 2011; LI 2011)).

(8) *?? Xilakemen zhe **lei** ren* juezhongle.
Chirac-men cette espèce personne éteint ASP
'Les Chiracs cette **espèce** de personnes sont éteints.'

Conclusions Dans notre travail, nous montrons que le NPr-*men* peut avoir deux interprétations : i. Un groupe d'individus; les individus atomiques dans la pluralité sont plus ou moins accessibles, en fonction de différents types de prédicats employés. ii. Une catégorie d'individus, qui se distingue de (i), du fait qu'elle possède la même caractéristique et exprime le trait en commun.

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Mots Clés : Mandarin chinois, nom propre-*men*, syntaxe, sémantique

The count/mass distinction in Yudja (Tupi): quantity judgment studies

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Introduction Three studies explored the semantics of the count/mass distinction in Yudja (Tupi; Brazil). In Yudja, all nouns can be combined directly with numerals without intervening classifiers or container/measure phrases (container/measure phrases are always optional, cf. Lima 2010):

1a	txabïu	iidja	karia	1b	txabïu	uda	awïla	wï
	three	woman	dance		three	someone	honey	bring
	'Three women danced'				'Someone brought three containers of honey'			
					Lit.: 'Someone brought three honey(s)'			

Besides, all nouns can be combined with quantifiers that only derive a count interpretation. The literature on the Yudja language presents no evidence in favor of mass quantifiers in Yudja (cf. Fargetti 2001):

iidja 'woman' (human)	2a	itxïbï	iidja	2b	kïnana hinaku	iidja	
		many	woman		few	woman	
		'Many women'			'Few women'		
awïla 'honey' (substance)	3a	itxïbï	awïla	3b	kïnana hinaku		awïla
		many	honey		few		honey
		'Many containers of honey'			'Few containers of honey'		

Analysis Following Kratzer (2007), we argue that nominal roots themselves denote kinds rather than sets of individuals. For a NP to denote a set of individuals, its nominal root must be combined with a silent functional head (c.f. Kratzer 2007), which denotes a context sensitive atomic function. This function maps the kind denoted by the nominal root to a set of individuals. In different contexts, the function may map the same kind to different sets of individuals – i.e. what counts as an individual that instantiates a kind may vary across contexts (c.f. Rothstein 2010). **Steps for the proposal in Yudja** A nominal root N denotes a kind k. An atomic function F, which is relative to a context c, maps k to a set of k-individuals (i.e. individuals that are instances of the kind). More precisely, given a context c, F maps k to a set of individuals x such that x is a part of the kind k and x is k-atom in a context c: $[[\text{ F blood }]]^c = \lambda x.\ x \leq k\ \&\ AT(k)(c)(x) = 1$; $AT(k)(c)(x) = 1$ iff x is k-atom in c. From this theoretical perspective, an NP can denote a set of individuals only if its root has been combined with an atomic function F. The possibility of being count is not given *a priori* for any noun, but is always context dependent.

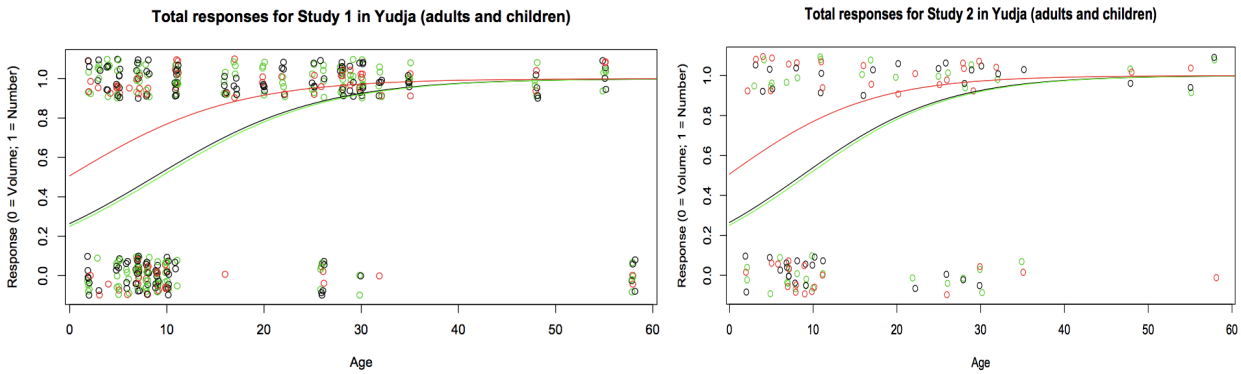
Quantity judgment studies In this paper we tested whether speakers make a distinction between notional mass nouns such as y'a 'water', notional count nouns such as karaxu 'spoon' and aggregate nouns such as abeta 'clothes' in tasks involving the evaluation of a quantity of objects/stuff. A total of 18 adults and 22 children (7, 2-5 years old and 15, 6-11 years old) participated in the studies. The studies were based on Barner and Snedeker (2005) and were fully prepared and elicited in Yudja. A control group with 10 Brazilian Portuguese adults responded the same as English adults have in prior studies (Barner and Snedeker 2005).

Study 1 While presenting two different drawings one with a big portion of *X* (Quantity) and another with many different portions of *X* (Number), we asked:

Ma de	bitu	X	dju au?	
who	more	X	have	'Who has more *X* ?'

Subjects answered 3 questions with a notional mass noun (e.g., *asa* 'flour'), 3 questions with a notional count noun (e.g., *xaa* 'bowl') and 2 questions with an aggregate noun (e.g., *abeata* 'clothes'). Participants had to point to one of the drawings to answer the question. Independent

evidence in Yudja shows that *bitu* 'more' (the quantifier in the target question) does not bias Number or Quantity. **Results** Mixed effects modeling using Helmert contrasts confirmed that there was no effect of noun type. However, there was a significant effect of age on proportion of 'Number' responses (Wald's Z = 2.5, p = 0.01, β = 122). **Study 2** We tested whether the results from Study 1 for adults are an effect of a strong dispreference for a single big portion of *X* in comparison to many portions of *X*. We asked the questions presented in Study 1 accompanied by two drawings: one with two big portions of *X* and another with six small portions of *X*. **Results** All three groups tested kept the pattern observed in Study 1. Mixed effects modeling using Helmert contrasts confirmed that there was no effect of noun type. However, there was a significant effect of age on proportion of 'Number' responses (Wald's Z = =2.4; p = 0.01; β = .156):



Where: **black:** notional count nouns; **green:** notional mass nouns and **red:** aggregate nouns.

Study 3 In principle, Studies 1 and 2 may suggest an absence of a conceptual distinction between Quantity and Number. In Study 3, participants saw the drawings presented in Study 1 and answered two different target questions:

Number question:	Ma de	itxïbï	X	dju a'u?	
	who	many	X	have?	'Who has many portions of X?'
Quantity question:	Ma de	urahu	X	dju a'u?	
	who	big	X	have	'Who has a big portion of *X*?'

The issue was whether the participants would establish a conceptual difference between Quantity and Number. The adjective *urahu* (*urahu y'a* 'a big puddle of water; a lot of water'; *urahu ali* 'a big child')) and *itxïbï* (*itxïbï y'a* 'many containers of water'; *itxïbï ali* 'many pacas') enforce this distinction. **Results** children associated *urahu* to Quantity and *itxïbï* to Number. In other words, they conceptually distinguish Quantity from Number.

Discussion the results from these studies in Yudja diverge from the results for the same studies in English (Barner and Snedeker 2005). In English, a number-marking language that distinguishes count from mass nouns grammatically, adults and children based their quantity judgments on the number of individuals significantly more for count (shoes) and object-mass nouns (furniture) compared to substance-mass nouns (toothpaste). In Yudja, a number neutral language where the count/mass distinction is not grammaticalized, there was no significant difference between the potential three classes of nouns. The only significant factor was age.

Conclusion Study 3 shows that Yudja speakers make a conceptual distinction between Quantity and Number. Nevertheless, Studies 1 and 2 show that all nouns can be treated as count. Therefore, the conceptual distinction between Quantity and Number might not be grammaticalized as a distinction between count and mass nouns.

« How Much Sideboob Is Too Much Sideboob? » Fonctionnement du nom, quantification et/ou qualification : une analyse énonciative des emplois en contexte du néologisme « sideboob ».

Il s'agira d'envisager les problèmes posés par l'opposition massif/comptable au regard des emplois en contexte d'un néologisme en anglais, le nom « *sideboob* » ou « *side boob* », désignant la courbure extérieure d'un sein féminin partiellement exposé aux regards.

En effet, le fonctionnement grammatical de ce terme est instable :

-d'une part, on le trouve associé à des marqueurs qui tendraient à le classer du côté du « massif », détermination zéro, (too) much, a dose of, a helping of, + singulier

On the cover of May's Marie Claire, Zooey makes like a true Hollywood starlet and serves up ***a generous helping of side boob.***

We've asked it before and we'll ask it again: is ***this much side boob*** *ever acceptable?*

-d'autre part, on peut le trouver également associé au pluriel ainsi qu'à *one* ou *a* au singulier, ce qui tendrait à lui attribuer les propriétés des dits « comptables » .

We thought ***one Gwyneth Paltrow side boob*** *in a day was enough. But then Gwynnie got dolled up for the 2012 Met Gala and let even more spill out.*

Kirsten Stewart : ***a sideboob*** *in Cannes*

En se situant dans le cadre de la théorie des opérations prédicatives et énonciatives élaborée par A.Culioli, dans laquelle l'opposition binaire massif/comptable est réévaluée sous la forme d'une description ternaire discret/dense/compact, l'observation des énoncés en contexte permet de rendre compte de manière stable de ces fluctuations apparentes de fonctionnement.

Il apparaît en effet que, dans les cas où le fonctionnement de ce terme serait qualifié de comptable, on a affaire à une construction de discontinuité qui s'apparente plus à l'individuation d'une occurrence en situation qu'à un véritable comptage. Ainsi « *a sideboob in Cannes* » renvoie priortairement à la construction d'existence d'une instance de « *sideboob* » plutôt qu'à un dénombrement.

Parallèlement, dans ses emplois dits « massifs », on observe qu'il ne s'agit pas tant de prélèvement quantitatif simple (construction d'une quantité mesurable de « *sideboob* »), que de qualification de la quantité (cf *« a* ***generous*** *helping of sideboob »*).

A ce titre, il paraît plus juste d'envisager le nom « *sideboob* » comme s'apparentant aux noms ayant un fonctionnement dit « compact », désignant habituellement des prédicats, et qui ont les mêmes propriétés (cf « *a generous helping of passion* »). Ainsi « *sideboob* » ne renverrait pas directement à l'objet perçu (la partie de sein), mais à son dévoilement ou à la perception de son apparition.

Le corpus d'exemples observés est majoritairement fourni par une section du Huffington Post US dédié à la question,
http://www.huffingtonpost.com/news/sideboob/

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Individuation in a Bare-Nouns-Only Language

This paper investigates individuation by looking at the denotation of Bare Nouns (BNs) in a bare-nouns-only language - Karitiana (Arikém family, Tupi stock, spoken by approximately 400 people in northwestern Brazilian Amazonia).

Karitiana Noun Phrases (NPs) are always bare and occur with definite, indefinite, and kind/generic interpretations in all argument positions. Karitiana has no nominal inflectional morphology, such as gender, case, or number. It is also determinerless, having no functional words equivalent to Romance and Germanic definite or indefinite articles or quantifiers like *some/any* or *each/every*. Karitiana BNs are also number-neutral in that their denotations are undetermined for singularity or plurality (Müller *et al* 2006). Sentence (1), for ex., is totally undefined as for the number or (in)definiteness of its NPs. It is also important to note that sentence (1) may also be read generically. Counting is attested in the language (see 2). In addition, Karitiana is not a classifier language, since numerals and common nouns combine directly (see 2).

(1) **ombaky** ∅-naka-'y-t **pikom**
jaguar 3-DECL-eat-NFT monkey
'A/the/some jaguar(s) ate a/the/some monkey(s)'
'Jarguars eat monkeys'

(2) yn naka-'y-t **sypom-t** **pikom**
1S DECL-eat-NFT two-OBL monkey
'I ate two monkeys.'/ 'I ate monkeys twice.'/

Theories about the count-mass distinction usually claim that predicative count nouns denote atoms in languages that have number (Link 1983, Chierchia 1998, Rothstein 2010); whereas predicative count nouns have been claimed to denote both atoms and pluralities in number-neutral languages (Chierchia 1998, Müller 2001, Wilheim 2008). An opposite view is taken by Borer 2005, who claims that nouns are 'born' mass, and that it is syntax that turns them into count.

This paper supports the claim that, in number-neutral languages, count nouns denote both singularities and pluralities. It does so by looking at how reduplicated numerals access the denotations of Karitiana BNs. Reduplicated numerals in Karitiana, as in many other languages, are similar to adverbials such as 'one by one' or 'two at a time' of English and other indo-european languages. Nevertheless, they do not share exactly the same readings (Gil 1982). Karitiana reduplicated numerals are illustrated in (3).

(3) **Sypom-t.sypom-t** Ø-naka-m-'a-t gooj õwã
two-OBL.two-OBL 3-DECL-CAUS-build-NFT canoe child
a. For each occasion, there was an event of kids building two canoes.
b. For each kid_1, there was an event of his_1 building two canoes.

According to Müller & Negrão (*in press*), reduplicated numerals in Karitiana are sentential distributivity operators: (i) whose distributive share is always events; (ii) whose distributive key is either the external argument or 'occasions'; (iii) that establish the cardinality of the internal argument. Evidence in support of the analysis of reduplicated numerals as adverbials comes from the fact that they have the same distribution as any other adverbials in the language, and that the readings of the sentences they participate in are always the same (3a,b) independently of their structural position (see 3 and 4a-c). Note that the only position that is not available for adverbials is between the subject and the VP.

(4)a.	*Õwã	**sypom-t.sypom-t/mynda**	nakam'at	gooj
	child	two-OBL.two-OBL/slowly	3-DECL-CAUS-build-NFT	canoe
c.	Õwã	nakam'at	**sypom-t.sypom-t/mynda**	gooj
	child	3-DECL-CAUS-build-NFT	two-OBL.two-OBL/slowly	canoe
d.	Õwã	nakam'at	gooj	**sypom-t.sypom-t/mynda**
	child	3-DECL-CAUS-build-NFT	canoe	two-OBL.two-OBL/slowly

The distribution of individuals or of pluralities of a given cardinality demands individuation on both sides of the distributive relation – in the case of (3), two canoes per event or two canoes per boy. Distribution then can only operate on individuated arguments. Thus in Karitiana the individuability of units is directly reflected without the mediation of morphology.

Reduplicated numerals then give us a window into the denotations of the NPs they operate on. The interpretations of sentence (3), for instance, imply that the NPs *õwã* and *gooj* are individuated and number-neutral. Since reduplicated numerals are sentential adverbials, they cannot be claimed to introduce operators such as hidden classifiers or type-shifters that could turn mass-denoting NPs into count-denoting NPs. Or to introduce operators that shift an atomic denotation into a plural denotation.

I conclude then that, since reduplicated numerals access BN denotations directly without the mediation of any empty type-shifters, they show that count BNs in Karitiana are individuated predicates, they are mass-denoting NPs, as proposed for bare nouns in many languages (Carlson 1977, Borer 2005, Oliveira & Rothstein 2011).

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A statistical investigation into the crosslinguistic distribution of mass and count nouns: morphosyntactic and semantic perspectives.

Abstract

It has often been argued that the mass count distinction is a grammatical phenomenon and not a linguistic projection of facts about the 'real world'. (Chierchia 1998, Gillon 1992, Rothstein 2010 and many others.) A major piece of evidence in support of this claim has always been that nouns which are mass in one language are realized as count in another language. However, the data on which this is based is largely anecdotal (see the references cited above) and focusses on well-known contrasts like *furniture*, which is mass in English, but which has a count-correlate in French and mass/count duals in Hebrew and Dutch. The current research aims to rectify this by carrying out a relatively large scale analysis of the mass/count classification of nouns cross linguistically. Count nouns are usually distinguished from mass nouns by a number of different syntactic properties, e.g. co-occurrence with numerical expressions, co-occurrence with distributive quantifiers like each and so on, but the specific tests vary from language to language. We focused on several issues: (i) To what extent can mass/count syntax be predicted in language A on the basis of knowledge of language B? (ii) To what extent is mass/count syntax a binary division, i.e. if a noun classifies as count on one test, what are the odds that it will classify as count on all tests? (iii) To what extent can mass/count syntax be predicted on the basis of real-world semantic properties, put differently, how common are 'furniture' type nouns?

We collected from over 20 native speakers a database of how 1434 nouns are used with respect to the mass/count distinction in 6 natural languages, using a variety of different syntactic tests in each language, the tests varying per language according to its particular morphosyntactic properties. Additional informants provided information on semantic aspects of the concepts denoted by those nouns. The responses of each informant were in the form of tables with binary entries, in 1434 rows and as many columns as questions used to probe either semantics or syntax. The set of all tables was used for a variety of statistical analyses, including measures of entropy and of the mutual information between the responses of two informants. In addition, we carried out a separate analysis of 1551 English nouns extracted from the adult section of the CHILDES corpus.

Results indicate that no individual semantic aspect that we proposed can fully account for each specific syntactic usage property, and only a partial correlation is possible. When considering several syntactic properties at once, we find that in 5 out of 6 languages over half the nouns in the database (873 on average, out of 1434) are used as pure count nouns, where 'pure count' means testing positive on all count properties, and negative on all others. The rest differ from pure counts over distinct syntactic properties, with fewer nouns differing on more properties, and typically very few at the pure mass end of the spectrum. Such a graded distribution is similar across 5 of the languages, but the exact syntactic classes do not map onto each other, nor do they reflect, beyond a weak correlation (ca. 10% of the maximal mutual information), semantic attributes of the concepts. Only 392 nouns are simultaneously pure count in all 5 languages.

Results for English are consistent with those emerging from a separate analysis of 1551 nouns extracted from the adult section of the CHILDES corpus.

The sixth language, Marathi differs from the other languages considered in having many more nouns close to pure mass, particularly among those denoting abstract objects. In all cases, considerable variability is seen even among speakers of the same language. These findings are in line with the hypothesis that much of the mass count syntax emerges from language specific grammaticalization and only a more limited component has its roots in the universal semantic attributes of things in the world. It suggests also a significant degree of speaker specific grammaticalization.

Overall, there were only 116 nouns that were classified as pure count in all 6 languages, and still only 392 when excluding Marathi.

This is to our knowledge the first wide scale examination of cross-linguistic variation in the expression of the mass count distinction and investigation of the degree to which the distinction is driven by perceptual-semantic attributes. Previous discussions in terms of data have stayed more or less at the level of the anecdotal. Our major contribution to the discussion then is that beyond a core group of count nouns where semantic atomicity corresponds directly with count syntax, there is indeed widespread cross-linguistic variation in whether or not a concept is expressed via count syntax. We have little to say about core mass nouns, of which there were few in our sample. This might conceivably be because of the way in which we chose our data base, rather than because of the inherently lower number of mass nouns in the languages. We leave it to other studies to identify a significant core group of mass nouns, cross-linguistically. We have made a number of observations which are relevant to the discussion of the mass/count distinction:

I. Single semantic or 'real world' attributes do not lead in a straightforward manner to individual syntactic rules in the mass/count domain, hence we have to probe a potential mapping, for any given natural language, between multiple semantic attributes and a constellation of multiple syntactic rules. The obvious alternation i.e. atomic vs. homogeneous does not predict mass vs. count morphosyntax. This provides solid statistical support for the theoretical discussion in e.g. Gillon 1992, Chierchia 1998, Rothstein 2010 and many others.

II. When probing this domain with multiple syntactic usage alternatives, the distribution of 1434 frequently occurring nouns in 6 natural languages is typically very far from binary.

III. Outside of the pure count nouns, the correspondence between languages is weak, even when considering a single matching usage marker in each of the 5 'typical' languages in the sample.

IV. Marathi differs from the other 'typical' languages, in having a substantial fraction of nouns close to a pure mass prototype, particularly among abstract nouns, and a distribution closer to bimodal.

V. The semantic attributes that may be at the origin of the syntactic usage properties are distributed similarly, across concrete nouns, to the typical syntactic distribution, with most concrete nouns having 'count-like' attributes, and gradually decreasing proportions showing progressively more mass-like attributes.

VI. Despite the overall similarity between distributions, of semantic attributes and of syntactic usage properties (in all languages tested except Marathi) the correspondence in position along the main mass/count dimensions between semantics and syntax is weak, even for concrete nouns. Quantitatively, in terms of variance it is midway between fully matching and random, and in terms of mutual information it is close to random. The different range reflects the non-linearity of the MI measure, but both measures point at the weakness of the observed correlation. Similarly, the correspondence between languages is weak, whatever measure is used. Taking into account the detailed attributes and syntactic rules, rather than only the main mass/count dimension, the correspondence remains weak.

One conclusion is that there is a core correlation between non-homogeneous nouns and count syntax, and a core group of 392 (284 concrete and 108 abstract) nouns which pattern as pure count in all languages checked, excluding Marathi, indicating a correlation between perceptual/semantic and grammatical/morphosyntactic properties. Beyond that, the low level of mutual information between any two languages indicates language-specific grammaticalization of the distinction. It is plausible that there are language-specific principles governing or at least constraining the grammaticalization. Thus, for example, a cursory examination of the data indicates that Marathi is very restricted in allowing count syntax for abstract nouns. However, at this stage we cannot tell to what the degree grammaticalization is governed by semantic or perceptual (or even cultural) principles in different languages.

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Bare Noun Phrases and Comparatives: a cross-linguistic perspective

I. Bale and Barner (2009) argue that comparative constructions are the best tests of the denotative properties of NPs: nouns denoting individuals are compared via cardinalities, while nouns which do not denote individuals are compared along continuous dimensions. They use comparative constructions to make two generalizations: (i) nouns that can be used in both mass and count syntax are always compared via cardinalities when used as count, but never when used as mass, and thus the count interpretation must always denote sets of individuals; (ii) comparative constructions show that some mass nouns e.g. *furniture* denote sets of individuals while others e.g. *water* do not. We agree with Barner and Bale that count nouns are always compared in terms of cardinalities, but present data from a variety of constructions in English, Dutch and Brazilian Portuguese to show that the generalisations about mass nouns do not hold. Mass nouns can be compared either in terms of cardinalities or along a continuous dimension, depending on the context, and comparison does not support a semantic classification of mass nouns into those which do and those which do not denote individuals. We argue that an analysis of mass nouns as kind-denoting terms explains the data more straightforwardly.

II. We begin with the claim that *furniture* type nouns denote sets of individuals and force a comparison with respect to cardinality. While comparison with respect to cardinality is possible (see e.g. Barner and Snedeker 2006), it is far from forced. First, context may facilitate comparison in terms of overall volume or quantity:

(1) John has more furniture than Mary, so he will need a larger moving truck.

It seems clear that (1) is true if John has a large sofa, a large wardrobe and a large dining room table while Mary has 10 folding chairs, indicating that the relevant comparison is in terms of volume and not in terms of the cardinality of the sets of individual items. Second, other comparative structures may also involve comparison of volume, rather than cardinality, for example 'too much furniture' in (2), where the comparison is between the volume of furniture and the volume which can be contained in the relevant truck.

(2) John has too much furniture to fit in that moving truck.

Landman (2011) shows that *most* and the Dutch counterpart *het meeste* also compare subsets of mass noun denotations either in terms of cardinality or along a continuous dimension:

(3) In the summer, most livestock is kept outside.

(4) In terms of volume, most livestock is cattle. (Landman 2010: (36a))

(5) #In terms of volume, most farm animals are cattle. (Landman 2010: (36a))

Suppose the livestock/farm animals are chickens and cows, with there being 10 chickens for every cow, and all the cows are kept outside in summer. (3) is then judged true in contexts in which the volume of livestock is relevant (e.g. by those who have to clean the sheds). Similarly, (4) is felicitous, while (5) is not felicitous, indicating that a comparison of subsets of *farm animals* cannot be in terms of volume. The evidence therefore is that while comparison with *furniture* nouns in terms of cardinality is salient, it is not obligatory.

III. Bale and Barner's second claim is that, with a flexible noun such as *stone*, mass syntax necessitates comparison along a continuous dimension. In English, this seems to be true in most cases, though we can find some counterexamples. Thus if John has short hair all over his head, while Bill is partially bald but has a long pony-tail, (6) is judged true, even though we are comparing number of hairs rather than quantity of hair by volume or length.

(6) John has more hair than Bill.

When we look further afield to Brazilian Portuguese, we see that the phenomenon illustrated in (6) is quite general. Brazilian Portuguese has a count/mass distinction, but every count noun has a 'bare singular nominal' counterpart. Pires de Oliveira and Rothstein 2011 show that bare singular noun phrases have the distribution and grammatical interpretation of mass nouns, and are in fact mass. They argue that while in English 'flexible nouns' are the exception, and most nouns have either mass or count syntax but not both, in Brazilian

Portuguese the opposite is the case: most nouns are flexible, while some nouns have only a mass form. There is no evidence for purely count nouns, i.e. count nouns which do not allow a bare singular counterpart. Bare singular nouns allow comparison either by cardinality or along a continuous dimension:

(7) João tem mais pedra que a Maria. (cardinal^{ok}, volume^{ok})
John has more stone than the Maria

(8) João tem mais caneta que a Maria. (cardinal^{ok}, volume^{ok})
John has more pen than the Maria

(8) contrasts with (9), where the plural N *canetas* can only be compared in terms of cardinality:

(9) João tem mais canetas que a Maria. (cardinal^{ok}, volume*)
John has more pens than the Maria.

This data is supported by the interaction between bare nouns and quantifiers. The count quantifier is *muitos/muitas* 'many', while *muito/muita* correlates with the mass quantifier 'much', as is shown by *muita água* / '**muitas águas* 'much water'. Even if plural morphology is dropped from a count noun, as happens in some dialects of Brazilian Portuguese, the count quantifier forces a cardinal interpretation in (10), while (11), with the mass quantifier and a bare noun, may be interpreted by cardinality or volume:

(10) João tem muitas caneta(s). (cardinal^{ok}, volume*)
John has many pens.

(11) João tem muita caneta. (cardinal^{ok}, volume^{ok})
John has much pen.

Similarly, (12) is true either if the can has more earthworms in it or if it weighs more depending on which dimension of comparison is salient:

(12) Essa lata tem mais minhoca do que aquela.
this can have more earthworm of.the that that.

We give an analysis of this data in the framework of Pires de Oliveira and Rothstein 2011, arguing that mass nouns denote kinds, while count nouns denote sets of semantic atoms, in the sense of Rothstein 2010. Comparison in the count domain must thus compare cardinalities of sums of atoms. Comparison in the mass domain is comparison along a contextually relevant dimension. Mass quantifiers and comparative operators trigger a shift from the kind reading of the mass noun to the predicate interpretation in which the mass noun denotes the set of instantiations of the kind. When the instantiations of the kind are entities which are naturally atomic (again in the sense of Rothstein 2010), the scale of natural numbers is one of the contextually relevant dimensions, and comparison in terms of cardinality is one, but only one of the possibilities available. This explains the data in Brazilian Portuguese as well as example (6) above. As for the impossibility of comparing *more stone* in terms of cardinalities, we give a pragmatic explanation. English rarely allows mass/count variants of the same stem, so, when it does, the choice of one over the other fully determines the perspective: choice of mass noun makes the substance salient, while choice of count noun makes the atomic elements salient, and comparison is sensitive to this. In Brazilian Portuguese, every noun has a mass interpretation, while only some have a count interpretation. While choice of count syntax forces an interpretation in terms of semantic atoms and thus comparison in terms of cardinalities, choice of mass syntax, since it is always available, does not make a particular dimension of comparison salient, although naturally atomic predicates tend to be interpreted via cardinality if no other contextual clues are given.

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Count-mass Nouns May Not Be Mass After All

Overview: We present an analysis of mass nouns in English that have minimal parts (count-mass nouns, Doetjes 1997), such as *furniture, mail, silverware* etc, where they are not argued to be mass nouns at all, but rather inherently semantically plural. It is shown that the surface characteristics that have motivated them to be analyzed as mass nouns (lack of countability, singular number, combination with mass quantifiers *etc*) instead arise from independent factors, allowing for a restrictive definition of a [mass] lexical feature, and hence simplifying the theory of what it actually means to be a mass noun.

The problem: In the study of the count-mass distinction, a guiding intuition of what it is, is that mass nouns somehow lack identifiable minimal parts, and this results in their inability to be directly counted (1). Various proposals have attempted to account for this in different ways (Link 1983, Chierchia 1998, Borer 2005, Rothstein 2010 amongst many others), but a problem for this intuition has always the existence of nouns that are ostensibly mass, but do have minimal parts, such as English *furniture.* Doetjes (1997) showed that although these nouns cannot be directly counted, like true mass nouns (2), they contrast with mass nouns on intuitions about divisiveness (3). Further diagnostics show count-mass nouns patterning with count nouns instead of true mass nouns. Schwarzschild (to appear) shows that in contrast to prototypical mass nouns, they combine freely with stubbornly distributive predicates (4), whilst Barner & Snedeker (2005) and Bale & Barner (2009) show they allow for comparisons based on number as opposed to measurements, (5), both analyzed here as indications of having atomic domains. Thus, it is often complained that theories which attempt to have separate algebraic domains for count nouns and mass nouns (see Link 1983 for one example) fail to capture the facts of count-mass nouns, whilst theories (exemplified by Chierchia 1998, 2010) where there is a uniform algebraic domain with minimal parts for all nouns fail to predict differences between mass and count with respect to minimal parts.

The proposal: In this paper we argue that count-mass nouns are really count nouns, and so it is possible to appeal to a restrictive theory where mass and count nouns contrast with respect to domain atomicity. We follow Borer (2005), Bale & Barner (2009), Mathieu (to appear) a.o. in assuming that noun roots represent undivided extensions, which require partitioning out in order to be count nouns. In contrast to these approaches however, we assume that partitioning is the job of number features, which are definable in terms of atomicity, (6) (see Harbour 2007, 2011). Number features are the cue for the semantics to partition the noun by creating a context sensitive interpretation of what counts as an atomic element of the noun in question (see Rothstein 2010 on the role of context), thereby picking out something that can be used as a criterion for counting. Mass nouns result from the combination with a privative [mass] feature, defined in (7), which prevents atomic elements from being constructed by the semantic component (the function of the feature is to prevent any interpretation involving atomic subparts). Count-mass nouns, having atomic domains therefore cannot be in combination with [mass] (and so mass), rather they only look as though they are. We propose that count-mass nouns carry an inherent semantic [-atomic] feature, which being a number feature partitions count-mass nouns into having atomic subparts causing them to get interpreted as count nouns. However, having an inherent number specification prevents the nP from combining with NumP (the locus of numerals and non-inherent number features), and so they cannot combine with numerals, nor receive morphological number specification (see Smith 2012 on diverging morphological and semantic feature values). This is independently visible in English by the fact that *pluralia tantum* cannot be counted, (8) (see also Pesetsky 2012 on Russian paucals for similar), with the inherent morphological number blocking projection of NumP. Thus, there is an independent reason - inherent number - for why count-mass nouns cannot be counted. Since count-mass nouns have no morphological number specification, they are realized as singular due to a last resort realization of default morphological number.

Quantifiers: Finally we show that even with count-mass nouns not carrying the [mass] feature, it is possible to explain their combination with mass-only quantifiers (*much, little*). In doing so, we appeal to Harbour's (2010) claim that, within the realm of number features, monovalent features are not sufficient (i.e. there is a discernible difference for some feature [F] between [+F], [-F] and absent, [0F]). Assuming that unmarked values can be unspecified, a DP without a specification for semantic number will be interpreted in the same way as a DP inherently specified as [-atomic], with both atoms and sums in the domain (see Schwarzschild 1996, Chierchia 1998 and Sauerland 2003 on the idea that plurals contain atoms in their domain; Sauerland 2003 and Bale et al 2011 on the semantic unmarkedness of the plural). Though [-atomic] and [0atomic] will be interpreted the same way semantically, they however crucially

play a different role in quantifier selection. Mass quantifiers (*much, little*) quantify over nouns that are specified for the features [mass] or [-atomic], whereas their count counterparts quantify elsewhere. Therefore a plural count noun (unspecified for number, so [0atomic]) will combine with *many* instead of *much,* whilst [-atomic] forces *furniture* to interact with *much*. These language specific rules are supported by data from Purépecha (see Vazquez-Rojas 2012), where it is shown that in this language, there is a count/mass distinction of quantifiers (9a,b) - but the count-mass nouns in Purépecha combine with the quantifiers associated with count nouns instead of mass, (9c) (see Vazquez Rojas for discussion of why *tsiri, 'flea'* is count-mass in Purépecha). This supports the current proposal that count-mass nouns are not really mass nouns, but instead may only be made to *look* like mass nouns due to language specific idiosyncrasies. The doubtful status of count-mass as really belonging to the category "mass" is further undermined by count nouns shifted to mass readings, which never take on count-mass properties, (10).

(1) a. *There are three muds.
b. There are three pieces of mud.

(2) a. *There are three furnitures.
b. There are three pieces of furniture.

(3) a. A piece of a piece of cheese is a piece of cheese. (Doetjes 1997)
b. A piece of a piece of furniture is NOT a piece of furniture.

(4) a. *The water/mud/sand is round/large. (Schwarzschild to appear)
b. The furniture/mail/luggage is round/large.

(5) Mark bought more furniture than Bill.
(= true if Mark bought 6 pieces, Bill 5)

(6) SINGULAR = $[\lambda P.\lambda x.\ P(x) \wedge \text{atom}(x)]$
where atom(x) is true of a predicate P iff P(x) is true and there is no non-trivial part y of x where P(y) is also true. (PLURAL = ¬SINGULAR)

(7) $[\text{mass}] = \lambda P{:}\forall x[P(x) \rightarrow \exists y[P(y) \wedge y \neq x \wedge y < x]]$

(8) a. *I bought two scissors.
b. I bought two pairs of scissors.

(9) a. Eróka-sha-p-ka **wánikwa/*kánikwa** k'wirípu-icha-ni (Purépecha)
wait-IMPFVE-PST-1/2IND many/much person-PL-OBJ
'I was expecting a lot of people (count).'

b. Chirhipu **kánika/*wánikwa** juka-h-ti itúkwa-(*icha)
soup much/many have-PFVE-3IND salt-PL
'The soup has a lot of salt (mass).'

c. Wíchu **wánikwa/*kánikwa** jukarha-h-ti tsiri-(icha)
dog many/much have-PFVE-3IND flea-PL
'The dog has a lot of fleas (count-mass).'

(10) *There wasn't much round duck spread over the road.

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As well-known, Chinese languages require classifiers for counting (1), a fact which led Chierchia (1998a) to propose that in these languages all nouns are mass, like *rice* or *water* in English.

Cheng and Sybesma (1999) and others have convincingly shown that a count/mass distinction exists also in these languages, and that it is reflected in a difference between Chinese nouns (or 'noun uses' – I will be agnostic on this important distinction here) that behave like the English words *furniture* or *silverwere* (mass, but with a well-defined notion of what *a piece of furniture/silverwere* might be) and nouns that, like *water* or *space*, do not provide a univocal notion of self-unit. The first class is compatible with what Doetjes (1997) calls 'count-classifiers' (e.g. *ben* in (1-a)), the second must be accompanied by CLs (Doetjes' "massifiers") which correspond to the expressions found in Romance and Germanic pseudopartitives (cf *a* HANDFUL/BIT/CUP *of rice* etc.).

(1) san ben syu
3 CL- book(*)
lit: 'three units of book' (= '3 books')

(2) san ping jiu
3 CL_{bottle} liquor
lit: 'three bottles of liquor'

Beyond these general ideas, the exact semantics for nouns and the reason why some languages should need count-classifiers at all is still a matter of debate (see Doetjes 1997, and Wu and Bodomo, 2009 vs. Cheng and Syebesma, 2012 for a recent exchange). One aspect which is particularly unclear—and the topic of this presentation—is the role of classifiers in the determination of *number* and *(in)definiteness*. The main background facts for Mandarin (MA) and Cantonese (CA) (from Cheng and Sybesma 1999, 2005) are as follows:

A. in MA and CA bare N arguments are *singular or plural* indefinites or kind-denoting; in MA, but not in CA, they can also be *definite*;

B. in MA and CA a bare [CL N] argument is *singular*. In CA, but not MA, it can be *definite*;

C. in MA and CA a bare [Num CL N] is *singular or plural* (depending on the numeral) and indefinite;

The two thesis I would like to defend in this talk are:

(3) a. Classifiers do not just individuate units, but also pluralized them: they create the semilattice structure needed for counting. Given this role, they are good candidate for the Pl functional head proposed in Heycock and Zamparelli (2005) as the locus for semantic pluralization.
b. Classifiers do not create definiteness.

According to this proposal, classifiers create a *number-neutral* denotion (singular+plural). They not 'singularizers', as proposed in Cheng and Sybesma (1999). This helps making sense of the Cantonese data in (4) and (5).

(4) [$_{\text{CLP}}$ ben syu]
[$_{\text{CLP}}$ CL book(s)]
'the book'

(5) [$_{\text{Num}}$ sam [$_{\text{CLP}}$ ben syu]]
[$_{\text{Num}}$ 3 [$_{\text{CLP}}$ CL book(s)]]
'3 books'

(5-a) is definite and singular, (5-b) is plural. How to construct a *compositional* account of the effect of adding a numeral above 1 to a CLP, if the CLP is an operator with uniqueness presuppositions? (Cf. the ill-formedness of partitives like **3 of the person*). The proposal that CLP are neither singular nor definites *per se* can address this problem by treating numerals as modifiers of semilattices (Verkuyl and van der Does 1991; Landman 2004; Link 1987). Moreover, I will propose that the definite meaning is the result of abstract movement of NP (for MA) or CLP (for CA) to [Spec,DP] (in the spirit of Simpson 2005, but with the semantic effect discussed in Heycock and Zamparelli 2003), a movement which is blocked by the presence of an overt Num head.

This proposal faces two obvious counterexamples: why (5-a) is singular and not number-neutral, and why a bare N argument seems to be number-neutral even in the absence of any CL.

Why bare [CL N] are singular: competition with the plural CL

One possible answer to why [CL N] is singular, explored in Cheng, Doetjes, Sybesma, and Zamparelli (2012), is that the number-neutral meaning of [CL N] is interpreted as a singular due to the competition with the **plural general classifier** (*di*[1] for Cantonese) (6), which produces a semilattice minus the atomic units (proper plurality). Since for any CL other than *di* the denotation of [CL N] is a superset of that of [*di* N], the latter is more informative, thus preferred in a cooperative exchange. Upon hearing [CL N], a speaker can reason that CL was used to cover the only case for which [*di* N] could not be used, i.e. a singular meaning.

(6) [$_{\text{CLP}}$ di jan]
[$_{\text{CLP}}$ CL_{plur} person]
'the people'

This Grician implicature is suspended in (5-b), since [*di* N] is incompatible with number modification (**saam di syu* '3 CL_{plur} book'), so, in (5) the other CLs have no more informative competitor, and resume their normal number-neutral meaning.

How can bare [N] be number-neutral?

Bare arguments in both Mandarin and Cantonese can be singular or plural. This seems to go against the idea that a semilattice denotation is available only with the CLP layer, but this reasoning follows only if the implication in (7-a) was a biconditional like (7-b). This would be problematic, since it would be a mystery why bare Ns cannot be counted without a CLP.

(7) a. Semilattice denotation → plural meaning
b. Semilattice denotation ↔ numeric modification ("counting")

My proposal is that the plurality ones sees in bare Ns is not a sign of the presence of a lattice denotation. Rather, it derives from two distinct sources. In the *indefinite* readings, reference to singular or plural object comes from the possibility for bare Ns to refer to 'kinds of things' (see Cheng and Sybesma 2005) and from the ability of kinds to be instantiated by singular or plural objects via the mechanism of Derived Kind Predication (Chierchia 1998b, Zamparelli 2002).

In the *definite* reading, the plural is derived simply by observing that the sentences in (8) would both be made true by the presence of either a single or multiple sheep/pieces of furniture in the corner.

(8) a. The sheep must be in that corner.
b. The furniture must be in that corner

We judge *sheep* a count noun ambiguous w.r.t. number, and *furniture* a mass noun, but from (8) it is just impossible to tell the difference. In Chinese all canonically count nouns are like *furniture*, hence the impression of a singular/plural ambiguity.

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