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Countability and measured parts in mixed drink nouns

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Liquids (e.g. *oil*, *wine*) are considered to be examples of canonical non-count nouns. Yet nouns referring to cocktails and coffee drinks (e.g. *margarita*, *cappuccino*) display strongly count behavior, which raises questions about the semantics of countability and the relationship between nouns and the things to which they refer. This paper investigates these mixed drink nouns and proposes the source of their countability lies in their possessing a MEASURED PART which provides a unit for individuation. This part, in connection with the ratio relationship between the drink's ingredient parts, is the source of countability for these nouns.

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1 Introduction

A central question in the literature on nominal countability is why some nouns combine directly with plural syntax while others do not. A speaker can make reference to one *dog* or multiple *dogs*, but not to one *rice* or multiple *rices* without strong contextual support. Traditionally, the literature on countability has focused on paradigmatic cases of individuals, like *dog* or *apple*, and substances, like *water* and *wine*, and, more recently, aggregates and granulars, like *furniture* or *rice*, which behave as non-count predicates despite existing as discrete objects in the physical world. This paper investigates another group of nouns—which, as of yet, the literature has not addressed—that make reference to substances, yet are count. These are mixed drink nouns, which denote cocktails, such as *martini* and *margarita*, along with coffee drink terms like *americano* or *cappuccino*. Unlike other nouns referring to liquids, these mixed drink nouns are, surprisingly, count. This is a puzzling group of nouns—a priori, there is no reason why a mixture of two or more liquids which are referred to with non-count nouns should result in something described by a count noun.

This paper investigates the grammatical behavior of mixed drink nouns, and provides the first semantic analysis of these nouns. Their behavior reveals a rich structure of ingredient parts, relationships between parts, and standardized measures. I will argue that the source of countability for cocktails and other mixed drink nouns is a combination of the unique ratio relationship between their parts and the existence of a MEASURED PART as a component of the ingredients of the drink which provides a unit for individuation. While this MEASURED PART—often referred to colloquially as a *shot* of liquor or espresso—is only one of the ingredients making up a mixed drink, it is central to the countability of the noun. Thus, countability of the noun is rooted in the noun’s parts and their structure. This paper also shows that this small group of nouns are a rich ground for further semantic investigation, especially in their unique behavior in quantity judgment tests and with quantifiers that target specific parts of a noun’s denotation.

Mixed drink nominals are of interest for two reasons. The first is that they provide a puzzle for formal semantic theories of countability. Count nouns are often defined as having denotations which are atomic—that is, lacking any proper parts. Mixed drink nouns are an exception to this rule and while they are a small exception, the way in which they do not conform to the usual formal structure warrants further exploration. I argue they provide evidence for a unique source of countability where one of the proper parts of the noun’s referent provides the unit for counting. In this sense, mixed drink nouns are a hitherto undiscussed example of subatomic quantification (Wągiel 2021) as their count status is due to the structure of their parts and with one of these, the MEASURED PART, impacting countability. In addition to being of interest for formal semantic theories of countability, mixed drink nouns also raise interesting questions about the relationship between the structure of language and the structure of the world more broadly. In general, in languages with a countability distinction like English, count nouns refer to discrete

objects or events, while non-count nouns refer to unindividuated substances, material, aggregates, properties, or abstract entities. Mixed drink nouns are count nouns, yet they refer to substances. In what ways might they differ from other drink nouns which are non-count nouns? How is their semantic behavior relative to countability influenced by the features of the drinks to which they refer and speakers' world knowledge about these features?

Section 2 provides an overview of nominal countability behavior, while Section 3 outlines the grammatical behavior of mixed drink nouns and gives examples of these nouns in a number of syntactic and semantic countability tests. In Section 4, I provide an analysis of the countability of these mixed drink nouns and introduce the concept of a MEASURED PART. Section 5 concludes.

2 Nominal countability in English

Two facets of countability have been identified in the literature—the syntactic and semantic (e.g. Gillon 2012; Deal 2017; Bale 2021). Separating the syntactic countability behavior of a noun from its semantic countability with distinct criteria and tests distinguishes different groups of nouns and, in many cases, helps clarify the source of countability. I will follow this approach, first examining the syntactic and morphological features of countability behavior before moving to the semantics.

2.1 Syntactic countability

The syntactic facet of countability regards whether nouns occur with plural marking¹ or combine directly with numerals and determiners, like *many*, in (1).

- (1) There are *six dogs* and *many cats* at the shelter.

Count nouns frequently occur in bare plural constructions, but do not occur in the bare singular except in non-standard or coerced interpretations. Non-count, or mass, nouns are frequently found in bare singular constructions and do not combine directly with numerals, but instead require a measure or container phrase to be grammatical, as in (2a). These nouns also occur with mass-specific determiners, like *much*, as in (2b).

- (2) a. I'll get *one gallon of milk* and *two bottles of wine* from the store.
b. There is *so much dirt* on the floor!

While non-count nouns do not combine directly with cardinal numbers in most cases, there is still some degree of flexibility provided by coercion phenomena. In these uses, non-count nouns can be counted when either a standard portion or distinction between multiple types is established in context. In the literature, these functions have often been referred to as the UNIVERSAL PACKAGER

¹ While plurality alone is standardly a diagnostic of count nouns, some have called the straightforwardness of this diagnostic into question, see Rothstein (2021) and Erbach & Schoenfeld (2022) for further discussion.

or UNIVERSAL SORTER (Bunt 1985). For example, a noun like *water* directly combining with numerals is normally ungrammatical but it can occur in a context such as ordering at a restaurant, as in (3a), where there's an established standard portion of *three glasses of water*. The inverse is true for count nouns in UNIVERSAL GRINDER (Pelletier 1975) constructions, like in (3b).

- (3) a. Can we get *three waters* for the table?
 b. There is *too much apple* in this salad.

This mass-to-count coercion behavior is restricted to contexts where a standard portion or unit for individuation has already been established (Rothstein 2010; Zamparelli 2020; Grimm et al. 2021) though frequent and familiar uses—such as a drink being portioned in a cup or other standard vessel—can be easily extended to novel coercion uses. In cases where a noun refers to a drinkable, liquid substance it can be felicitously used in a sentence like (3a). However, coerced readings account for only a small percentage of uses for a given noun, and thus most of the literature treats these uses as a unique sub-case of nominal countability; even though *water* can occur in a count reading as in (3a), this countability does not account for most uses of *water* and thus *water* is considered to be a non-count noun. I will return to the issue of nominal coercion, specifically portioning, for mixed drink nouns in Section 3.5.

2.2 Semantic countability

While syntactic aspects of countability focus on the distribution of nouns within certain morphosyntactic environments, examining the semantic element of countability often involves placing a noun into different acceptability judgment constructions or other experimental conditions. These often help tease apart the reference of a noun from other aspects, such as the portioning or grinding coercions seen above. The underlying question in many semantic tests is whether a noun refers to an individual or otherwise has some sort of accessible unit for counting. For example, acceptability with stubbornly distributive predicates like *large* or *big* is one test for accessibility of individuals (Schwarzschild 2011), as can be seen in the pairs in (4) and (5).

- (4) a. The *apple* is large.
 b. The *apples* are large.
 (5) a. ?The *milk* is large.
 b. ?The *milks* are large.

The predicate *large* distributes over the apples in (4b)—each apple is itself large, not the apples collectively—which is possible since count nouns like *apple* pick out individuals. Non-count nouns like *milk* have no clear individual for *large* to distribute over.²

² Setting aside cases of coercion where a container reading like *bottle of milk* would be understood.

In a similar vein, quantity judgments (Gathercole 1985; Barner & Snedeker 2005) are another way to determine if a noun references individuals. Quantity judgment tests accomplish this by creating contexts where two portions of some noun are compared, a participant is asked who has more, and the judgment given—either more in volume or more in number—reflects whether the participant is quantifying over individual entities or the total volume. Nouns which have no semantically accessible units for individuation are unable to be compared on the basis of number, but only on total volume. For example, in experiments by Barner & Snedeker (2005), participants were asked to judge who had more between two larger units or portions and six smaller units or portions. Count nouns like *shoes* are judged to be more on the basis of number while non-count nouns like *toothpaste* are judged to be more based on volume.

Looking at the behavior of English nouns relative to these aspects of countability, two main groups emerge: count nouns like *dog* or *book* and non-count nouns like *water* and *rice*.³ Given the diagnostics provided in this two-part summary of countability, one might expect mixed drink nouns like *martini* and *cappuccino* to behave similarly to other drink nouns, like *wine* or *coffee*. Mixed drink nouns refer to liquid substances, which appear to lack semantically accessible units for individuation. Mixed drinks are composed of other liquid substances, which themselves are referred to with non-count nouns, such as *tequila*, *whiskey*, or *simple syrup*. These mixed drink nouns should be expected to occur as count only when coerced into UNIVERSAL PACKAGER constructions—which would be unsurprising given that many of them have a standardized portion in restaurant contexts—while strongly count behavior would be unexpected. However, despite these predictions, mixed drink nouns behave like count nouns, as the next section will lay out.

3 Mixed drink nouns

First, which nouns qualify as mixed drink nouns? This paper will consider two main groups—nouns which refer to cocktails and nouns which refer to coffee drinks—though other nouns might also fall into this category. I will take cocktails to be the paradigmatic case. In its most common sense, *cocktail* refers to a drink made from some combination of liquors, liqueurs, juices, syrups, or other ingredients. While many combinations of these ingredients can be a cocktail, this paper will limit the set of cocktail nouns to the drinks recognized by the International Bartenders Association. A number of coffee drinks, such as *cappuccino*, *latte*, *americano* and *mocha*, will also be included. These are all drinks where the base component consists of a shot or shots of espresso, with additional ingredients like milk or flavorings. While there does not exist an industry-standard

³ However, note that not all nouns fit neatly into this binary. A third group, object-mass nouns like *furniture*, are syntactically non-count but make reference to individual objects. Other nouns like *stone* or *fence* seem to be flexible between countability classes. I will not talk about these nouns here, but see Allan (1980), Barner & Snedeker (2005), and Grimm & Wahlang (2021) for further discussion.

list of coffee drinks like for cocktails, the menus of major coffee shop chains provide a good reference for this group of nouns.

3.1 Mixed drinks and proper names

Before getting into the mixed drink noun data, I would like to briefly discuss the common noun status of mixed drink nouns. The terms used to refer to different mixed drinks, especially cocktails, come from a wide range of sources. Some cocktail nouns reference the base alcohol and method of preparation, such as *gin fizz* or *whiskey sour*, but most are either unique coinages using common nouns, like *old fashioned* or *tuxedo*, named after places or people, like *manhattan* or *mary pickford*, or some combination of the two, like with *cuba libre* or *hemingway special*. Most coffee drink nouns and many cocktail nouns are loanwords, such as Italian *cappuccino* or Cuban Spanish *mojito*. And in modern usage, there are semi-productive affixes like *-tini* for anything served in a martini glass or *-ccino* for any drink with espresso and milk. Etymology is not the focus of this paper, but the data raises some questions as to whether mixed drink nouns are proper names or common nouns.⁴ I take the view that despite the origins of some mixed drink terms, they are common nouns and not names.

Unlike familiar examples of proper names such as *France* or *Taylor Swift*, mixed drink nouns do not make unique reference to a single object or individual. Instead, mixed drink nouns have particular conditions under which some substance is or is not a particular drink. I can't mix whiskey and blackberry liqueur together, garnish it with an orange wedge, and call it a *margarita*. This points towards a common noun interpretation of mixed drink names, despite the fact that some originate from proper names. Thus, mixed drink terms like *macchiato* or *long island iced tea* should be treated like any other predicates which pick out certain portions of matter in the world falling under their extension.

3.2 A corpus of mixed drink nouns

If mixed drink nouns are common nouns, the next question is how they behave syntactically and semantically when it comes to countability—are they similar to or different from other common nouns for drinks like *water*, *beer*, or *lemonade*? To gather data relevant to these questions, I created a small corpus. I chose nouns for drinks which had the most well-known and distinctive names to avoid confusion with other word senses, for example excluding nouns like *cosmopolitan* or *aviation*. The corpus contained 10 cocktail nouns (*bellini*, *bloody mary*, *daiquiri*, *margarita*, *martini*, *mimosa*, *mojito*, *negrone*, *pina colada*, *whiskey sour*) and 8 coffee drink nouns (*americano*, *cappuccino*, *cortado*, *frappe*, *frappuccino*, *latte*, *macchiato*, *mocha*) along

⁴ This is also an issue for editors and style guides, who have to make the decision whether to capitalize all words within a mixed drink name, lowercase all, or capitalize only the proper nouns within the names (e.g. *Singapore sling* or *rum and Coke*). For consistency throughout this paper, I will write all in lowercase.

with 10 non-count drink nouns (*beer, cider, coffee, grog, juice, lemonade, milk, tea, water, wine*) and 10 non-drink count nouns (*basket, bead, bullet, contest, cookie, dream, follower, return, sum, weapon*).⁵

For each of these nouns, I used the Corpus of Contemporary American English (COCA; Davies 2008–) to examine what countability contexts they occur in. I searched COCA for each of the 38 nouns in the groups of cocktail, coffee drink, non-count drink, and core count nouns⁶ then sampled 100 instances of that noun, across all forms, using the sample feature within COCA.⁷ I excluded all cases where the noun was not the head (e.g. *margarita mix, coffee shop*) or was a different sense of the word (e.g. *think about using dark brown shades in mocha, cocoa and chocolate*). For each of the nouns I then counted the number of times it occurred in the bare singular, in the bare plural, with a unit modifier (*a/an, one* or other cardinal numbers), or in container or measure phrases (e.g. *bottles of, a quart of*).⁸ I also coded for several categories not explicitly relevant to countability, including occurrence with the definite article and with other modifiers (e.g. *no, any, some*) in both singular and plural. In addition, a number of occurrences were categorized as non-sentential, including uses of the nouns in titles, in quotes (e.g. *No, it's in the name, caramel macchiato*), and in ordering contexts (e.g. *Hey, what can I get for you? Um, Americano, thanks*) which occurred primarily in the spoken genre in COCA.

Figure 1 presents the average percentages of nouns in each group occurring in each countability context: bare singular, bare plural, unit or numeral, and container or measure phrase. Detailed percentages for all 38 nouns are in Appendix A.

The mixed drink nouns in both groups—cocktails and coffee drinks—display considerable count behavior, particularly in their high frequency in the bare plural form, use with unit modifiers, and infrequent use in container or measure constructions compared with the non-count drink nouns. However, the coffee drink nouns behave as slightly less count than the cocktail nouns, including less frequent uses in the bare plural and more instances of the bare singular. But, interestingly, the coffee drink nouns occur more frequently with a unit modifier than either the cocktail or core count nouns. Taking these distributional patterns together a clear difference can be seen between cocktail and coffee drink nouns on the one hand and non-count

⁵ These nouns are taken from the “core countable” group in Grimm & Wahlang (2021).

⁶ I formatted the search string in all caps, which returns all lemmatized forms, both singular and plural, of the noun. In cases where the search returned other lemmas, such as *milked* for *milk*, I used the noun tag *_n* to filter to just noun lemmas. For some low-frequency nouns, COCA treats the singular and plural lemmas as separate words; in these cases I manually searched for all forms with the search string *[n|N|ns|Ns]*.

⁷ For three nouns (*negroni, cortado, frappe*) there were less than 100 instances total in COCA, so I took all of them. For four other nouns I sampled more than 100 examples: the results for *americano* and *bellini* contained a large amount of noise from other senses, so I used all instances (454 and 307, respectively), while for *tea* and *mocha* I sampled 200 to compensate for the amount of noise.

⁸ For more on the contexts diagnostic of countability see Allan (1980) and Grimm & Wahlang (2021).

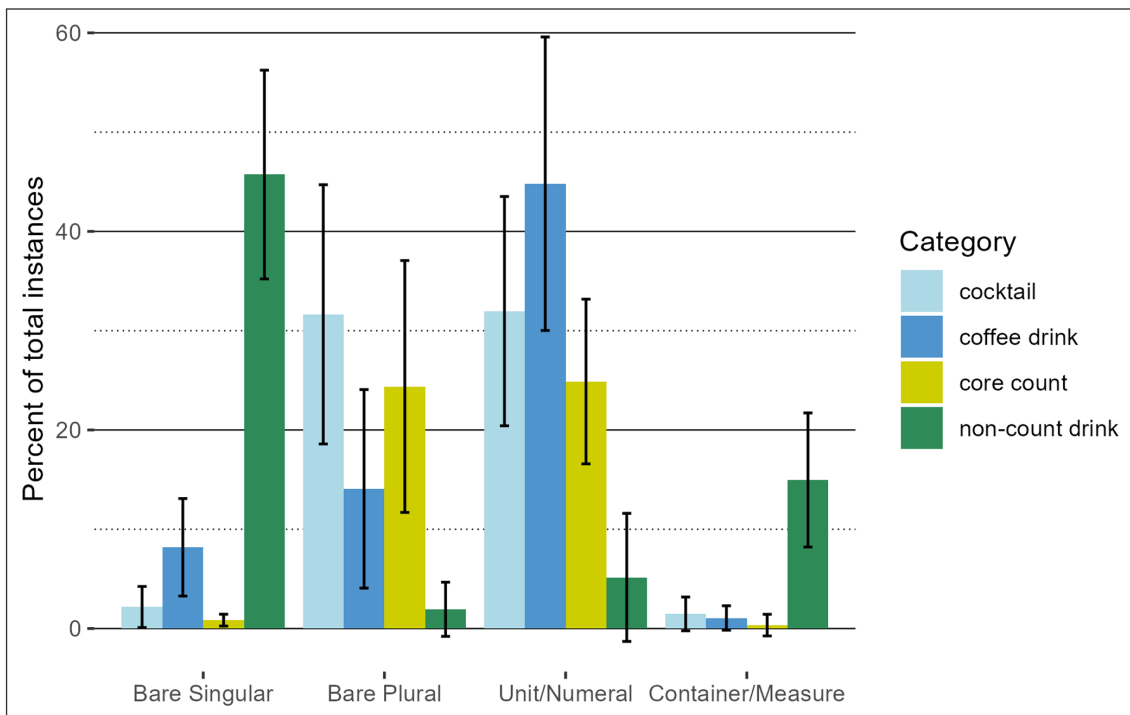


Figure 1: Distribution of countability contexts by noun group.

drink nouns on the other. A chi-squared test comparing the mixed drink nouns and the non-count drink nouns across the four relevant categories confirms these results as statistically significant, $\chi^2(3, N = 1361) = 858.29, p < .001, V = .79$.

3.3 Syntactic countability of mixed drinks

The data given above demonstrates that all of these nouns occur with count morphosyntax, including occurrence with count determiners and numerals. The examples in (6) provide a summary of these contexts.⁹

- (6)
- a. Or it could have been the result of *a few too many mojitos* during the after party.
 - b. They led us over to a sidewalk cafe, and we ordered *four macchiatos*.
 - c. He had drunk *a number of martinis*, preceded by champagne the night before.
 - d. He's standing in front of the espresso machine pulling shots for *two small Americanos* (one with two pumps of hazelnut and one of vanilla).

This syntactic countability of mixed drink nouns even appears for drinks that end in *y* like *bloody mary* in (7).

⁹ Unless otherwise noted, these and all following examples in Section 3 are taken from COCA.

- (7) a. I hear they have great *bloody marys* at the hotel next door.
 b. Have *two bloody marys* and something festive with an umbrella on it.

This syntactic behavior differs sharply from other drink terms like *beer* or *coffee*, which are paradigmatic cases of non-count nouns—only occurring in count noun constructions when coerced into portion or type readings. While both mixed drink and other non-count drink nouns occur in volume measure phrases, they do so in slightly different ways. Non-count nouns most frequently use measure pseudopartatives, where a measure noun like *ounces* combines with *of*, as in (8a). With mixed drink nouns, measure phrases more frequently use direct modification, as in (8b).

- (8) a. The best way to thwart the dreaded afternoon slump is to drink *two ounces of coffee* (about six to eight sips) every hour from mid-morning until early afternoon.
 b. The big draw here is *a 44-ounce \$24 margarita*.

In the cases where mixed drink nouns do occur in non-count uses, like with non-count determiners (*much*, *less*), the focus is often on the total volume consumed and subsequent impact of the alcohol or caffeine in the drink, such as in the examples in (9a, 9b),¹⁰ or the physical arrangement of the substance, as in (9c).

- (9) a. I feel hungover just thinking of having that *much negroni*.
 b. Drinking too *much latte* can cause the same side effects as drinking too much coffee, such as jitters, insomnia, and headaches.
 c. We know how *much margarita* was in the blender because the residue left a mark.

The other contexts where mixed drink nouns occur with non-count syntax—in this case, the lack of a determiner—include spilled readings (10a), which parallel other count nouns in UNIVERSAL GRINDER readings. Other bare singular uses (10b) read much more like generic or kind uses, and (10c) may be an example of what Rudolph & Kocurek (2024) call metalinguistic gradability.

- (10) a. Sam bursts through the doors. Suit stained, hair sticky with *frappuccino*.
 b. Her post-graduation plans include traveling the world and pursuing a career in journalism, *latte* (and pen) in hand.
 c. MORALES: Delicious. ROKER: That's really *frappe*. MORALES: Love it.

In summary, syntactically, mixed drink nouns behave more like count nouns than like non-count nouns. This distributional difference is odd unless mixed drink nouns are assumed to have an underlying unit for individuation, unlike non-count drink nouns.

¹⁰ These two examples come from web searches, as (9c) was the only instance of a mixed drink noun occurring with either *much* or *less* in COCA.

3.4 Semantic countability of mixed drinks

When it comes to semantic countability tests, mixed drinks, for the most part, behave like count nouns. First, mixed drink nouns are felicitous with stubbornly distributive predicates, unlike their non-count drink counterparts.¹¹

- (11) a. The *margaritas are large* and not watered down.
 b. Well, our *pineapple martini is big* and filling, we might as well call it soup!
 c. The *lattes are big*, beautiful and of course delicious.

The mixed drinks in (11) are perfectly acceptable with these distributive predicates—the drink behaves as an individual for the predicate to distribute over. However, the comparable constructions with non-count drinks in (12) sound odd, and the only interpretations possible have to do with portion size or a very esoteric comparison of types of a substance, such as a sense of *big* in (12c) as a descriptor of bold flavor. While it is possible for non-count drinks to occur with stubbornly distributive predicates, these occurrences are highly infrequent and are only possible in restricted contexts where relative portion sizes or type comparisons have been established via coercion to type readings or with the UNIVERSAL PACKAGER.

- (12) a. ?The *lemonades are large* and not watered down.
 b. ?Our *beer is big* and filling.
 c. ?The *wines are big*, beautiful and of course delicious.

In comparison with these non-count drink examples, the mixed drink nouns in (11) have a straightforward reading with distributive predicates just like count nouns do. And just like with the syntactic countability behavior discussed in the section above, this status is surprising.

The questions raised by the apparent count noun behavior of mixed drinks with the distributivity tests also carries over to other semantic countability tests like quantity judgment tests. Given the data so far, it might seem straightforward to assume that mixed drink nouns must be syntactically count and semantically make reference to individual units of some sort—that they behave as count nouns all the way through, with just the exception of UNIVERSAL GRINDER readings where the noun has a substance reading when spilled or scattered. The assumption with these tests is that for count nouns it is natural to compare on the basis of number, where the entire unit is quantified. Consider the following constructed examples:

- (13) a. Who has *more margaritas*?
 b. Who ordered *more margaritas*?
 c. Who drank *more margaritas*?

¹¹ These examples are from web searches, as these constructions are too infrequent to occur in COCA.

These examples are not as straightforward as might be expected. In (13a) a number reading (portions of margarita) and a volume reading (total amount of margarita) are both possible.¹² Consider a scenario where one person has three standard margaritas and the other has two jumbo margaritas. It is difficult to judge who has more.

Changing the verb in the comparative constructions has a major effect on the judgment as well. In contexts like (13b) it seems more intuitive to compare drinks by number—for example, judge three smaller margaritas to be more than two larger ones, even if the latter is more total volume of beverage—since the context of ordering individuates drink by drink. In a context like (13c), the number of glasses that the margaritas were drunk from seems less relevant, so the focus returns to the total volume of margaritas. Considering this wide range of possible responses, the quantity judgment test does not appear to be very definitive in the case of mixed drink nouns.

Complicating matters further, I would argue that another dimension of judgment exists for cocktail nouns specifically—the total volume of alcohol, not total volume of liquid, consumed. If one person is drinking big frozen margaritas that are watered down with ice and mixer while another person is drinking smaller margaritas on the rocks with a higher percentage of alcohol by volume, a reading is possible where the second person is drinking more in terms of alcohol, regardless of the total volume of liquid for each drinker. Should this dimension of quantity be considered quantity based on volume (total volume of alcohol, regardless of the amount of mixers), quantity based on number (total number of shots of alcohol, regardless of the number of drinks those shots were in), or something else entirely? In the case of mixed drink nouns, more than just straightforward volume and number are at play, and the results of quantity judgment tests are thus only helpful in that they raise questions about countability, portioning, and the role of the alcohol part for cocktail drinks. I will set aside the complicated results of the quantity judgment tests for now, but I will return to some of these questions in Section 4.3.2 below.

3.5 Standard portions and coercion

In the data presented so far, mixed drink nouns behave more like count nouns than non-count nouns despite referring to fluid substances. Given this, one might suggest that the ideal way to account for the behavior of these nouns is by treating them as non-count nouns which nearly always invoke the UNIVERSAL PACKAGER, arguing that in most all uses of these nouns a standard portion interpretation is applied, generating a count reading. This seems plausible at first glance. Mixed drinks are liquids, and made from liquids that are referenced by non-count terms but are so commonly ordered, mixed up, and served as individual, single-portion drinks that one could argue speakers only think of a portioned, and thus countable, version. However, this approach runs into a few difficulties.

¹² Additionally, a type reading is also possible, e.g. which restaurant or bar offers more types of margaritas.

First, given what is known about nominal coercion by portioning or type readings and the distributional behavior of nouns relative to it (Zamparelli 2020; Grimm et al. 2021), positing that the countability behavior of an entire group of nouns is the result of near-universal coercion is tenuous, as it would have to account for the vast majority of the uses of those nouns, given the data presented above. If the main reason for this approach is the physical fluidity of the objects the nouns refer to, rather than the grammatical behavior of those nouns, proposing that all mixed drink noun countability is the result of portioning interpretations lacks motivation. Examples of mixed drink nouns behaving in a clearly non-count way are incredibly few and far between, with many of these examples being cases of the UNIVERSAL GRINDER construction, as in (10a), which is a phenomena well-established in the literature to apply to count nouns.

Second, if mixed drink nouns are non-count but almost always occur in a coerced portioning reading, they should behave like other portioned non-count nouns do when placed into a different container than their standard serving glass. Instead, mixed drink nouns behave generally like count nouns when placed in a container larger than their standard serving glass. Recipes for pitchers of a drink, such as in (14a), occur with mixed drink nouns in count plural form,¹³ as do phrases like *bottomless* applied to cocktails in (14b) in contrast with *bottomless* applied to non-count drink terms like in (14c), where the noun does not take on count plural syntax. This difference in behavior can be seen especially clearly in (14d), where *margaritas* retains plurality even in the measure phrase, while *beer* does not.

- (14) a. Penny spied a *pitcher of martinis* and began to pour herself one.
 b. There are plenty of restaurants around Dallas that offer *bottomless mimosas* on the weekends.
 c. This place was a disaster, so much for *bottomless coffee and tea* when they never come by to refill.
 d. Fill it up with more than two liters of *margaritas* or *beer*.

The fact that mixed drink nouns retain their countability even when poured into pitchers, in measure constructions, or when they are in a *bottomless*, constantly-refilled context demonstrates that they are conceptualized and spoken about as whole entities, unlike non-count drink nouns such as *coffee* or *tea*. This is strong evidence against a UNIVERSAL PACKAGER coercion being the source of mixed drink countability. Instead, mixed drink nouns should be straightforwardly treated as count nouns.

¹³ There is a slight amount of flexibility here. While *pitcher of margarita* does not occur in COCA, it is attested through additional web searches (meanwhile *pitcher of margaritas* occurs 32 times in COCA). For non-count nouns referring to alcoholic beverages, like *beer*, the unit of a standard drink of alcohol permits very infrequent pluralization in pitcher-cases and similar sentences (e.g. *how many beers are in a keg?*) as pointed out by a reviewer. Though possible, these readings are rare—there is one instance of *pitcher of beers* in COCA compared with 76 instances of *pitcher of beer*.

4 Mixed drink countability: Parts, ratios, and connection

A satisfactory account of the mixed drink noun countability behavior needs to explain the source of mixed drink countability—and how this differs from other non-count drink nouns. Ideally, the puzzling behavior of mixed drink nouns in quantity judgment tests can also be accounted for. I will accomplish both of these by proposing that mixed drinks have a unique parthood structure, including a central MEASURED PART, in specific ratio relationships, which differs somewhat from previous theories of part-whole relationships in the semantics literature. Since Quine (1960), many approaches to the semantics of countability involve some notion of mereological structure, especially following the formal lattice-theoretic framework of Link (1983). The analysis presented in this section anchors mixed drink countability in the existence of a MEASURED PART, not at the level of the drink as a whole but at the level of the drink’s ingredient parts. This proposal relies on a structure of parts that is semantically accessible and relevant to quantification and the count-mass distinction. This is modeled using a mereotopological framework (Casati & Varzi 1999; Grimm 2012; Krifka 2021), which involves both parthood relationships and spatial configurations, such as overlap and connectedness.

Given that the ingredient parts making up a mixed drink both stand in a ratio relationship to one another and are strongly self-connected due to their physical arrangement—being shaken or stirred together—the accessibility of a unit for individuation at the part level provides a basis for the countability for the whole. The existence of a MEASURED PART, the ratio relationships holding between all parts, and the mereotopological maximal strong self-connection of the parts are the components that, together, provide a unit for individuation which is the source of mixed drink nouns’ countability. The existence of the MEASURED PART also explains their behavior with subatomic modifiers (Wągiel 2021) like *double*, which modify the part, rather than the whole. Since one of the elements making up a mixed drink can be individuated there is a criterion for counting the whole, whereas a standard treatment of them as non-count nouns modeled as semi-lattices with no bottom elements fails.

Section 4.1 introduces the part-whole structure of mixed drinks. Section 4.2 discusses how these parts connect, using a mereotopological approach. Section 4.3 gives a detailed overview of the MEASURED PART proposal, and the relationship between countable unit parts and the countability of the mixed drink noun as a whole. Sections 4.3.1 and 4.3.2 explore the implications of this proposal for subatomic modification and for comparative quantity judgments, respectively. Section 4.4 presents a summary of the final proposal.

4.1 Parts and ratios

What differences are there between mixed drinks and other drinks? Consider *wine* and *mimosa*. One is a non-count noun, one is a count noun. Both are found in similar contexts, spoken about in similar ways, and both are materially similar—they are alcoholic drinks composed of fruit

juices, some of which have been fermented. What difference is there between the two that would lead to a speaker talking about *wine* or *a glass of wine* on the one hand and *a mimosa* on the other? I believe this difference is due to a speaker's knowledge of the world and knowledge of the inherent structure in a mimosa which is lacking in wine. Wine, while made up of different ingredients, is bottled, uncorked, poured, and drank as a singular substance whereas a mimosa is a mixture of two things—sparkling wine and orange juice—in a particular ratio. Considering the entire class of mixed drinks it is apparent that they all share the feature of being some mixture of ingredient parts. What it means to be a margarita—the thing picked out by the noun *margarita*—is not so much to be some singular margarita-substance but instead to be a mixture of other substances—tequila, triple sec, and lime juice.

Since Quine (1960) and Link (1983), much of the discussion on the representation of count and non-count nouns has focused on atomicity, using mereological approaches to model semantics: count nouns are atomic, and have no proper parts, whereas non-count nouns are non-atomic. While this approach works well for many nouns, there are a number of cases it does not capture, including mixed drink nouns, which are count but seem to crucially involve semantically accessible parts. I will build my semantics for mixed drink nouns starting with the same basic mereological building blocks. Classical Extensional Mereology proposes a framework with a domain, U , the parthood relation, \subseteq , and the sum operator \oplus . I will follow the formal definitions given by Simons (1987), though my notation differs slightly (see also Casati & Varzi 1999).

For a mixed drink noun like *margarita*, the denotation should be the sum of the drink's ingredient parts, and should specify what those parts are, as in (15).

$$(15) \quad \llbracket \text{margarita} \rrbracket = \lambda x [x = y_0 \oplus y_1 \oplus y_2 \wedge \text{TEQUILA}(y_0) \wedge \text{TRIPLE SEC}(y_1) \wedge \text{LIME JUICE}(y_2)]$$

Per this formula, an entity is a *margarita* if it is composed of three parts—tequila, triple sec, and lime juice. But the existence of ingredient parts is not the only factor in play. Given the current proposal in (15), if a drink contains twenty milliliters of tequila, ten milliliters of triple sec, and one liter of lime juice, it satisfies the reference of *margarita*. But that would be a mildly alcoholic limeade, not a margarita. So the denotation needs to make reference to the amounts of each part, otherwise it will over-generate. The International Bartender's Association specifies that a margarita is 50 milliliters of tequila, 20 milliliters of triple sec, and 15 milliliters of lime juice, so this could be included in the formula in something along the lines of (16).

$$(16) \quad \llbracket \text{margarita} \rrbracket = \lambda x [x = y_0 \oplus y_1 \oplus y_2 \wedge \text{TEQUILA}(y_0) \wedge \text{TRIPLE SEC}(y_1) \wedge \text{LIME JUICE}(y_2) \\ \wedge \mu(y_0) = 50 \text{ milliliters} \wedge \mu(y_1) = 20 \text{ milliliters} \wedge \mu(y_2) = 15 \text{ milliliters}]$$

Now, formally, an entity is a *margarita* if it is composed of three parts—tequila, triple sec, and lime juice—and the measure of tequila is 50 milliliters, the measure of triple sec is 20 milliliters,

and the measure of lime juice is 15 milliliters. Note that nothing in my proposal hinges on the specifics of the measure function μ , though I treat it as an extensive function on an entity following Champollion (2017). Any measure semantics could work here, the main issue is that there is some specification of volume.

However, (16) isn't quite right. What matters for mixed drinks is not only the measurements of the parts, but the ratio between those measurements. Otherwise, only margaritas made with exact milliliter measurements would be described by this formula, so it now under-generates. The formula should account for jumbo margaritas, mini margaritas, and margaritas made with any system of volume measurement like ounces or teaspoons. What is needed is not a specific measurement but something that can fix the ratio relationship between the parts that make up the drink. This can be achieved by instead setting the measurements, divided by a ratio constant of sorts, equal to one another, as in (17).

$$(17) \quad \frac{\mu(y_0)}{5} = \frac{\mu(y_1)}{2} = \frac{\mu(y_2)}{1.5}$$

This captures the ratio relationship for a margarita as 5:2:1.5 without specifying any particular volume measurements; the measure of each part can be increased or decreased, but since it must stay in the same ratio relationship the measure of the other parts must increase or decrease accordingly, otherwise the mixture is no longer a margarita. Now the formula for the denotation of *margarita* can be modified to include this relationship between parts, rather than a specific measurement for each part.

$$(18) \quad \llbracket \text{margarita} \rrbracket = \lambda x [x = y_0 \oplus y_1 \oplus y_2 \wedge \text{TEQUILA}(y_0) \wedge \text{TRIPLE SEC}(y_1) \wedge \text{LIME JUICE}(y_2) \\ \wedge \frac{\mu(y_0)}{5} = \frac{\mu(y_1)}{2} = \frac{\mu(y_2)}{1.5}]$$

Now that this ratio structure for the parts has been worked out for *margarita*, it can also be generalized for the semantics of any mixed drink noun by giving a sequence of variables for the parts and the predicates. The parts of the drink can be represented as a series of indexed variables, \vec{y}_0^n , given that some mixed drinks only have two parts while others have three or more. For each part, y , there exists a corresponding ratio constant, r , and the parts are set in a ratio relationship with each other. The specifics of this depend on the particular drink, but the formula given in (19) allows for a flexible number of ingredients in any ratio relationship, which can account for everything from *americanos* to *zombies*.

$$(19) \quad \llbracket \text{mixed drink} \rrbracket = \lambda x \exists \vec{y}_0^n \exists \vec{P}_0^n [x = \oplus \vec{y} \wedge \forall y_i \forall P_i [P_i(y_i)] \wedge \exists \vec{r}_0^n \forall \vec{y}_0^n [\frac{\mu(y_i)}{r_i} = \frac{\mu(y_j)}{r_j}]]$$

Thus, an entity is a mixed drink if it is composed of two or more parts which are all an ingredient of the drink and where the measure of each part divided by its ratio value is equal to the measure of every other part divided by its ratio value.

However, (19) is incomplete in two aspects—it says nothing about the physical arrangement of the ingredient parts and it does not provide the source of countability for the noun. As it stands, (19) applies to cases where the parts have the proper ratio, regardless of their physical arrangement. And it holds for many non-count drinks with ingredient parts, such as *lemonade*. The following two sections will address both of these in turn, before Section 4.4 presents the final version of the formula.

4.2 Connecting the parts

The proposal so far has focused on the parts making up a mixed drink, and the relationships between those parts. But how do those parts form the relevant whole? The proposal above utilizes Classical Extensional Mereology, which is incredibly flexible in its definition of a M(ereological)-INDIVIDUAL—any group of objects can be an M-INDIVIDUAL, and sum formation is unrestricted. A semantics textbook on my shelf and a particular cluster of grapes growing in a French vineyard can compose a M-INDIVIDUAL, despite the distance between them. In the case of mixed drinks, consider a scenario where a person walks into a bar, orders two shots of tequila, a shot of triple sec, and a shot of lime juice, drinks each of them, and then says they enjoyed drinking *a margarita*. The correct ingredients in roughly the correct ratio were present, but calling those shots a *margarita* would be incorrect. The referents of mixed drink nouns consist of ingredient parts in ratios that also are mixed together in particular ways and the analysis should account for this.

This presents a problem formally, since the proposal needs a way to handle spatial arrangement as well as parthood to be able to rule out these separate-shots cases. While unrestricted sum formation allows mereology to model many types of part-whole relations, it has a downside. Classical Extensional Mereology without any further additions doesn't distinguish M-INDIVIDUALS that correspond to everyday intuitions and experiences—such as a delicious margarita in my hand—from M-INDIVIDUALS that do not—such as the scattered group of margarita ingredients behind the counter at a bar. A formal approach is needed that accounts not only for the parts of a drink but also their arrangement and the relationships that hold between them. Frameworks such as mereotopology (Casati & Varzi 1999) extend classical mereological frameworks with topological notions of spatial arrangement. The inclusion of topology has allowed for formal semantic proposals to model the different metaphysical and grammatical behavior of whole objects, granulars and aggregates, and non-count substances (e.g. Grimm 2012; Lima 2014; Scontras 2014; Krifka 2021; Wągiel 2021). Key topological axioms added to mereology include overlap, connectedness, and touch. From these, formal representations of entities as consisting of parts that are self-connected can be defined.

To do this, a few key mereotopological notions are needed. The following definitions are adapted from Casati & Varzi (1999) and Grimm (2012). The connection relation, *c*, is taken as primitive; this relation is both reflexive and symmetrical. Any two entities are connected if they

share a boundary, which includes cases where two things are only touching, such as the wine and the bottle it is in. Two things overlap (20a) if and only if they share a part. An entity is self-connected (20b) if and only if any two parts that form the whole of that entity overlap.

- (20) a. $O(x,y) := \exists z[z \subseteq x \wedge z \subseteq y]$
 b. $SC(x) := \forall y,z[\forall w (O(w,x) \leftrightarrow (O(w,y) \vee O(w,z))) \rightarrow C(y,z)]$

Krifka (2021) distinguishes solids, granulars, and liquids based on how they behave over time, building off a related notion of self-connectedness, which takes touch, ∞ , as primitive. The touch relation is symmetric, but not transitive or reflexive, as it is a type of external connectedness.

- (21) $x \infty y := \neg O(x,y) \wedge \exists z,z'[z \subseteq x \wedge z' \subseteq y \wedge \neg \exists z''[z < z'' < z']]$

On this definition, two non-overlapping entities x and y touch if and only if they contain parts z and z' such that no entity z'' fits in between those parts. Krifka uses this to define a slightly different version of self-connection that allows for parts to be connected by touch, without overlapping.

- (22) $SC(x) := \forall y,z[x = y \sqcup z \wedge \neg O(y,z) \rightarrow y \infty z]$

A self-connected entity is one where all parts that do not overlap touch each other. This distinction is important for the definition of a CONNECTED LIQUID. For liquids, their parts are in constant internal movement, yet they retain their self-connectedness—at any time, t , in a given interval, i , (23) holds.

- (23) $CONNECTED\ LIQUID(x) := \forall t \in i \forall x'[x' \subseteq x \rightarrow \neg[x' \text{ is solid at } t] \wedge \neg[x' \text{ is granular at } t] \wedge SC(x) \text{ at } t]$

For all times within an interval, for all parts of the liquid, those parts are not solid, they are not granular, and they are all self-connected at the given interval (see Krifka (2021) for the definitions of solid and granular, and further discussion of the temporal element). These mereotopological definitions distinguish arbitrary or unstructured mereological sums from entities which are physically self-connected.

4.3 The MEASURED PART

The formal parthood structure worked out above provides a framework to introduce the concept of a MEASURED PART. This, I argue, is the source of the countability of these mixed drink nouns, and what provides the distinction between these specific, count mixed drinks and other, non-count drinks, including ones that are made from ingredients in specific ratios. These include nouns referring to non-alcoholic drinks like *lemonade* as well as alcoholic, punch-format drinks like *sangria*, along with nouns referring to some non-drink substances, like chemical compounds

and alloys.¹⁴ If (19) was the only criteria for mixed drink countability, this would be a case of over-generation as it would predict, based on their structure as liquid substances composed of parts in ratios, that these would also be count nouns, but the data only shows count uses in UNIVERSAL PACKAGER contexts.

An initial response might be to return to the discussion of flexibility in the ratio relationship in (19). Cases such as *lemonade* might allow a much higher degree of flexibility of the ratio between parts than cocktails or count coffee drinks do. However, this would still include cases of chemical compounds, such as *citric acid*, and exclude some number of mixed drinks which allow for some variation of the ratio between a more standard base and the mixer part, like *americano* or *cuba libre*.

Additionally, some of the data presented in Section 3.5 shows that mixed drink nouns retain their countability even when the drink-stuff the noun refers to is mixed with multiple other individual drink-stuffs. In (14a) the referent of the noun phrase *pitcher of martinis* is one large vessel filled with un-individuated martini-liquid. I used these examples to argue that the countability behavior of mixed drink nouns is not simply a case of a standard portion coercion such as the UNIVERSAL PACKAGER. However, these examples also raise an interesting question—for a sentence like (14a) the formula in (19) is unable to account for the ‘units’ of martini that seem to be conceptually relevant for a count plural construction. The source of countability must lie somewhere else.

So what makes the referent of *a martini* a martini, regardless of its physical arrangement? If one consumes multiple portions of liquid from a *pitcher of martinis* over the course of an evening, how many martinis have been drunk? One could argue that the number of standard portions of martini-stuff is the number of martinis drunk. What about cases with highball or long drinks like *cuba libres*? It still seems like the number of drinks drunk corresponds to the number of standard portions even if the drink is not served, glass-at-a-time, corresponding to these portions. And the volume measurements differ from drink to drink—a standard portion of a dry martini following the IBA specifications, is about 84 milliliters after being stirred with ice, while a *cuba libre* would be around 198 milliliters after being built in the glass. But in both cases, there seems to be an established standard portion for the drink, independent of the total volume. This also seems to be reflected by cultural awareness regarding a ‘standard drink’ or ‘unit of alcohol’ where a 350 milliliter glass of beer and a 44 milliliter shot of whiskey both count as one drink. In the case of *martini* and *cuba libre*, both contain around 50 milliliters of hard liquor as the base spirit.

Without straying further into details about legislation surrounding alcohol, I argue that the notion of a ‘standard drink’ is very much intertwined with semantically relevant ideas of what counts as one. However, I don’t think the solution is as simple as equating the countability of

¹⁴ Thanks to Chris Kennedy for pointing out these cases.

mixed drinks to the concept of a standard drink of alcohol. First of all, that approach would incorrectly predict that nouns like *beer* and *wine*—which can also be individuated by number of standard drinks—would have the same countability behavior as nouns for cocktails, which is not what the data shows.¹⁵ Secondly, it would leave out the similar grammatical behavior of certain non-alcoholic coffee drink nouns, which also seem to have a type of standard unit based on the number of espresso shots in a drink. While many coffee drinks, such as an americano, are portioned by total volume, such as 12 or 16 ounces, when considering a case of comparison it seems odd to say that one person who drank two single-shot 16 ounce americanos drank *more americano* than the person who drank two quadruple-shot 12 ounce americanos. This highlights what’s really the unit for individuation in the case of both coffee drinks and cocktails—shots of liquor or espresso.

This is what I will call the *MEASURED PART* of the mixed drink: the ingredient part foundational to the identity of the drink. While the volume of the *MEASURED PART* is flexible, that volume measurement serves as the determining quantity for the rest of the drink’s components. Despite being a portion of liquid, it is conceptualized as and spoken about as a unit—a unique part that can be individuated. I argue that the *MEASURED PART* provides a mechanism for individuation at the level of parts. Since the ingredient parts of a mixed drink stand in a ratio relationship, the accessibility of this part for counting serves as the basis for the countability of the whole. And since one of the parts of the mixed drink is individuated in this way, cumulative and divisive reference fail to hold. Not only does this analysis explain the grammatical behavior of the mixed drink nouns, it corresponds to the ways in which their creation and consumption differs from other beverages.

4.3.1 Measured parts and multiplier modification

The *MEASURED PART* proposal shares some similarities with a proposal by Wągiel (2021) who shows that a certain class of multiplier phrases give insight into the semantic accessibility of parts of entities. Wągiel uses multiplier phrase data to argue for a semantics that moves beyond the idea of countability as corresponding to atomic units, and focuses his work on subatomic quantification. In these cases, multiplier phrases like *double* and *triple* do not count entities, but instead modify parts of entities, such as in (24), where *double* modifies the number of patties in the hamburger, not the overall quantity of hamburgers, which can be shown by the felicity with *two*.

(24) I accidentally purchased *two double hamburgers*.

¹⁵ This is not to say that having a ‘standard drink’ doesn’t produce some degree of countability in these cases, as discussed in Section 3.5. It certainly does for *beer*, *cider* and other alcoholic drinks, but nonetheless these nouns have very different, and much less frequently count, uses compared to cocktail nouns.

A central observation in Wągiel’s work is that multipliers like *double* are picking out what he calls the ESSENTIAL PART of an object, such as the patty in a hamburger. Formally, Wągiel introduces a measure function $\text{EP}(x)$ which counts the essential parts. His analysis shares some similarities with my proposal for the MEASURED PART in mixed drinks, though I believe the latter is restricted to certain types of liquid substance mixtures, while essential parthood is a more broad property.

Wągiel’s analysis of multiplier modification is also interesting in the case of mixed drinks. Consider the following examples with *double*.

- (25) a. I have *four double Americanos* a day during the week.
 b. We started with *three double mimosas* and a bellini.

It seems that in similar behavior to *double hamburger*, the multiplier in (25a) modifies the number of shots of espresso in the americano, not the total volume or number of americanos, while in (25b) it modifies the amount of champagne in the cocktail. Following Wągiel’s proposal, the espresso is the ESSENTIAL PART of the americano and the champagne is the ESSENTIAL PART of the mimosa, making them accessible for counting via the multiplier phrase; meanwhile the cardinal numerals *four* and *three* count the total number of double americanos or double mimosas.

Phrases like *double americano* in (25a) are possible because there is some ingredient part of *americano* accessible for modification—the MEASURED PART. Contrast this with the unacceptability of a phrase like *four double milks*. What is being doubled in this case? Milk has no semantically accessible subatomic parts that would provide a basis for a ‘double of some ingredient part’ reading.¹⁶ However, note that only some mixed drink nouns seem to freely combine with these multiplier phases—drinks where the MEASURED PART is a base shot and is combined with some flexible amount of a mixer like soda, juice, or water. In the case of *americano*, for example, the espresso is the semantically salient ESSENTIAL PART for doubling, and the mixer ingredient is the amount of hot water needed to bring the total volume to whatever has been specified. While the number of espresso shots can be modified by *double*, *triple*, and so forth, there does not seem to be a similar way to modify the mixer part of the drink. This makes sense, as only the MEASURED PART of a drink is countable.

For so-called ‘equal parts’ drinks like *negroni* or *last word* a more strongly fixed ratio relationship exists between the ingredient parts. Thus, multiplier modification is less explicitly available, since there is no way to modify the volume of one part without modifying it for all parts. For these equal parts cocktails, a modifier like *double* usually can only mean one thing—twice the total volume of drink. In web searches I conducted, phrases like *double negroni* only turned up on

¹⁶ A reviewer pointed out the use of multipliers like *double* or *triple* with certain types of beer. This usually refers to the doubling or tripling of the grain or hops used, which leads to a higher alcohol by volume and/or a stronger taste. While this shares some parallels to multiplier modification with mixed drinks, it is not quite the same, and is a use restricted to beer, not other non-count drink nouns.

cocktail forums as a tongue-in-cheek description of a negroni made to twice standard volume, or when discussing the fact that you can't actually order a double negroni, as in (26).

(26) Most bartenders will flat-out say no if you request a *double negroni*.

There is also a third group of mixed drinks that are not specifically equal parts but still maintain a somewhat standard balance between the volume of the MEASURED PART and other mixers. These drinks, such as *margarita* or *martini*, have rather infrequent uses of *double* modifiers. However, some other interesting and rather idiosyncratic modifiers, akin to multipliers like *double*, exist. Consider the following uses of *jumbo* and *dry*.

- (27) a. The *jumbo margarita* is so appropriately named and it's definitely what you're going to want to order.
 b. One of the most popular styles of this cocktail, however, is the *dry martini*.

In the mixed drinks in these examples, if any one measurement changes, either the measures of the other ingredients must be adjusted or the ratio is changed. In (27a), *jumbo* increases the volume of the MEASURED PART—the shots of tequila—but as this drink has a fixed ratio between the tequila, triple sec, and lime the volume of the other parts must correspondingly increase so that the relationship between parts remains the same. If this ratio is not maintained, the drink could be described as *watered-down* (compare with (11a) from the discussion of distributivity above). What *jumbo* does is clarify that the drink is larger than a standard portion with the assumption that the balance between ingredient parts is maintained.

However, a modifier like *dry* in (27b) refers to a change the ratio relationship between parts. A dry martini has less vermouth relative to the gin, so even if the total volume of the drink is the same as a standard martini, the different ratio relationship of the parts can be modeled. Interestingly, *dry* is a modifier seemingly restricted to martinis, though I was able to find occasional joking use of it with other two-part drinks like mimosas. These examples show just how fine-tuned the reference to the MEASURED PART—and, by extension, the other ingredient parts—of a mixed drink can be. Collecting other examples of idiosyncratic subatomic-sensitive modifiers like these is an avenue for further research.

4.3.2 Measured parts and quantity judgments

The MEASURED PART proposal also accounts for the complicated behavior of mixed drink nouns in quantity judgment tests, as discussed in Section 3.4. Traditional approaches to these tests assume only two dimensions for quantity comparison: more in terms of volume and more in terms of units or portions. The examples in (13), however, seemed less conclusive than the data in many established studies. Judgments can be given both in terms of total volume and for number of portions, usually glasses, of the drink, and in some cases additional judgments for cocktail nouns

seem to be informed by the total volume of alcohol or the number of standard drinks of alcohol consumed, regardless of volume or portioning.

I believe the MEASURED PART in mixed drink nouns is the source of this puzzling data. If mixed drinks have units accessible for counting at the subatomic level, not only can mixed drinks be measured by total volume and individuated standard portions, they can also be quantified by the MEASURED PART. This reading is possible for both mixed drinks with shots of alcohol as the MEASURED PART and for some coffee drinks as well. As discussed above, compare one person who drinks two single-shot 16 ounce americanos with one who drinks two quadruple-shot 12 ounce americanos. The number of portions is the same, two in both cases, while the total volume is greater for the first americano-drinker. But the total number of shots—measured parts of the drink—are greater for the second americano-drinker. Who drank more? The answer is less clear than with other paradigmatic count or non-count nouns. In these quantity judgment tests, ambiguity arises between ‘total volume of liquid’ and ‘number of measured parts’ readings in addition to ‘number of portions’ readings. Because of this ambiguity, quantity judgment tests—at least in their current format—are not very informative for mixed drink noun semantics.

4.4 Putting it all together

With these components of the proposal in place, the full picture of the source of countability for mixed drink nouns becomes clear. These nouns have a MEASURED PART, which is a unit for individuation that anchors the countability of the drink as a whole. The remaining parts are connected by the ratio relationships holding between them, and they are mereotopologically self-connected. The final version of the formula for mixed drink nouns is in (28).

$$(28) \quad \llbracket \text{mixed drink} \rrbracket = \lambda x \exists \vec{y}_0^n \exists \vec{P}_0^n [x = \oplus \vec{y} \wedge \forall y_i \forall P_i [P_i(y_i)] \wedge \exists \vec{r}_0^n \forall \vec{y}_0^n [\frac{\mu(y_i)}{r_i} = \frac{\mu(y_j)}{r_j}] \wedge \text{MEASURED PART}(y_0) \wedge \text{CONNECTED LIQUID}(x)]$$

An entity is a mixed drink if it is composed of two or more parts, which are all an ingredient of the drink, and where the measure of each part divided by its ratio value is equal to the measure of every other part divided by its ratio value, one of the parts is a MEASURED PART, and all the parts form a CONNECTED LIQUID.

5 Conclusion

This paper discussed the countability of a group of nouns which, despite referencing liquid substances, are count nouns. After providing a survey of the syntactic and semantic behavior of these mixed drink nouns, I proposed an analysis of the source of their countability as due to the presence of a MEASURED PART among the mixed drink’s ingredient components. This MEASURED PART—colloquially called a *shot* for both cocktails and coffee drinks—provides a unit for individuation for the mixed drink noun. The analysis presented here differs from one

where a standard portion reading provides the source of the countability via nominal coercion, such as with the UNIVERSAL PACKAGER, as this approach fails to account for countability being preserved in pitcher-of constructions like *pitcher of martinis*. This analysis also suggests that units for individuation for count nouns can occur as a special type of part at the subatomic level of the noun, which implies that countability cannot simply be reduced to atomicity or the lack thereof. This proposal thus expands on previous work on subatomic quantification, particularly work by Wągiel (2021) on modifiers like *double*. Additionally, the proposed analysis raises questions as to the reliability of some semantic tests for countability, such as quantity judgment tests, when these tests only compare quantity by number versus total volume. In summary, mixed drink nouns demonstrate unique countability behavior that suggests a more nuanced and complex picture for the role of parts in nominal countability.

Appendix A

Table 1 displays the percentage of times a noun occurred in a given countability context for all 38 nouns in the corpus study, along with the averages and the standard deviation for each group.

	bare sg	bare pl	unit	contr/ mea sg	contr/ mea pl	other sg	other pl	non- sent
<i>bellini</i>	4.55	50	16.67	0	1.52	9.09	7.58	10.61
<i>bloody mary</i>	4.05	29.73	43.24	0	0	12.16	5.41	5.41
<i>daiquiri</i>	3.45	27.59	28.74	0	0	19.54	8.05	12.64
<i>margarita</i>	1.67	50	26.67	0	5	6.67	8.33	1.67
<i>martini</i>	1.35	21.62	37.84	0	1.35	18.92	10.81	8.11
<i>mimosa</i>	0	35.09	24.56	0	3.51	15.79	10.53	10.53
<i>mojito</i>	0	36.36	23.86	1.14	1.14	12.5	19.32	5.68
<i>negroni</i>	0	14.29	33.33	0	0	42.86	4.76	4.76
<i>pina colada</i>	5.56	38.89	27.78	0	0	11.11	10	6.67
<i>whiskey sour</i>	1.08	12.9	56.99	1.08	0	15.05	5.38	7.53
average	2.17	31.65	31.97	0.22	1.25	16.37	9.02	7.36
st. dev.	2.07	13.05	11.55	0.47	1.73	10.15	4.22	3.25
<i>americano</i>	2.82	7.04	53.52	2.82	0	9.86	2.82	21.13
<i>cappuccino</i>	14.94	8.05	45.98	2.3	0	18.39	2.3	8.05
<i>cortado</i>	7.69	0	76.92	0	0	15.38	0	0
<i>frappe</i>	13.64	25	31.82	2.27	0	11.36	9.09	6.82
<i>frappuccino</i>	2.22	22.22	32.22	1.11	0	27.78	6.67	7.78
<i>latte</i>	4.88	28.05	37.8	0	0	18.29	8.54	2.44
<i>macchiato</i>	12.24	8.16	39.8	0	0	19.39	4.08	16.33
<i>mocha</i>	7.02	14.04	40.35	0	0	14.04	7.02	17.54
average	8.18	14.07	44.8	1.06	0	16.81	5.06	10.01
st. dev.	4.91	10	14.78	1.23	0	5.6	3.25	7.53
<i>beer</i>	38.36	8.22	20.55	10.96	0	16.44	2.74	2.74
<i>cider</i>	57.63	1.69	5.08	20.34	0	13.56	0	1.69
<i>coffee</i>	40.28	0	6.94	15.28	0	31.94	1.39	4.17
<i>grog</i>	31.75	0	0	3.17	0	39.68	1.59	23.81
<i>juice</i>	59.09	1.52	0	25.76	0	13.64	0	0

(Contd.)

	bare sg	bare pl	unit	contr/ mea sg	contr/ mea pl	other sg	other pl	non- sent
<i>lemonade</i>	50	0	3.57	11.9	0	22.62	2.38	9.52
<i>milk</i>	54.67	0	0	18.67	0	24	0	2.67
<i>tea</i>	40.82	4.08	10.2	10.2	0	27.55	0	7.14
<i>water</i>	53.52	0	0	11.27	0	33.8	0	1.41
<i>wine</i>	31.17	3.9	5.19	22.08	0	25.97	9.09	2.6
average	45.73	1.94	5.15	14.96	0	24.92	1.72	5.58
st. dev.	10.51	2.73	6.45	6.75	0	8.75	2.8	7
<i>basket</i>	1.14	17.05	31.82	0	0	45.45	1.14	3.41
<i>bead</i>	1.09	46.74	13.04	0	0	5.43	33.7	1.09
<i>bullet</i>	1.15	24.14	34.48	0	0	29.89	10.34	0
<i>contest</i>	1.05	9.47	34.74	0	0	50.53	3.16	1.05
<i>cookie</i>	0	34.48	17.24	0	3.45	15.52	24.14	5.17
<i>dream</i>	0	10.26	26.92	0	0	34.62	28.21	7.69
<i>follower</i>	0	21.51	24.73	0	0	1.08	52.69	6.45
<i>return</i>	1.45	15.94	23.19	0	0	46.38	13.04	1.45
<i>sum</i>	1.43	22.86	30	0	0	40	5.71	0
<i>weapon</i>	1.15	41.38	12.64	0	0	20.69	24.14	0
average	0.85	24.38	24.88	0	0.34	28.96	19.63	2.63
st. dev.	0.6	12.69	8.29	0	1.09	17.56	16.13	2.87

Table 1: Percentages of distribution of countability contexts across all nouns.

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Competing interests

The author has no competing interests to declare.

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