

## 7 Object Mass Nouns as an Arbiter for the Count–Mass Category

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### 1. Introduction

Chierchia (2010) argues that object mass nouns constitute a good testing ground for theories of the count–mass distinction, given that these nouns constitute a non-canonical type of mass noun that seems to be restricted to number marking languages (excluding outliers like Greek that admit plural morphology on mass nouns). Taking this idea as a springboard, in this paper we pose the following questions: Are there object mass nouns in classifier languages such as Japanese? What does the answer to this question mean for semantic accounts of the count–mass distinction in classifier languages?

Object mass nouns (e.g. *furniture, jewelry, mail*) are genuine mass nouns insofar as they do not freely admit pluralization, are infelicitous with determiners that select for count predicates (e.g. *many, each, and every*), and are felicitous with determiners that select for mass predicates (e.g. *much*). Object mass nouns are non-canonical insofar as they refer to collections of discrete entities (e.g. *jewelry* refers to sets of earrings, necklaces, bracelets, etc.) that are identifiable via semantic tests like the availability of cardinality comparisons in *more than* constructions (Barner and Snedeker 2005), and they are felicitous with stubbornly distributive predicates (Rothstein 2010). In contrast, canonical mass nouns like *water* refer to undifferentiated stuff and behave differently with respect to these semantic tests. Given these characteristics, object mass nouns have been used at least as early as Chierchia (1998a) and B. Gillon (1999) to exemplify the lack of direct alignment between the count–mass distinction and the pre-linguistic substance–object distinction of Soja, Carey, and Spelke (1991) and Spelke (1985). In exemplifying this misalignment,

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object mass nouns stand as counterexamples to early analyses of the count–mass distinction that assume count nouns denote individuals and mass nouns do not (e.g. Link 1983).

Analyses of the count–mass distinction in number marking languages such as English account for object mass nouns in various ways. However, when it comes to classifier languages like Japanese and Mandarin, it is sometimes assumed that a parallel, non-canonical class of mass nouns is not similarly attested. Chierchia (2010), for example, argues that classifier languages should have no object mass nouns, which he aligns with their lack of obligatory number marking. Chierchia (2010) and others (e.g. Muromatsu 2003; Nemoto 2005) follow Cheng and Sybesma (1998) in assuming that the count–mass distinction is encoded in classifier languages through the syntax and semantics of classifiers, because shape-based classifiers do not combine with substance denoting mass nouns, at least not without coercing a countable interpretation. In other words, shape-based classifiers only straightforwardly compose with object denoting nouns, and in this sense, classifier languages have count–mass syntax that is sensitive to whether nouns denote substances or objects. These assumptions lead to a picture of classifier languages in which the count–mass distinction aligns with the substance–object distinction.

Some recent studies have proposed that nouns in classifier languages, e.g. Japanese, encode individuation (Inagaki and Barner 2009) and that Japanese has several morphosyntactic reflexes that indicate that determiners are sensitive to the countability of nouns (Sudo to appear). Inagaki and Barner (2009) conclude from quantity comparison tasks that Japanese nouns like *isu* ('chair') encode individuation, because quantities of chairs can be compared in terms of cardinality in the absence of grammatical markers like classifiers. Sudo (to appear) argues that Japanese has nouns (e.g. *hon* 'book') whose denotations are countable. This is based upon, for example, the fact that such nouns can be felicitously modified by counting modifiers like *nan-byaku to iu* ('hundreds of') without an intervening classifier. He coins the term *countable nouns* for such nouns (reserving the term *count nouns* for the class of nouns in English and other languages that stands in opposition with *mass nouns*).

Given that Inagaki and Barner (2009) show that nouns encode individuation and Sudo (to appear) shows that some determiners are sensitive to countability of nouns in Japanese, Inagaki and Barner (2009) and Sudo (to appear) have collectively demonstrated that Japanese contains the necessary characteristics for identifying object mass nouns, which are known to encode individuation and pattern with mass nouns (Barner and Snedeker 2005, i.a.). That said, certain analyses have argued that classifier languages should have no such class of nouns (Chierchia 2010, 2015). This prompts the following question: If nouns in classifier languages encode individuation and the lack of it, and if determiners in classifier languages are sensitive to the countability of

nouns, then why should classifier languages like Japanese lack object mass nouns? To address this question, we delimit the class of object mass nouns to those that are grammatically mass and yet are individuated in the sense of Barner and Snedeker (2005). We follow Sudo (to appear) in using determiners as our test for countability in Japanese, and we follow Inagaki and Barner (2009) in using cardinality-based quantity comparison cardinality as our test for individuation.

Using the evidence for individuation from Inagaki and Barner (2009) and countability from Sudo (to appear), we present a means of putting claims like those of Chierchia (2010) to the test: we constructed a felicity judgment task to test the felicity of forty-four nouns from three different conceptual classes (discrete individuals, collections of discrete entities, and undifferentiated stuff) when composed with the determiner *nan-byaku to iu* ('hundreds of'), which selects for *countable nouns* (in the sense of Sudo (to appear)). The results of this study provide some evidence to suggest that at least four Japanese nouns have one of the hallmark properties of object mass nouns, namely exhibiting grammatically mass behavior. We also tested the second hallmark property of object mass nouns, namely that they encode individuation, as argued by Barner and Snedeker (2005) and Inagaki and Barner (2009). Our consultants indicated that they can compare quantities of entities in the extension of these nouns in terms of cardinality. The results of these two tests give us some reason to think that at least four Japanese nouns demonstrate the mass noun behavior of being infelicitous with determiners that select for count nouns, and the object denoting property of being comparable in terms of cardinality. In other words, we have some evidence for the claim that Japanese has a small set of nouns that demonstrate the behavior of object mass nouns.

However, further studies are needed to explore the existence and robustness of a class of object mass nouns in Japanese, including the testing of the same nouns in further grammatical environments that arguably might be considered good diagnostics of the count–mass distinction in Japanese. If Japanese were to have a class of such nouns (admittedly a rather limited one), then the following question arises: What would an analysis of the count–mass distinction in Japanese be like? We outline one proposal that builds upon Sutton and Filip (2016a, 2016b, 2018a, 2020). This proposal is based on the idea that the key property that grounds the grammatical property of countability is quantization relative to a contextually specified *schema of individuation* (details given in Section 4).

## 2. Background

Since at least Krifka (1995), it has been commonly assumed that all bare nouns in classifier languages denote kinds (Chierchia 2010, 2015; Rothstein 2017;

among others) or are otherwise uniform in their internal structure (Muromatsu 2003).<sup>1</sup> Chierchia (1998a, 1998b) observes that several characteristics of classifier languages naturally follow from the assumption that nouns in classifier languages are kind-denoting arguments: namely, (i) bare arguments freely occur, (ii) there is no obligatory number marking, (iii) there are no definite or indefinite articles, and (iv) there is a generalized classifier system. The generalized classifier system follows from this analysis on the assumption that classifiers provide the necessary semantic criteria to specify a set of individuals to be counted. Chierchia (1998a, 1998b), just like many others (e.g., X.-P. Li 2011; Nemoto 2005; Rothstein 2010, 2017), assumes that all nouns in classifier languages have a macro syntax similar to that of mass nouns in number marking languages. Related to this, it is also observed that the grammars of classifier languages reflect the pre-linguistic distinction between nouns that refer to objects and those that refer to substances in the sense of Soja, Carey, and Spelke (1991).

Recent work on the count–mass distinction has added more refinements. Chierchia (2010, 2015), for example, while maintaining that all nouns in classifier languages denote kinds, also argues that classifier languages should not have object mass nouns, because they lack the prerequisite criteria for the formation of object mass nouns, namely an obligatory number marking system. Bale and Coon (2014), Doetjes (2012), and Inagaki and Barner (2009), on the other hand, propose that a large number of nouns are encoded with individuation criteria, and Sudo (2016; to appear) discusses the properties of what he refers to as *countable* and *non-countable* nouns in Japanese.

### 2.1. Languages Without Object Mass Nouns

Chierchia (1998a, 1998b, 2010) observes that no noun in classifier languages like Chinese can combine with a numerical without first combining with a classifier which shifts a given noun into a count predicate. Rather than at the lexical level, the count–mass distinction in classifier languages is taken to be reflected in the syntax and semantics of classifiers. For example, while the general classifier in Mandarin *ge* (CL<sub>general</sub>) is typically used with nouns like *ji* ('chicken'), which denote clearly individuated entities, it is infelicitous with nouns like *xue* ('blood') that describe undifferentiated stuff:

- (1) a. san ge ji Mandarin  
          three CL<sub>general</sub> chicken  
          'three chickens'

<sup>1</sup> This is a slight simplification. Krifka (1995) assumes that bare nouns in classifier languages denote *concepts*, which are a proper superset of kinds (concepts can, for example, be the product of combining different kinds).

b. #san ge xue  
 three CL<sup>general</sup> blood  
 ‘three portions of blood’

(Chierchia, 2010: 106–7)

Such combinatorial properties are typical not only of the general classifier *ge*, but also of shape-based classifiers, which may also enforce a count interpretation on nouns denoting stuff. As Cheng and Sybesma (1998) suggest, shape-based classifiers have a syntactic distribution that differs from that of classifiers that are not restricted to such nouns with countable denotations.

Most importantly, Chierchia (2010, 2015) also argues that classifier languages cannot have object mass nouns, because they lack the prerequisite properties for their existence, namely those that characterize a number marking system defined in terms of (stable) atomicity, as in English, for instance. As defined in (Chierchia, 2015), a predicate (singular or plural) is *stably atomic* if and only if there is a set of stably atomic entities in that predicate’s denotation at all worlds in the common ground.

From this analytical assumption, several characteristics of number marking languages follow. By assuming that morphologically singular and plural nouns must refer to atoms, Chierchia’s (2010, 2015) analysis explains why it should be the case that mass nouns are singular despite the fact that they can refer to sums of entities. Mass nouns are atomic and can refer to sums of entities, because they are assumed to denote a singleton property, that is, a property which, relative to all worlds for which the property is non-empty, denotes a set with only one member. At a given world, the denotation of a mass noun is the sum or totality of all the instances of the mass noun property. Crucially, the entities in the denotation of mass nouns like *mud* are assumed to be unstable, unlike those in the denotation of count nouns like *chair*, which are stably atomic. Singular count nouns denote individual atoms, and plural count nouns denote these atoms and all of the possible sums thereof. Mass nouns cannot pluralize because their pluralization would be semantically vacuous (given that they denote singleton properties). Furthermore, nouns that refer to stable atoms can be encoded as singleton properties as a matter of lexical choice, giving rise to object mass nouns like *furniture*. Because classifier languages lack obligatory number marking, they lack the semantic requirement that singular nouns must be (stably) atomic. Nouns that refer to unstable individuals are not expected to be encoded as singleton properties, so the encoding of stably atomic predicates as singleton properties via lexical choice is not expected to occur.

The picture of the count–mass distinction in classifier languages that emerges from the work of Cheng and Sybesma (1998) and Chierchia (2010, 2015) is one in which the count–mass distinction falls neatly in line with the

substance–object distinction, and in this way they mirror early analyses of the count–mass distinction in English (e.g. Link 1983). More recent research on the count–mass distinction has focused on the ways in which the count–mass distinction deviates from the substance–object distinction (e.g. Barner and Snedeker 2005; Landman 2011; Rothstein 2010; among others); however, outside of some work done by Inagaki and Barner (2009), little work of this kind has been conducted on classifier languages.

## 2.2. *Individuation Without Classifiers: Inagaki and Barner (2009)*

Inagaki and Barner (2009) use quantity comparison tasks to explore whether Japanese nouns encode individuation or whether individuation is a prerequisite for counting that is imposed via the semantics of classifiers, as some assume (e.g. Chierchia 1998a; Rothstein 2010, 2017). Inagaki and Barner (2009) compared judgments related to quantities in three languages: English, French, and Japanese. Native speakers of these languages were presented with two sets of items at a time and asked to evaluate their relative quantity. For example, the participant would be directed to look at two portions of spinach, one with a larger cardinality and one with larger volume, as depicted in Figure 7.1. Other examples tested included images of undifferentiated stuff (e.g. mustard), discrete individuals (e.g. shoes), and collections of discrete individuals (e.g. furniture). Japanese participants were asked to compare the quantities of the stuff/entities in the pictures.

For spinach, for example, this was done via the question in (2), which contains no classifier or other grammatical means of specifying that there might be individuals to be counted and compared in terms of cardinality.

- (2) Dotira-no hito-ga yori-ookuno hoorensoo-o motte-iru desyoo  
 which-GEN person-NOM more.than-more spinach-ACC have-PROG COP.QCOP.Q  
 ‘Who has more spinach?’ (Inagaki and Barner (2009): 125)

For *hoorensoo* ‘spinach’ and other nouns that typically have count and mass counterparts cross-linguistically, Japanese participants were fairly evenly split as to whether or not they compared quantity in terms of

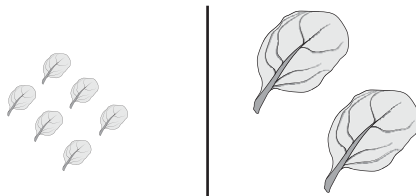


Fig. 7.1: Quantity comparison in the style of Inagaki and Barner (2009)

number or volume. Japanese- and English-speaking participants favored volume-based comparison for nouns that refer to undifferentiated stuff like *karasi* ('mustard'), and they favored cardinality comparisons for nouns like *kutu* ('shoe') that refer to discrete individuals and are count nouns in English. The ability to compare according to cardinality extends to nouns that refer to collections of discrete entities, such as *kagu* ('furniture'), as was also shown to be the case for English nouns in this category by Barner and Snedeker (2005). Based on such observations, Inagaki and Barner (2009) propose that Japanese nouns that refer to discrete individuals can individuate just as they can in English, while those that refer to undifferentiated stuff cannot.

### 2.3. *Arguments for Nominal Individuation: Doetjes (2012)*

Doetjes (2012) reviews a number of characteristics of nouns in classifier languages that she argues indicate that classifier languages have 'count meanings and mass meanings at the lexical level' (2577). The first characteristic is that classifier languages do not always require classifiers in counting constructions. Sudo (to appear) also shows this to be the case in Japanese. For example, large round numbers like 1000 can combine directly with nouns that refer to discrete individuals:

- (3) sen-(choo)-no bairorin  
 1000-CL-GEN violin  
 'a thousand violins' (Sudo (to appear): 4)

Second, general classifiers can be used in the place of sortal classifiers. Doetjes (2012) argues that this indicates that nouns themselves must be individuated, because the general classifier would otherwise have to contribute the individuation criteria for every noun that it can combine with.

Third, some classifier languages have determiners that are sensitive to individuation properties of nouns. The Mandarin determiner *yī diǎnr* ('a little') has been shown by Iljic (1994) to never occur with a classifier, and to typically occur with substance denoting nouns and abstract nouns. Doetjes (2012) argues that these three characteristics of classifier languages indicate that some nouns in classifier language have count meanings.

Although Doetjes (2012) concludes that this evidence supports a view in which nouns in obligatory classifier languages have a lexical count–mass distinction, arguably this is at most evidence for a weaker claim, namely that nouns in such languages encode individuation in the sense of Inagaki and Barner (2009). In other words, a safer conclusion from this evidence would be that a distinction can be drawn between nouns in classifier languages that refer to discrete objects and those that refer to undifferentiated stuff.

2.4. *Count–Mass Characteristics in Japanese: Sudo 2016; to appear*

Sudo (2016; to appear) shows that there are nouns in Japanese that exhibit syntactic behavior that resembles that which we find with mass and count nouns in languages that have a grammaticized lexical count–mass distinction. As mentioned in the previous sub-section, large round numbers like 100 and 1000 can directly combine with nouns that refer to discrete entities, i.e., his *countable nouns*. Japanese also has five determiners that, as Sudo (to appear) argues, also select for such *countable nouns* and that can be used without classifiers: *tasuu* ('many'), *shoosuu* ('few'), *nan-byaku-toiiuu* ('what-100-say'), *dono* ('which'), and *hotondo* ('most'). As shown in (4), the determiner *nan-byaku to iu* ('hundreds of') is felicitous with *komento* ('comment') but not with *ase* ('sweat').

- (4) a. sono tookoo-ni nan-byaku-toiiuu komento-ga tsuita.  
 that post-TO what-100-say comment-NOM provided.  
 'That post got hundreds of comments.'
- b. Taro-wa nan-byaku-toiiuu ase-o kaita  
 Taro-TOP what-100-say sweat-ACC secreted  
 (intended) 'Taro sweated a lot.' (Sudo to appear: 5)

3. **Testing for Object Mass Nouns**

Recent research on Japanese by Inagaki and Barner (2009), Doetjes (2012), and Sudo (2016; to appear), which we have just summarized, has laid the groundwork for showing that Japanese distinguishes between different kinds of nouns, those that encode individuation versus those that do not (Inagaki and Barner 2009) and those that encode countability versus those that do not (Sudo to appear). We take it that such studies provide relevant observations and tests that allow us to explore the question of whether object mass nouns exist in Japanese. If we can indeed isolate among Japanese nouns those that exhibit notional and distributional properties similar to those of object mass nouns in English, this would serve as evidence for the proposal that Japanese might possess at least some properties of languages with a lexical count–mass distinction among nouns. The putative 'object mass' nouns in Japanese would exhibit a misalignment between individuation properties and the notional substance–object distinction, and so it could then plausibly be claimed that Japanese has at least some reflexes of the grammaticized lexical count–mass distinction.

We set out to test for object mass nouns in Japanese by mainly building upon Sudo's (to appear) observations about Japanese determiners. Specifically, we focused on his observation that the determiner *nan-byaku to iu* ('hundreds of') is felicitous with nouns that denote discrete entities, but not those that



denote undifferentiated stuff, and we formulated a set of test sentences, each containing this determiner and a noun from one of three different conceptual classes: discrete individuals (e.g. *onna no hito* ‘woman’ in (5)); undifferentiated stuff (e.g. *yuki* ‘snow’ in (6)); and collections of discrete entities (e.g. *chōrikigu* ‘kitchenware’ in (7)).

- (5) toranpu-shi ga daitoryō ni na-tta ato, nan-byaku-to-iu  
 Trump-president NOM president ACC become-PST after; what-hundred-to-say  
 onna.no.hito ga washinton de neriarui-ta  
 woman NOM Washington LOC march-PST  
 ‘After Trump became president, hundreds of women marched in Washington DC.’
- (6) # nan-byaku-to-iu yuki wa mō toke-te shima-tta  
 what-hundred-to-say snow NOM already melt-TE finish-PST  
 ‘#Hundreds of snow melted already.’
- (7) # Atarashī ryōri no gakkō wa nan-byaku-to-iu chōrikigu o ka-tta.  
 new cooking GEN school TOP what-hundred-to-say kitchenware ACC buy-PST  
 Dakara subete no seito ga benkyōsuru tame no potto to furaipan  
 therefore all GEN student NOM study for GEN pot and pan  
 o mo-tta.  
 ACC hold-PST  
 #‘The new culinary school bought hundreds of kitchenware, so every student had pots and pans to work with.’

In languages with a grammaticized lexical count–mass distinction, nouns that refer to undifferentiated stuff (e.g. *mud*) are generally encoded as mass, while nouns that refer to clearly discrete individuals, especially those that are animate (e.g. *woman*), can be encoded as count. Based on such observations, we can immediately make several predictions about what we should expect to find when using our test sentences in an acceptability judgment task. First, sentences containing nouns that refer to discrete individuals composed with *nan-byaku to iu* (‘hundreds of’) should be judged felicitous, because this determiner selects for countable nouns in Japanese, i.e., nouns that denote discrete individuals, and such nouns are often encoded as count in languages with a grammaticized lexical count–mass distinction.

Second, sentences containing nouns that refer to undifferentiated stuff composed with *nan-byaku to iu* (‘hundreds of’) should be judged to be infelicitous, because this determiner selects for *countable nouns* (in the sense of Sudo to appear), and nouns that refer to undifferentiated stuff are typically mass in languages with a grammaticized lexical count–mass distinction.

What is less clear is how sentences containing nouns that describe collections of discrete entities composed with *nan-byaku to iu* (‘hundreds of’) will be judged. Sutton and Filip (2016b) observe that this notional class of nouns is the site of variation in the encoding of nouns as either mass or count, both within and across languages. If sentences containing these nouns

are judged to be felicitous, then we have some evidence that these nouns are count. On the other hand, if sentences containing these nouns are judged infelicitous, then we have some evidence that these nouns are mass (i.e. not countable), on the assumption that the infelicity is due to ungrammaticality that results when a determiner that selects for *countable nouns* is composed with such nouns. Any noun that refers to collections of discrete entities and is shown not to be countable is a candidate for being an object mass noun if it can be shown to also encode individuation, for example, in a quantity comparison task like that of Inagaki and Barner (2009).

In addition to these test sentences, we constructed an equal number of filler sentences. Our filler sentences consisted of adjective–noun combinations, a subset of which were infelicitous. The set of survey items had an approximately equal number of felicitous and infelicitous filler constructions and target constructions, as far as such judgments could be predicted based on the chosen data. We tested the felicity of these constructions in an online survey in which participants were asked to judge the naturalness of sentences on a five point Likert scale from 1, *zenzen yokunai* ('not at all good'), to 5, *totemo yoi* ('very good'). Each sentence was judged by fifty native Japanese speakers via the crowd-sourcing platform [www.crowdworks.jp](http://www.crowdworks.jp).

### 3.1. Results

As predicted by previous work on Japanese (Sudo to appear), the results of our acceptability judgment task show that sentences with nouns that refer to discrete individuals (e.g. *onna no hito* 'woman') composed with the determiner *nan-byaku to iu* ('hundreds of') are felicitous, while sentences with nouns that refer to undifferentiated stuff (e.g. *yuki* 'snow') composed with the same determiner are infelicitous (see Figure 7.2). More specifically, sentences with nouns referring to discrete individuals have a high average acceptability ( $\bar{x} = 4.20$ ), while sentences with nouns referring to unindividuated stuff have a low average acceptability ( $\bar{x} = 2.76$ ). As a single class, the sentences containing nouns that refer to collections of discrete entities (e.g. *chōrikigu* 'kitchenware') did not pattern as high as those with nouns referring to discrete individuals nor as low as sentences containing nouns that refer to undifferentiated stuff ( $\bar{x} = 3.77$ ).

These results were analyzed using the *lme4* package in R (R Core Team 2019) and a generalized linear mixed effects model. The fixed effect was notional class and the random effects were noun and participant. This analysis shows that the judgments of sentences containing nouns that refer to undifferentiated stuff were significantly lower than the judgments of sentences containing nouns that refer to discrete individuals ( $p < 0.001$ ), as were judgments of sentences containing nouns that refer to collections of discrete entities

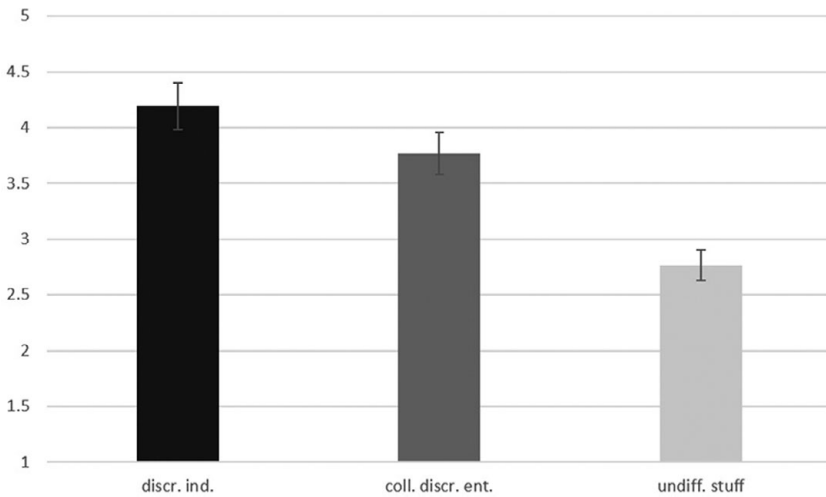


Fig. 7.2: Average judgment by conceptual class

( $p < 0.01$ ). Interpreting these results relative to composition with the determiner *nan-byaku to iu* ('hundreds of'), we might say that nouns that refer to undifferentiated stuff are infelicitous with this determiner, as is claimed by Sudo (to appear). Furthermore, the class of nouns that refer to collections of discrete entities does not pattern similarly to nouns that refer to discrete individuals. This result is not predicted by analyses that assume that all nouns that can compose with shape-based classifiers are uniform in their encoding. Instead, what seems to be the case is that the class of nouns that refer to collections of discrete entities shows count–mass variation in Japanese.

To tease apart differences in behavior among nouns that refer to collections of discrete entities, we conducted a post hoc analysis based on how closely the judgments of individual sentences containing these nouns resembled the judgments of sentences containing nouns referring to discrete individuals, and how closely these judgments resembled the judgments of sentences containing nouns referring to undifferentiated stuff. In addition to using the generalized linear mixed effects model to analyze the results of this post hoc analysis, these results were also analyzed with respect to effect size, namely the degree to which a phenomenon exists, which is determined by dividing the difference between two average judgments by the standard deviation of all judgments (Cohen 1988). In acceptability judgment tasks, the measure of grammaticality is the size of the effect (Mahowald et al. 2016). Using the high felicity of sentences containing nouns that refer to discrete entities as our baseline, a trivial effect is an effect size less than 0.2, a small effect is an effect size

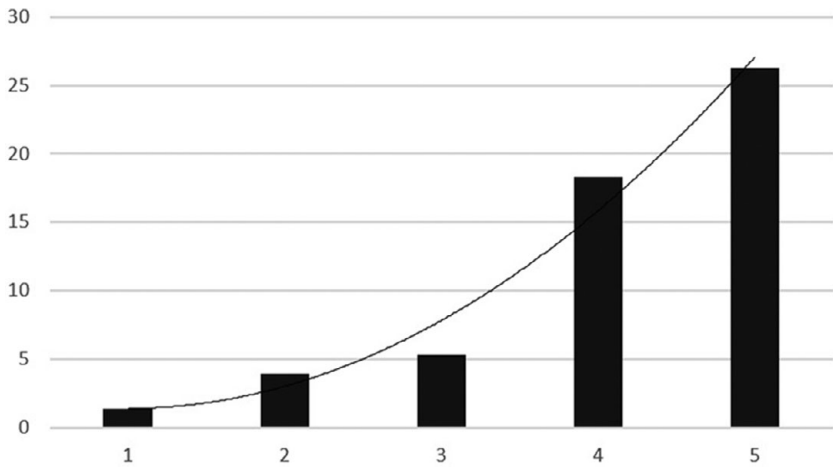


Fig. 7.3: Average judgments: nouns referring to discrete individuals

between 0.2 and 0.5, a medium effect is between 0.5 and 0.8, and a large effect size is anything greater than 0.8.

The graph in Figure 7.3 contains the average number of judgments the sentences containing a noun referring to discrete entities had at each level of the Likert scale. The judgments of sentences containing nouns that refer to discrete individuals had a clear tendency towards the high (felicitous) end of the Likert scale. In this post hoc analysis, we interpret the average judgment of these sentences and this distribution pattern as our baseline of felicity.

The judgments of sentences with nouns that refer to undifferentiated stuff patterned towards the center and only slightly towards the low (infelicitous) end of the Likert scale (Figure 7.4). Notably, this pattern is not the inverse of the felicity pattern seen in judgments of sentences containing nouns that refer to discrete individuals. Despite this distribution of judgments, the difference between this group of sentences and the set of sentences that contain nouns that refer to discrete individuals is statistically significant ( $p < 0.001$ , effect size  $> 0.8$ ). We interpret this measure of difference in statistical tests as the criteria for categorization as infelicitous.

The sentences that contain nouns referring to collections of discrete entities were separated in three groups depending on whether the distribution of judgments of these sentences most closely resembled those of sentences containing nouns referring to discrete individuals, those containing nouns referring to undifferentiated stuff, or neither. While having three categories of felicity does not reflect the binary way in which morphosyntactic reflexes of the count–mass distinction are typically discussed, such gradients are common

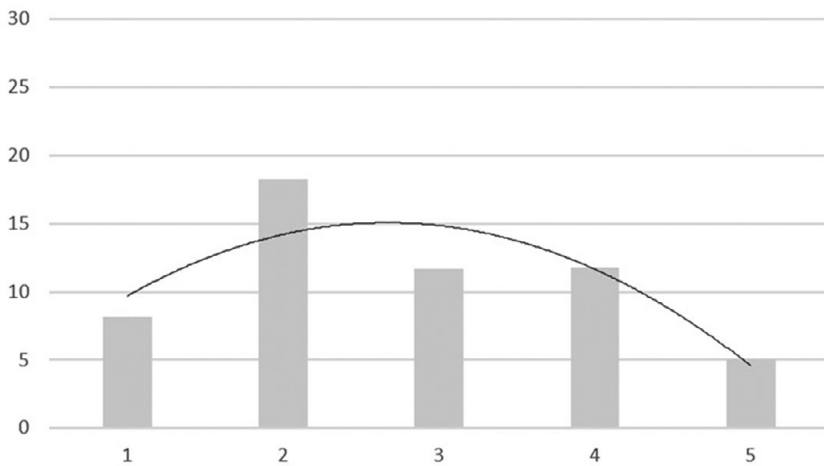


Fig. 7.4: Average judgments: nouns referring to undifferentiated stuff

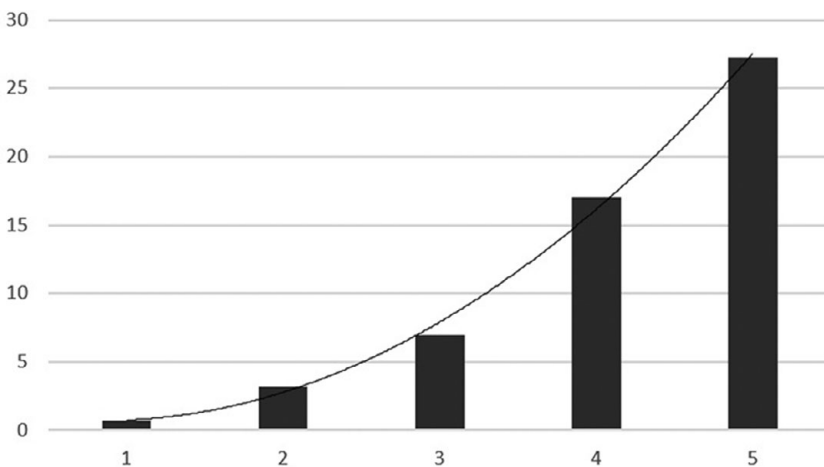


Fig. 7.5: Average judgments: nouns referring to collections of discrete entities, Group 1

in acceptability judgment tasks, (e.g. Bresnan 2007; Bresnan and Ford 2010; Featherston 2005; Keller 2000; Newmeyer 2007; Sorace and Keller 2005; Sprouse 2007), and this more accurately reflects the judgments of the individual sentences in this study.

As depicted in Figure 7.5, one set of sentences containing nouns that refer to collections of discrete entities (Group 1) was judged in a way that is nearly

identical to the way that sentences containing nouns that refer to discrete individuals were judged. Furthermore, the average judgment of sentences in this class strongly resembles the average judgment of sentences containing nouns that refer to discrete individuals ( $n = 7$ ,  $\bar{x} = 4.22$ ,  $p = 0.567$ , effect size  $< 0.2$ ). On the assumption that sentences containing nouns that refer to discrete entities are felicitous, the statistical analysis of the judgments of sentences in Group 1, which contain nouns that refer to collections of discrete entities, are such that these sentences are also felicitous.

The judgments of one set of sentences containing nouns referring to collections of discrete entities (Group 3) resemble the judgment of sentences containing nouns that refer to undifferentiated stuff in three ways. First, the judgments of both sets of sentences pattern towards the center of the Likert scale. Additionally, the two sets of sentences meet the same thresholds for statistical significance ( $p < 0.001$ ) and effect size ( $>0.8$ ). Despite the fact that the average acceptability judgment of sentences containing collective artifact referring nouns in Group 3 ( $\bar{x} = 3.21$ ) is higher than both the middle point of the Likert scale and the average judgment of sentences containing nouns that refer to undifferentiated stuff ( $\bar{x} = 2.76$ ), on the assumption that a p-value less than 0.001 and an effect size greater than 0.8 are indicators of infelicity, then the sentences in Group 3 are infelicitous.

Another set of nouns (Group 2) patterned in between Groups 1 and 3, not being judged as straightforwardly felicitous as sentences containing nouns that refer to discrete individuals nor as infelicitous as sentences containing nouns that refer to undifferentiated stuff ( $n = 7$ ,  $\bar{x} = 3.71$ ,  $p < 0.05$ , effect size 0.5–0.8). The distribution of judgments across the Likert scale is generally towards the high (felicitous) end of the scale, though not with the same clear pattern as the distribution of judgments of sentences containing nouns that refer to discrete individuals. In other words, the third group of sentences only weakly patterns like those containing nouns that refer to discrete individuals.

The average judgments of each class of nouns in this post-hoc analysis are depicted in Figure 7.8, along with the average judgments of sentences containing nouns that refer to discrete individuals and those referring to undifferentiated stuff. This graph shows three distinct judgment patterns with respect to sentences containing the determiner *nan-byaku to iu* ('hundreds of') and nouns that refer to collections of discrete entities. The nouns in each group are listed in in Table 7.1, where the category *Felicitous* contains the nouns that occurred in sentences that were judged like those containing nouns that refer to discrete entities, *Weakly Felicitous* contains the nouns that occurred in sentences that were judged differently from those containing nouns that refer to discrete entities, albeit weakly so given their p-value and effect size, and *Infelicitous* contains the nouns that occurred in sentences that were judged differently

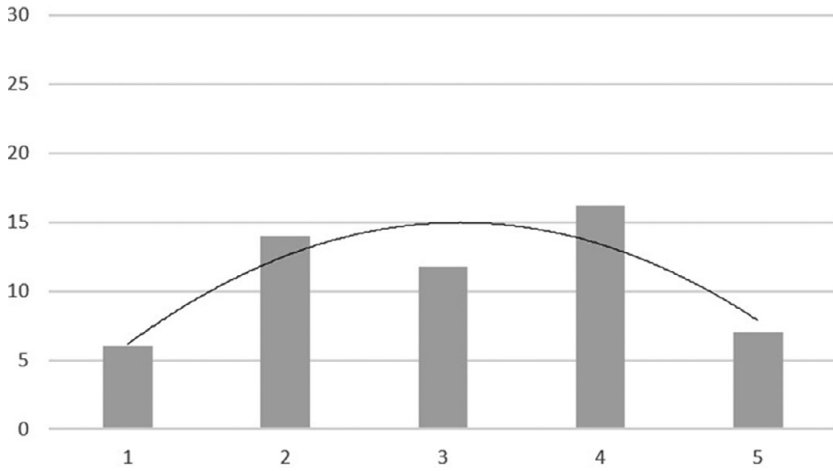


Fig. 7.6: Average judgments: nouns referring to collections of discrete entities, Group 3

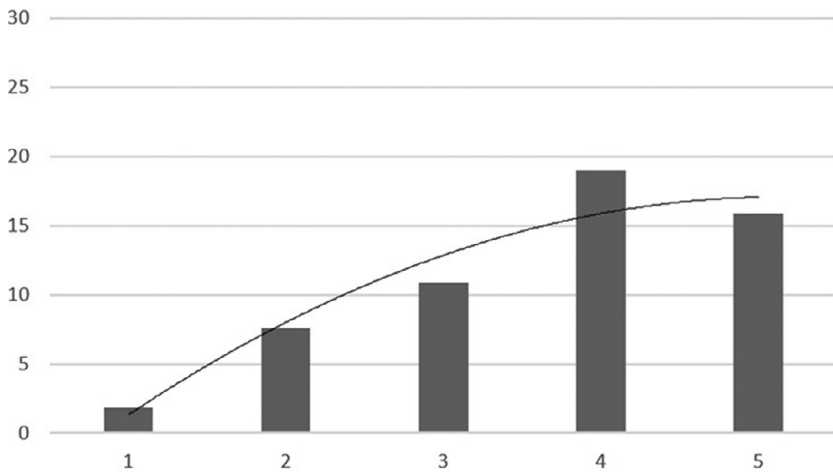


Fig. 7.7: Average judgments: nouns referring to collections of discrete entities, Group 2

Table 7.1. *Felicity with nan-byaku to iu ('hundreds of')*

Felicitous	Weakly Felicitous	Infelicitous
<i>haikibutsu</i> ('waste')	<i>shōhin</i> ('goods/wares')	<i>hakimono</i> ('footwear')
<i>kizai</i> ('equipment')	<i>kagu</i> ('furniture')	<i>shinamono</i> ('wares/articles')
<i>yōfuku</i> ('western clothes')	<i>shokki</i> ('dishware')	<i>kattamono</i> ('shopped goods')
<i>chōri-ki</i> ('kitchenware')	<i>sōbi</i> ('equipment')	<i>chōri-kigu</i> ('kitchenware')
<i>yūbin</i> ('mail')	<i>dōgu</i> ('tools')	
<i>daidokoro yōhin</i> ('kitchenware')	<i>yūbinbutsu</i> ('mail')	
<i>kutsu</i> ('shoes')	<i>gomi</i> ('garbage')	

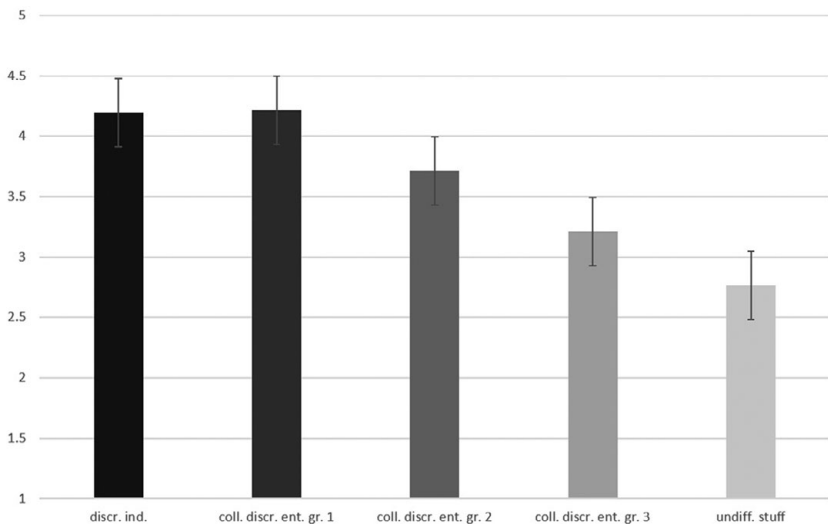


Fig. 7.8: Average judgment: post-hoc classes

from those containing nouns that refer to discrete entities with the same p-value and effect size as those sentences containing nouns that refer to undifferentiated stuff.

### 3.2. Discussion

Assuming that the results of the study are due solely to the felicity of the composition of the different nouns with the determiner *nan-byaku to iu* ('hundreds of'), these results confirm several predictions and suggest that the lexical encoding of Japanese nouns might not be as uniform with respect to



countability as is commonly assumed for classifier languages. First, as proposed by Sudo (to appear), *nan-byaku to iu* ('hundreds of') is felicitous with countable nouns and infelicitous with non-countable nouns. Second, as predicted by Sutton and Filip (2016a), the conceptual class of nouns that refer to discrete *singular* individuals is stably count, the conceptual class of nouns that refer to undifferentiated stuff are stably mass, and the conceptual class of nouns that refer to collections of discrete entities can be encoded as either mass or count, within a particular language and across different languages. These results also suggest that, despite the fact that all nouns require classifiers in order to be counted, they do not behave uniformly with respect to all syntactic environments indicative of the count–mass distinction. Instead, these results suggest that at least four Japanese nouns (22% of those we tested in the relevant class) – *hakimono* ('footwear'), *shinamono* ('wares/articles'), *kattamono* ('shopped goods'), and *chōri-kigu* ('kitchenware') – have the characteristic property of object mass nouns, insofar as they syntactically pattern with non-countable ('mass') nouns.

Rather than relying on whether or not the average judgment of sentences containing one of these four nouns composed with the determiner *nan-byaku to iu* ('hundreds of') is the same as the average judgment of the sentences containing nouns that refer to undifferentiated stuff composed with *nan-byaku to iu* ('hundreds of') in order to determine infelicity, we assess infelicity based on statistically determined differences of the sets of sentences from those that contain nouns that refer to discrete individuals composed with *nan-byaku to iu* ('hundreds of'). Because both the set of sentences containing nouns that refer to undifferentiated stuff and the group of sentences containing *hakimono* ('footwear'), *shinamono* ('wares/articles'), *kattamono* ('shopped goods'), and *chōri-kigu* ('kitchenware') are judged in a way that displays a statistically significant difference ( $p < 0.001$ , effect size  $> 0.8$ ) from the group of sentences containing nouns that refer to discrete individuals composed with *nan-byaku to iu* ('hundreds of'), we consider both the set of sentences containing nouns that refer to undifferentiated stuff and the group of sentences containing *hakimono* ('footwear'), *shinamono* ('wares/articles'), *kattamono* ('shopped goods'), and *chōri-kigu* ('kitchenware') to be equally infelicitous in that they are in the same statistically based category when compared to sentences containing nouns that refer to discrete individuals (count nouns).

To confirm that the nouns that refer to collections of discrete entities are individuated in the sense of Barner and Snedeker (2005), and therefore that these nouns have a hallmark property of object mass nouns, we set up a quantity comparison task for three consultants. Each consultant was given a context in which two people possessed items of the same kind, but in amounts that differed with respect to volume and cardinality. One person's possessions

were larger in terms of volume, while the other person's possessions were higher in cardinality.

- (8) Mayo no kago ni wa ookii mi-ttsu no men no fukuro to fatatsu no  
 Mayo GEN basket LOC TOP big 3-CL GEN noodle GEN bag and 2-CL GEN  
 suika ga hai-tte iru. Ai no kago ni wa chiisai yo-ttsuno men  
 watermelon NOM contain-TE IRU Ai GEN basket LOC TOP small 4-CL GEN noodle  
 no fukuro to mi-ttsu no satsuma mikan ga hai-tte iru.  
 GEN bag and 3-CL GEN satsuma mandarin NOM contain-TE IRU  
 'Mayo's basket has three large packs of noodles and two watermelons in it. Ai's basket  
 has four small packs of noodles and three satsumas in it.'
- (9) Dochira no hito no kago ga yori ōku no kattamono o motte  
 Who GEN person GEN basket NOM more much GEN goods DIR carry  
 irudeshou?  
 stay  
 'Whose basket has more goods?'

Our consultants were asked to judge who had more of the item in question. For each of the nouns that refer to collections of discrete entities in our study, the person whose possessions were larger in cardinality was judged to have the larger amount. Following Barner and Snedeker (2005) and Inagaki and Barner (2009), we interpret the results of these cardinality judgment tasks as indicating that the nouns in question denote individuated entities that can be compared according to cardinality. Having this property, combined with the results of our study, suggests that we have at least some evidence for thinking that there are at least some nouns in Japanese that have both of the hallmark properties of object mass nouns.

However, the nature of the differences between average acceptability judgments militates against any strong conclusions regarding whether or not Japanese has a class of object mass nouns. For example, the results were presented with the assumption that the judgments of sentences containing nouns that refer to discrete individuals, like *isu* ('chair'), constituted the baseline for acceptability, and that infelicity is determined by being deviant from this baseline by a statistically significant amount ( $p < 0.001$ , effect size  $> 0.8$ ). However, the average judgment of the least acceptable sentences containing nouns that refer to collections of discrete entities like *hakimono* ('footwear') was not as low as the average judgment of the sentences containing nouns that refer to undifferentiated stuff like *yuki* ('snow'). If the average judgment of sentences containing nouns referring to undifferentiated stuff was assumed to be the baseline for infelicity, then the least felicitous sentences containing nouns referring to collections of discrete entities might be classified as *weakly infelicitous* on account of the fact that they might not statistically pattern identically to the sentences containing nouns that refer to undifferentiated stuff.

In addition to the differences between the two least felicitous groups of sentences, the fact that judgments of sentences that contain nouns that refer to

collections of discrete individuals were graded suggests that more than just the felicity of nouns and the determiner that selects for countable nouns was at issue in our acceptability judgment task. Differences in the complexity of sentences – for example length, lexical items, topic, syntax, etc. – might have contributed to some sentences being rated higher or lower than others. To investigate the cause of graded judgments and to possibly get a clearer picture of the countability of these nouns, we reviewed the test items with a different consultant than the one who provided the test sentences. This consultant noted several ways in which sentences might be judged to be at least partly unacceptable aside from infelicity of the determiner+noun composition. For example, some sentences were particularly long and could have included commas in order to make them easier to parse. The fact that these sentences were less straightforward to parse could have resulted in lower acceptability judgments. Additionally, certain sentences contained vocabulary of different registers, one which is more formal and one which is more casual, and this mismatch of register might have caused some participants in the study to give lower judgments. Low judgments could also be accounted for, in some cases, due to world knowledge conflicting with the information in the sentence. For example, one sentence described a piano store that sold hundreds of pianos on a single day, which participants might have thought to be very unlikely and therefore less acceptable. This review of test items showed that, across all conceptual classes of nouns, sentences could have been judged to have low acceptability for reasons other than the composition of the target noun and the determiner *nan-byaku to iu* ('hundreds of').

Given the number of reasons why each of the test sentences might have gotten a low judgment, it is less clear whether the results are indicative of genuine object mass nouns or not. When asked to help clarify this picture by reflecting on the felicity of the individual determiner+noun compositions, the consultant reported that both *shinamono* ('wares/articles') and *kattamono* ('shopped goods') seemed particularly strange composed with *nan-byaku to iu*, though the felicity of *hakimono* ('footwear') and *chōri-kigu* ('kitchenware') with this determiner is less clear. We take these results to suggest that, given the current state of research, *shinamono* ('wares/articles') and *kattamono* ('shopped goods') seem to be the most promising candidates for being considered object mass nouns in Japanese. Further investigation is necessary to see if the results for *hakimono* ('footwear') and *chōri-kigu* ('kitchenware') and other nouns that refer to collections of discrete entities can be upheld in this and other syntactic environments that are diagnostic of the count–mass distinction in Japanese. What we can conclude from this study is that there is a set of nouns that refer to collections of discrete entities that straightforwardly pattern with countable nouns (in the sense of Sudo (to appear)) and others that seem like they might not when it comes to being felicitously combined

with *nan-byaku to iu* ('hundreds of'). In other words, more investigation is required, both in terms of controlling for potential confounds and testing more grammatical environments.

#### 4. Analysis

In this section, we outline what an analysis of the count–mass distinction in classifier languages would look like on the assumptions that (a) bare nouns are kind-denoting, and (b) the count–mass distinction in classifier languages is not perfectly aligned with the substance–object distinction. Assumption (b) is, however, something that we concede is only weakly supported by the study we have reported. As for assumption (a), an analysis of classifier languages that assumes that nouns are kind-denoting is attractive because, from this assumption, it arguably follows that classifier languages allow bare arguments, require the use of classifiers in counting constructions, and do not have obligatory number marking (Chierchia 2015; see Section 2.1 above). However, given that, standardly, formal theories do not distinguish between kinds for count predicates and kinds for mass predicates even if some do implicitly assume a distinction between kinds of objects and kinds of substances (in order to account for the distribution of shape-based classifiers, for instance), there is a *prima facie* tension between assumptions (a) and (b).

The *prima facie* tension between (a) and (b) can be alleviated, however, by adding to a theory a distinction between kinds that are associated with count predicates and mass kinds that are associated with predicates that cannot be grammatically counted. That is to say that we must draw a distinction between kinds that form count predicates under something along the lines of Chierchia's (2010, 2015) 'up'  $\cup$  operator, and kinds that form mass predicates under something along the lines of Chierchia's (2010, 2015) 'down'  $\cap$  operator. This sort of analysis is what we outline below, namely one in which: nouns in Japanese are kind-denoting and so cannot felicitously enter into counting constructions without an intervening classifier; but despite being kind-denoting, nouns come out of the lexicon in some sense 'count' or 'mass', thus accounting for the possibility of being infelicitous with determiners like *nan-byaku to iu* ('hundreds of'). The former point is pretty common in the literature (see Chierchia 1998a, 1998b, 2010, 2015; Krifka 1995; X.-P. Li 2011; Nemoto 2005; Rothstein 2017; and others). The latter point is not exactly novel either insofar as a suggestion for a distinction between count and mass kinds is hinted at in the presented version of Chierchia's Chapter 2 in this volume. What is novel is a theory that formally implements both of these points.

On the (albeit tentative) assumption of (b), above, other accounts of counting constructions in classifier languages do not quite have the right

combination of features to capture the kind of grammatical patterns that our studies have suggested may be required, namely that Japanese nouns seem to have a grammaticized lexicalized count–mass distinction, and, of the mass nouns in Japanese, at least some appear to be object mass. A straightforward application of Chierchia’s (2010, 2015) theory, for example, is not possible, given that it is custom designed to exclude the possibility of object mass nouns from classifier languages (on this analysis, only number marking languages encode mass nouns as singleton properties, and only this feature licenses a copycat effect in which stably atomic predicates can come to have mass denotations).

On the other hand, analyses in which nouns in classifier languages come out of the lexicon as predicates (Bale and Coon 2014; Erbach et al. 2017; Muromatsu 2003; Sudo 2016)<sup>2</sup> lose the above-stated properties of being able to simply derive, for example, bare arguments, and lack of obligatory number marking in classifier languages (see Chierchia, this volume, Chapter 2).

An analysis along the lines of Krifka (1995) is the closest to what we need. It assumes that nouns in classifier languages denote *concepts* (such that the set of concepts is a superset of the set of kinds), and that counting classifiers, semantically, play the dual role of mapping numerals to numerical modifiers, and shifting concepts ‘up’ to the set of object units that are realizations of them. Our strategy will be to follow this dual-purpose approach for classifiers in Japanese. However, our approach will also allow for the possibility that, despite the fact that bare nouns in Japanese are interpreted as kinds, some of those that denote physical objects are nonetheless (in a sense to be elaborated upon) mass nouns.

Here we use the same analysis as Sutton and Filip (this volume, Chapter 12), which is based on compositional DRT (Muskens 1996) enriched with mereology along the lines proposed for domain-level plurality by Brasoveanu (2008). Importantly, we allow for discourse referents for properties (this is comparable to the discourse referents for sets of entities employed by Kamp and Reyle (1993) in their analysis of plurals). Specifically, we propose that (count) nouns make available a *counting base* property (see also Khrizman et al. 2015; Landman 2016; Sutton and Filip 2016a; amongst others) that specifies, for any given context, the set of entities that count as one for the relevant noun. (See, Sutton and Filip, this volume, Chapter 12 for the basis for this enrichment to compositional DRT.)

<sup>2</sup> Bale and Coon (2014) argue for this analysis for Chol (Mayan) in which classifiers are obligatory with some numerals and ungrammatical with others. It is not presupposed that this analysis applies to languages such as Japanese, Mandarin, etc.

Following Filip and Sutton (2017), Rothstein (2010), and Sutton and Filip (2016a), we assume that count nouns are interpreted relative to a context  $i$ . For us, contexts license individuation schemas  $\mathcal{S}_i$  that are applied to the extensions and counting bases of singular count nouns. Application of an individuation schema yields a quantized ( $QUA$ ; Krifka 1989) predicate (for a brief discussion of why we opt for ‘quantized relative to a context’ as opposed to ‘disjoint relative to a context’, see Sutton and Filip, this volume, Chapter 12):

$$(10) \quad QUA(P) \leftrightarrow \forall x, y [P(x) \wedge P(y) \rightarrow \neg x \sqsubset y]$$

For a context  $i$  and an individuation schema licensed by that context  $\mathcal{S}_i$ ,  $\mathcal{S}_i(P)$  is a maximally quantized subset of  $P$  ( $\mathcal{S}_i(P) \subseteq_{max.QUA} P$ ):

$$(11) \quad Q \subseteq_{max.QUA} P \leftrightarrow Q \subseteq P \wedge QUA(Q) \wedge \forall R [R \supseteq Q \wedge R \subseteq P \wedge QUA(R) \rightarrow R = Q]$$

Mass nouns, we assume, are not sensitive to the particular context of utterance when it comes to determining what counts as one. We model this by saturating the lexical entries of mass nouns with the null individuation schema ( $\mathcal{S}_0$ ), which, semantically, denotes the identity function.

Similarly to Krifka’s (1995) OU function, we assume that object denoting nouns include in their lexical semantics a function  $\theta$  such that,  $\forall P [\theta(P) \subseteq P]$  and  $\theta(P)$  is the set of entities that could count as one  $P$  on perceptual or functional grounds. Critically, for some predicates,  $\theta(P)$  doesn’t denote a set that is a suitable input to the grammatical counting operation, since for some  $P$ ,  $\neg QUA(\theta(P))$ . In such cases, to get a count concept, we would need the application of an individuation schema, i.e.,  $\mathcal{S}_i(\theta)(P)$ .

Finally, we assume the standard, ‘down’ operator (Chierchia 2010; 2015; amongst others) as it applies at the DRS condition level, but also at the DRS level, here defined only for single condition DRSs. In (13),  $k$  is a discourse referent for a kind:

$$(12) \quad \cap(P) = \lambda w. \iota P(w)$$

$$(13) \quad \cap'(\lambda w. \lambda v. [P(w)(v)]) = \lambda w. [k | k = \cap(P)(w)]$$

For the inverse function, ‘up’, we slightly adapt Chierchia’s definition in a way to be made clear below that reflects the fact that we do not make an atomicity assumption. (In brief, we make use of the fact that kinds specify counting bases, the sets of entities that count as one, and ‘up’ maps kinds to those entities that are part of the upward closure of the counting base under mereological sum.)

Incorporating these ingredients into Compositional DRT, we can distinguish between lexical entries for (object denoting) count nouns such as *kutsu*, ‘shoe(s)’ (14), and object denoting mass nouns such as *chōri-kigu*, ‘kitchenware’ (15). Both denote kinds, and both specify a counting base (and make available a discourse referent for the counting base,  $cbase_p$ ). However, the context of

utterance plays a role in determining the counting base of count kinds, but not mass kinds (since mass kinds are saturated with the null individuation schema).

$$(14) \quad \llbracket \text{kutsu} \rrbracket^i = \lambda w \begin{array}{|c|} \hline \text{cbase}_s \ k_s \\ \hline k_s = \cap (*\mathcal{S}_i(\mathcal{O})(\text{shoe}))(w) \\ \hline \text{cbase}_s = \lambda v' \boxed{* \mathcal{S}_i(\mathcal{O})(\text{shoe})(w)(v')} \\ \hline \end{array}$$

$\llbracket \text{chōri-kigu} \rrbracket^i$  has two key differences from  $\llbracket \text{kutsu} \rrbracket^i$ : (i) the counting base (cbase) for  $\llbracket \text{chōri-kigu} \rrbracket^i$  is saturated with the null individuation schema, and so (ii) unlike  $\llbracket \text{kutsu} \rrbracket^i$ , the counting base for  $\llbracket \text{chōri-kigu} \rrbracket^i$  does not specify a quantized set.

$$(15) \quad \llbracket \text{chōri-kigu} \rrbracket^i = \llbracket \text{chōri-kigu} \rrbracket = \lambda w \begin{array}{|c|} \hline \text{cbase}_k \ k_k \\ \hline k_k = \cap (*\mathcal{S}_0(\mathcal{O})(\text{kitchenware}))(w) \\ \hline \text{cbase}_k = \lambda v' \boxed{* \mathcal{S}_0(\mathcal{O})(\text{kitchenware})(w)(v')} \\ \hline \end{array}$$

However, we also want to allow for mass noun concepts to be shifted into countable ones (as part of the semantics of counting classifiers, for example). This can be done by applying a maximally quantizing individuation schema to a mass noun concept. We define this via the operation  $\mathbf{S}$  in (16), the output of which is a count concept, namely, when applied to  $\llbracket \text{chōri-kigu} \rrbracket^i$ , it returns a kind-denoting term for kitchenware that specifies a quantized set of items of kitchenware, relative to the context.<sup>3</sup>

$$(16) \quad \mathbf{S}(\llbracket \text{chōri-kigu} \rrbracket^i) = \lambda w \begin{array}{|c|} \hline \text{cbase}_k \ k_k \\ \hline k_k = \cap (*\mathcal{S}_i(\mathcal{O})(\text{kitchenware}))(w) \\ \hline \text{cbase}_k = \lambda v' \boxed{\mathcal{S}_i(\mathcal{O})(\text{kitchenware})(w)(v')} \\ \hline \end{array}$$

We can now define the ‘up’  $\cup$  operation as it applies to DRSs. Importantly, under our analysis, kinds have a standard extension, but *also* specify a counting base set. Hence  $\cup$  applied to a DRS for a kind ( $\cup(\mathbf{k})$ ) returns a property that denotes all entities and sums of entities in the counting base of the kind ( $\text{cbase}_k$ ).

$$(17) \quad \cup(\mathbf{k}) = \begin{cases} \lambda w. \lambda v. \begin{array}{|c|} \hline \text{cbase}_{k'} \\ \hline * \text{cbase}_k(w)(v) \\ \hline \text{cbase}_{k'} = \text{cbase}_k \\ \hline \end{array} & \text{if } k(w) \text{ is defined} \\ \emptyset, & \text{otherwise} \end{cases}$$

<sup>3</sup> We provide a simplified version of the operation here. Part of the operation, for example, would more fully be specified as  $\cap \mathcal{S}_i \cup \cap (*\mathcal{S}_0(\mathcal{O})(\text{kitchenware}))(w)$ , which reduces to the main condition in (16), since for all  $P$ ,  $\mathcal{S}_i(\mathcal{S}_0(P)) \leftrightarrow \mathcal{S}_i(P)$ .

For example, applied to  $\llbracket \text{kutsu} \rrbracket^i$ , we get the following, properties of shoes and sums thereof:

$$(18) \quad \cup \llbracket \text{kutsu} \rrbracket^i = \lambda w. \lambda v. \begin{array}{|c|} \hline \text{cbase}_s \\ \hline * \mathcal{S}_i(\emptyset)(\text{shoe})(w)(v) \\ \hline \text{cbase}_s = \lambda v' \left[ \mathcal{S}_i(\emptyset)(\text{shoe})(w)(v') \right] \\ \hline \end{array}$$

Following Krifka’s (1995) proposal for numerical expressions in Mandarin, we assume that numerical expressions in Japanese denote numerals of type  $n$ . Sortal classifiers in Japanese, we propose, encode the following three roles: (i) they are functions from numerals and shift numerals (of type  $n$ ) into numerical modifiers; (ii) they shift kind-denoting terms into predicates using the  $\cup$  operator (presupposing that the predicate is object denoting); (iii) they apply  $\mathcal{S}$  to the interpretation of the argument noun, thus shifting any object denoting mass predicate into a count predicate. These three things taken together allow for any object denoting noun in Japanese to be felicitously counted. Put simply, like in the account of Chierchia (2010), classifiers turn kinds into predicates (the right type of argument for numerical modifiers); however, like the analyses of Krifka (1995) and Bale and Coon (2014), sortal classifiers also shift numerals into numerical modifiers. Thirdly, unlike any other account, instead of merely shifting kinds into predicates, they shift object denoting count and mass kinds into object denoting count predicates. The derivation for *chōri-kigu itsu-tsu* (‘five pieces of kitchenware’) is given in (19)–(21).

$$(19) \quad \llbracket \text{itsu} \rrbracket = 5$$

$$(20) \quad \llbracket \text{tsu} \rrbracket^i = \lambda n. \lambda k. \lambda v. \begin{array}{|c|} \hline \mu_{\#}(v, \text{cbase}_k) = 5 \\ \hline \frac{u}{\text{cbase}_k(u)} \Rightarrow \text{inanimate}(u) \\ \hline \end{array} ; \cup \mathcal{S}(k)(w)(x)$$

$$(21) \quad \llbracket \text{chōri-kigu itsu-tsu} \rrbracket^i = \lambda w. \lambda v. \begin{array}{|c|} \hline \text{cbase}_k \\ \hline * \mathcal{S}_i(\emptyset)(\text{kitchenware})(w)(v) \\ \hline \text{cbase}_k = \lambda v' \left[ \mathcal{S}_i(\emptyset)(\text{kitchenware})(w)(v') \right] \\ \hline \mu_{\#}(v, \text{cbase}_k) = 5 \\ \hline \frac{u}{\text{cbase}_k(u)} \Rightarrow \text{inanimate}(u) \\ \hline \end{array}$$

If it is indeed the case that *nan-byaku to iu* (‘hundreds of’) selects for count kinds, then this can be modeled as a sensitivity to whether or not the counting



base for the relevant noun is quantized. On the assumption that *nan-byaku to iu* ('hundreds of') means *approximately some multiples of hundreds of* and where  $100n$  is a free variable that ranges over multiples of 100, then the semantics for *nan-byaku to iu* ('hundreds of') is that of an approximate number quantifier:

$$(22a) \quad \llbracket \text{nan-byaku-to-iu} \rrbracket^i = \lambda k. \lambda w. \lambda v. \left[ \frac{\mu_{\#}(v, \text{cbase}_k(w)) \approx 100n}{\text{QUA}(\text{cbase}_k(w))} \right]; \cup(k)$$

$$(22b) \quad \llbracket \text{nan-byaku-to-iu isu} \rrbracket^i = \lambda w. \lambda v. \left[ \frac{\text{cbase}_c}{\begin{array}{c} *S_i(\emptyset)(\text{chair})(w)(v) \\ \text{cbase}_c = \lambda v' \left[ \frac{S_i(\emptyset)(\text{chair})(w)(v')}{\mu_{\#}(v, \text{cbase}_c(w)) \approx 100n} \right] \\ \text{QUA}(\text{cbase}_c(w)) \end{array}} \right]$$

*Nan-byaku to iu isu* ('hundreds of chairs') denotes the set of sums of chairs that have a cardinality of around 100, 200, 300, etc. such that this cardinality is defined in terms of the counting base for individual chairs with the precondition that the counting base set is quantized. If nouns such as *chōri-kigu* ('kitchenware') denote mass kinds, then, since, by hypothesis,  $\llbracket \text{chōri-kigu} \rrbracket^i$  would specify a non-quantized counting base, it would be infelicitous to compose *chōri-kigu* ('kitchenware') with *nan-byaku to iu* ('hundreds of').

### 5. Conclusions

Our findings for Japanese raise the possibility that we may not be getting a complete picture from the standard view of classifier languages advocated by Chierchia (2010, 2015; this volume, Chapter 2) and Muromatsu (2003), among others, upon which the count–mass distinction in *all* classifier languages is solely reflected in the syntax and semantics of their classifier systems. We suggest that there is some evidence for the nascent idea that Japanese has a grammaticized lexical count–mass distinction, which is systematically reflected in the syntax and semantics of at least some Japanese nouns. This would mean that Japanese, and perhaps other classifier languages, might be typologically closer than has been previously assumed to number marking languages like English, which have a bona fide grammaticized lexical count–mass distinction. Such a conclusion, if right, would require some alterations to theories of classifier languages in which bare nouns refer to kinds, namely one which can distinguish between kinds that are mapped to count predicates and kinds which are mapped to mass predicates. We outlined what such an analysis might look like. In sum, while our empirical and theoretical results may not be

entirely uncontroversial, they at least raise important questions about the nominal systems in classifier languages. Furthermore, we hope to have paved the way for future studies to develop a battery of tests with a wide range of quantifiers to tap into the putative count–mass status of nouns in Japanese, and other classifier languages.