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Countability Distinctions and Semantic Variation

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Abstract To what extent are countability distinctions subject to systematic semantic variation? Could there be a language with no countability distinctions—in particular, one where all nouns are count? I argue that the answer is no: even in a language where all NPs have the core morphosyntactic properties of English count NPs, such as combining with numerals directly and showing singular/plural contrasts, countability distinctions still emerge on close inspection. I divide these distinctions into those related to sums (cumulativity) and those related to parts (divisiveness, atomicity and related notions). In the Sahaptian language Nez Perce, evidence can be found for both types of distinction, in spite of the absence of anything like a traditional mass-count division in noun morphosyntax. I propose an extension of the Nez Perce analysis to Yudja (Tupí), analyzed by Lima (2014) as lacking any countability distinctions. More generally, I suggest that at least one countability distinction may be universal and that languages without any countability distinctions may be unlearnable.

Keywords: mass-count distinction, crosslinguistic variation, Nez Perce

1 Introduction

Cat is a count noun; *blood* is not. What is this difference? Much recent work has argued that nouns like these are actually different along two dimensions related to countability, not just one. The central argument comes from the behavior of nouns like *footwear* and *jewelry*, which behave like *cat* in certain respects and like *blood* in others. In terms of pluralization, for instance, *footwear* behaves like *blood*, as seen in (1); in terms of combination with what Quine (1960) called 'count adjectives', it behaves like *cat*, as seen in (2).

(1) a. cats
b. *footwears / *bloods

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(2) a. small cats / small footwear
b. *small blood

Semanticists have arrived at a range of different conclusions concerning the semantics and syntax behind this distribution.[1] One persistent consequence concerns the basic way the field of inquiry is described. If we have three classes of nouns to distinguish, rather than simply two, then it becomes potentially dangerous to speak of *the* mass-count distinction, using the singular definite. There are two distinctions which must be kept apart – one that groups *cat* and *footwear* together, and one that groups *footwear* and *blood* together. If we want to understand the crosslinguistic picture related to countability, we will need to assess the two distinctions separately. In principle, either one (or both) could be a locus of variation.

In this paper I investigate countability distinctions in Nez Perce, a language that lacks both a distributional contrast like (1) and a distributional contrast like (2). The singular/plural distinction applies to all NPs in this language, and all nouns may combine with all adjectives. Furthermore, all nouns seem to combine with numerals in the same way; Nez Perce also lacks a pattern like English (3).

(3) a. one cat
b. one *(liter/unit/bottle/type of) blood
c. one *(piece/type of) footwear

The absence of any obvious countability distinction in the domains of numerals and number marking makes this language quite similar to Yudja, a Tupí language whose countability system has recently been analyzed by Lima (2014). Lima proposes that Yudja encodes no countability distinctions whatsoever. On this basis, she calls for a broadening of the crosslinguistic typology of countability.

The Nez Perce facts, on close examination, suggest a rather different conclusion. I argue that Nez Perce actually semantically distinguishes nouns like *picpic* 'cat' from nouns like *kike't* 'blood' in two ways, just as has been argued for English. What is needed is an explanation for why these distinctions do not have a visible effect in the obvious places. That is, if Nez Perce and English make the same semantic countability distinctions, why are there such differences in their numeral constructions and number marking? Why does Nez Perce not show distributional patterns like (1)–(3)? I propose a solution that may be applied not just to Nez Perce but also to Yudja, making it possible to maintain that all languages have at least one type of semantic countability distinction. In addition to its empirical advantages for Nez Perce, my proposal opens the door for the adoption of a general version of Soja, Carey, and Spelke's (1991) proposal about the early acquisition of countability distinctions. In particular, it may be that at least one of the countability distinctions is a language universal grounded in the way that word meanings are acquired.

While there is some agreement among semanticists that countability distinctions come in more than one variety, there is less agreement about what the two varieties actually are. I begin in the next section by adopting a rather traditional proposal, according to which two purely semantic distinctions are involved in countability. One type

[1] For a sample of proposed solutions, see Doetjes (1997), Bale and Barner (2009), Chierchia (2010), Rothstein (2010), Landman (2011), Schwarzschild (2011), Grimm (2012).

of distinction relates to sums, as emphasized by Quine (1960), whereas the other relates to parts, as emphasized by Cheng (1973). Then, in Sect. 3, I present the data that initially suggests that Nez Perce lacks both distinctions. There is no difference like (3) in how nouns combine with numerals, for instance, and this fact cannot merely be taken to reflect standard 'packaging' or 'sorting' coercions. The same goes regarding the absence of a difference like (1) or (2).

In Sect. 4, I introduce an alternative interpretation of the initial data, according to which Nez Perce has both countability distinctions after all. I then present the crucial data in support of this view. To show that Nez Perce makes a distinction related to sums, I investigate NP complements to quantifiers. Quantifier complements in Nez Perce must be cumulative. An NP like *kike't* 'blood' is inherently cumulative; an NP like *picpic* 'cat' is only cumulative when semantically pluralized. The Nez Perce pattern is essentially a generalized version of the countability distinction that emerges in English with quantifiers like *most* or *all*:

(4) a. all cat*(s)
b. all blood / footwear

To show that Nez Perce makes a distinction related to parts, I investigate the interpretation of quantity comparatives. Barner and Snedeker (2005) and Bale and Barner (2009) have observed that comparatives like those in (5) are assessed in different ways depending on whether they feature a noun with clear minimal parts, like *cat* or *footwear*, or a noun without clear minimal parts, like *water* (or *blood*). (5a) is assessed on numerosity: A must have a greater number of cats, or greater number of pieces of footwear, than B does, regardless of the volume of the cats or footwear involved. (5b) is assessed on volume: A must have a greater overall volume of water than B does, regardless of the number of portions of water.

(5) a. A has more cats / footwear than B. [assessed on numerosity]
b. A has more water than B. [assessed on volume]

In addition to the quantifier distinction, I will show that the quantity comparative distinction can also be reproduced in Nez Perce, once appropriate morphosyntactic controls are put in place.

Having demonstrated two types of countability distinctions in a language that initially presents as lacking any distinction at all, I conclude with two extensions of the Nez Perce analysis. First, in Sect. 5, I suggest an extension to Yudja, and note at least one possible empirical advantage over the proposal from Lima (2014). Second, in Sect. 6, I address the typological consequences and the ramifications for semantic variation. If no language completely lacks countability distinctions, why should this be? The answer may lie in the particular path that child learners follow in acquiring noun meanings, an early stage of which ignores language-particular evidence about countability in favor of conceptual distinctions between objects and substances (Soja et al. 1991).

2 Two countability distinctions

Before we ask how the two countability distinctions are manifested crosslinguistically, we must settle on a reasonably explicit picture of what the two distinctions are. The literature at this point contains a range of options, varying in what work they assign to syntactic and semantic components of grammar and in how they view the basic semantics of a noun. Lacking the space to do justice to the many issues involved, I do not review this literature here; some discussion and comparison of various possibilities can be found in Landman (2011) and Grimm (2012). Rather, in this section, I simply present an approach to the two distinctions that strikes me as having two advantages. First, it regulates noun distribution based purely on noun meaning, obviating any need for purely formal syntactic features [+/-COUNT]. Second, it is relatively simple in conception and traditional in execution, involving two of the oldest ways of formally characterizing countability in semantic terms. One of these ways involves sums, drawing on work by Quine; the other involves parts, drawing on work by Cheng. As far as parts are concerned, my proposal is somewhat flexible, in that it makes room for various precise responses to the so-called 'minimal parts problem' for nouns like *water*. In addition to allowing for this flexibility, I depart from traditional work (e.g. ter Meulen 1981, Link 1983, Bunt 1985, Pelletier and Schubert 1989/2003) in recognizing three basic varieties of noun denotations, rather than just two. The three varieties are differentiated by the overlapping sums-based and parts-based distinctions.

2.1 Sums and parts

Early work on the semantic basis of the mass-count distinction emphasized two distinctive properties of mass nouns, one concerned with sums and one concerned with parts. The property concerned with sums is introduced by Quine (1960, p. 91) as *cumulativity*, using the example of *water*: any sum of parts which are water is also water.[2] More generally:

(6) A noun is cumulative iff it denotes a cumulative predicate.
A predicate p is cumulative iff any sum of parts that are p is also p.

We can verify that the cumulativity of *water* contrasts with the non-cumulativity of *cat*, a prototypical count predicate. On standard assumptions, $[\![cat]\!]$ is a predicate holding only of individual cats, but not groups or pluralities thereof. No sum of elements with this property itself has this property. Therefore, *cat* is not cumulative.[3]

[2] Earlier work had described this property, but had evidently not used it to characterize mass nouns; e.g. Quine refers to Goodman's (1951, p. 39) discussion of what Goodman calls *collectiveness*.

[3] Matters are different, of course, for the plural predicate $[\![cats]\!]$, as Link (1983) observed. Work characterizing countability distinctions in terms of cumulativity therefore contrasts only the bare forms of nouns (*cat* and *water*, but not *cats*); see e.g. Krifka (1989), Chierchia (1998a). I return to this point below.

The property concerned with parts, as introduced by Cheng (1973), is dubbed *divisiveness* by Krifka (1989).[4] In general terms:

(7) A noun is divisive iff it denotes a divisive predicate.
A predicate *p* is divisive iff any part of something that is *p* is also *p*.

We can verify that *cat* is certainly not divisive. It has been a much more controversial question whether *water* is any different. Aristotle, who can be forgiven for ignorance of atomic theory, thought that it was (*Metaphysics* 5.1014a). In the modern literature, Bunt (1985) has been a prominent voice in arguing to this same end, and correspondingly for a sharp distinction between properties of physical objects and linguistic properties of noun usage: "mass nouns provide a way of speaking about things *as if they do not consist of discrete parts*" (1985, p. 45, emphasis original). This type of view holds in essence that ⟦*water*⟧ has no minimal parts.

This conclusion has long engendered discomfort because, as Pelletier puts it, "if *water* is divisive but water isn't, then water can't be the semantic value of *water*" (2012, p. 16). Accordingly, in the more recent literature, there are several proposed alternatives to the divisiveness criterion which avoid this particular consequence but nevertheless preserve the idea that there is something special about the parts of mass noun denotations. For instance, working in a theory of vague predicate denotations, Chierchia (2010) proposes that ⟦*water*⟧ has no *stable* minimal parts, i.e. elements that remain atomic across contexts. Alternatively, working in a theory where noun denotations are pairs of a basic set and a set of generators, Landman (2011) argues that ⟦*water*⟧ has only overlapping minimal parts (and only overlapping generators). Finally, working in a mereotopological theory, Grimm (2012) argues that ⟦*water*⟧ has only strongly connected parts, i.e. parts that are internally connected to at least one other element in ⟦*water*⟧. My interest here is not in comparing these theories, but rather in pointing out that each shares with earlier divisiveness theories a distinctive concern for the nature of the parts of mass noun denotations. This concern is distinct in principle from a concern for sums.

Much work on countability recognizes some mix of properties concerning sums and parts, and some terminology is useful to describe this. A noun or predicate is *quantized* iff it is anti-divisive (Krifka 1989), which entails that it is not cumulative:

(8) A noun is quantized iff it denotes a quantized predicate.
A predicate *p* is quantized iff no proper part of something that is *p* is also *p*.

Conversely, a noun or predicate is *homogeneous* iff it is both cumulative and divisive (Bunt 1985, p. 203). If we wanted to replace divisiveness with Chierchia's (2010) notion of unstable atomicity, Landman's (2011) notion of overlap, or Grimm's (2012) notion of strong connectedness, we could recognize analogous replacement notions, pairing cumulativity with whatever thesis we wished to adopt concerning parts. Henceforth, I will whenever possible use the term *homogeneous* in a general way, intended to allow alternative possible theses about parts to be used in place of

[4] Cheng himself refers to divisiveness as 'Cheng's condition'; Bunt (1985) refers to it as 'distributed reference'. Once again, in naming the property if not in applying it to natural language, Goodman seems to have been first; he uses the term 'dissective' (1951, p. 38).

the traditional divisiveness. That is to say, whenever possible, I will use *homogeneous* to mean *g-homogeneous* in the following sense:

(9) *Generalized homogeneity (g-homogeneity)*
A noun is g-homogeneous iff it denotes a g-homogeneous predicate.
A predicate is g-homogeneous iff it is both cumulative and one or more of the following:
   a. lacking in minimal parts (divisive)
   b. lacking in stable minimal parts
   c. lacking in non-overlapping minimal parts
   d. lacking in non-strongly-connected minimal parts

2.2 Toward semantic explanations

Semantic properties of denotations like ⟦*cat*⟧ and ⟦*water*⟧ take on a special interest for linguistic analysis to the extent that they can be connected to the morphosyntactic differences between the corresponding nouns. Such differences include, to mention the most famous contenders, susceptibility to pluralization (compare (1)); ability to combine with numerals directly (compare (3)); choice of quantifiers (e.g. *many, fewer* vs. *much, less*); and combination with so-called 'count adjectives' such as *small* (compare (2)).[5] [6] For semantic theories of countability, the general goal is to explain these distributional facts in terms of what nouns mean. But which semantic facts explain which distributional facts? In principle, a given morphosyntactic difference could be explained by a semantic difference related to sums (such as cumulativity), one related to parts (such as divisiveness, overlap, or stable atomicity), or both.[7]

Consider, for instance, what is perhaps the core distributional fact of the traditional mass-count distinction: nouns like *cat* combine with numerals, whereas nouns like *blood* or *water* do not. As it happens, both Chierchia and Landman have explored both sums-based and parts-based explanations for this difference, with Chierchia starting with sums (1998b) and moving to parts (2010) and Landman moving in the opposite direction (1991, 2011). For Chierchia (1998b) and Landman (2011), the core intuition is that counting is not possible in a set whose members overlap: in a set consisting of A, B, and the sum of A and B, there is no clear answer to the question of how many.[8] With *cat*, counting is successful because we may count in a set that has no overlapping members. With *water*, counting fails because the only thing available is a set with overlapping members. This proposal can be contrasted with a view based on divisiveness, as in Landman's less recent proposal (1991), or stable atomicity, as in Chierchia's more recent proposal (2010). For less recent Landman, counting

[5] These standard claims hold modulo 'coercions'; see the extensive discussion in Pelletier and Schubert 1989/2003 and other works cited in footnote 17.

[6] The term 'count adjective' comes from Quine (1960). In contemporary work, these adjectives are core exemplars of Schwarzschild's (2011) 'stubbornly distributive predicates' or 'stubs'.

[7] Alternatively, different semantic distinctions could be invoked: Krifka (1989) and Rothstein (2010), for instance, posit a type distinction between mass and count denotations.

[8] This point is clearly illustrated in Kratzer (1989).

is counting of atoms, but mass denotations are divisive rather than atomic. For more recent Chierchia, counting is counting of stable atoms, but mass denotations are not stably atomic. On both of these latter views, an NP denotation that contains sums is expected to be countable so long as it also contains (stable) atoms.

The choice between these two styles of explanation becomes an empirical question if we can identify nouns which share the sums-based property of ⟦*water*⟧ but not the parts-based property (or, in principle, vice versa). Over the past ten years, a body of research has converged on the conclusion that such nouns do indeed exist, with examples including *furniture, jewelry, mail,* and *footwear*. These are the nouns that Huddleston and Pullum (2002) call 'aggregate'.[9] Take the example of *footwear*. This noun is cumulative: a sum of parts that are each footwear is itself footwear. At the same time, intuitively, it does not behave like a mass noun on any of the theses we have considered about parts. It is *not* divisive (since half of a shoe is not footwear); it *is* stably atomic (since *shoe* is stably atomic, and *footwear* and *shoe* have the same minimal parts); its minimal parts do *not* overlap and are *not* necessarily connected (the minimal parts of ⟦*footwear*⟧ are individual, unconnected, non-overlapping shoes). So, *footwear* furnishes an opportunity to compare theories that attribute the special distributional properties of *cat* and *water* alternatively to a property about sums or to a property about parts.

The overall finding is that *both* types of countability distinctions turn out to be necessary, for different distributional tests. For combination with numerals, pluralization, and choice of quantifiers, aggregate nouns behave like *water* and unlike *cat*:

(10) a. one cat
b. *one footwear / *one water (modulo coercion)

(11) a. cats
b. *footwears / *waters (modulo coercion)

(12) a. how many cats
b. how much footwear / how much water

In terms of combinations with adjectives, on the other hand, aggregate nouns behave unlike *water* but like *cat* (McCawley 1975, Rothstein 2010, Schwarzschild 2011):

(13) a. small cats / small footwear
b. *small water

Doetjes (1997) and Landman (2011) discuss an additional distributional test of this type in Dutch, relating to the noun *stuks* 'piece'. Here, too, aggregate nouns behave like core count nouns; the split behavior of aggregate nouns cannot merely be a quirk of English. Nor is the distinction between aggregate nouns and nouns like *water* merely morphosyntactic, as Barner and Snedeker (2005) and Bale and Barner (2009) show. A semantic distinction between these classes becomes clear in the interpretation of comparative constructions like those in (14), discussed above in (5).

[9] Terminology abounds: Doetjes (1997) calls these nouns 'count mass' or 'collective'; Chierchia (1998b, 2010) calls them 'fake mass'; Barner and Snedeker (2005) call them 'object-mass'; Rothstein (2010) calls them 'superordinate mass'; Landman (2011) calls them 'neat mass'; Grimm (2012) calls them 'functional aggregates' or 'artifactual aggregates'.

(14) a. A has more cats / footwear than B.
b. Mary has more water than Sue.

The most natural interpretation of (14a) is that A has a greater number of cats, or greater number of pieces of footwear, than B does.[10] By contrast, the only available interpretation of (14b) is that A has a greater mass or volume of water than B does; it does not matter how many portions the water is stored in.

2.3 Toward crosslinguistic inquiry

The intermediate status of aggregate nouns points directly to a picture where countability distinctions come in two varieties, rather than just one. I have suggested, following many antecedents, that we think of the two varieties as relating to sums and relating to parts. Tabulating the various distributional distinctions along with the semantic distinctions related to comparison, we arrive at a picture like (15):

(15)

	cat	*footwear*	*water*
(a) pluralization	✓	*	*
(b) direct combination with numerals	✓	*	*
(c) combination with *each, many, fewer*	✓	*	*
(d) combination with *much, less*	*	✓	✓
(e) combination with 'count adjectives'	✓	✓	*
(f) comparison based on number	✓	✓	*
(g) comparison based on mass/volume	*	*	✓

Those patterns above the double line group *water* and *footwear* together and may be taken to reflect a semantic property related to sums (such as cumulativity). Those patterns below the line group *footwear* and *cat* together and may be taken to reflect a semantic property related to parts (such as divisiveness, stable atomicity, or overlap).

A number of consequences follow from this picture. For one thing, to model the two distinctions, noun denotations must come in three varieties, rather than just two. If we take the relevant thesis about parts to be divisiveness, the three varieties can be quantized denotations for nouns like *cat*; atomic join semilattices for nouns like *footwear*; and nonatomic join semilattices for nouns like *water*. A picture along these lines is proposed by Doetjes (1997, Chap. 2).[11] Parallel proposals can presumably be made using Chierchia's (2010) unstable atomicity, Landman's (2011) overlapping generators, or Grimm's (2012) strong connectedness as the relevant thesis about parts.

Second, if it is cumulativity that determines which nouns may combine with numerals, it must be that nouns, whatever their surface morphology, always combine with numerals as semantically singular predicates. That is to say, despite the plural

[10] For Bale and Barner (2009), this is the only interpretation of the *footwear* sentence. Building on McCawley (1975), Grimm and Levin (2012) show that, in special contexts, this preference may be overturned.

[11] Schwarzschild's (2011) proposal is somewhat similar, though couched in an event semantics. On this view, noun denotations are properties of events, and the three varieties are those that hold only of single-participant events (e.g. ⟦*cat*⟧), those that hold of both single- and multi-participant events (e.g. ⟦*footwear*⟧) and those that hold of only multi-participant events (e.g. ⟦*water*⟧).

morphology in *Two cats are sleeping*, what the numeral actually quantifies is the intersection of ⟦*are sleeping*⟧ with the singular denotation ⟦*cat*⟧. Barwise and Cooper (1981) encode this without remark; Krifka (1989, 1995) and Chierchia (1998a) outline two possible compositional implementations. For Chierchia, the numeral has a built-in singularizing operation which undoes the semantic effects of pluralization. For Krifka, the plural *-s* in *two cats* is "triggered syntactically and has no semantic effect at all" (1989, p. 85). For concreteness, I will adopt Krifka's proposal, assuming that numerals in some languages enter a derivation with a purely syntactic number feature. This feature is relevant for the morphosyntax of nominal concord (agreement within the noun phrase) but not for semantic interpretation.[12] In other languages, numerals lack such features and their complements never surface as morphologically plural. Krifka suggests that Turkish may be such a language (1995, p. 407).

A final consequence, as we transition from these theoretical questions to questions of crosslinguistic variation, concerns apparent debates over whether particular languages "lack the mass-count distinction". Once we recognize the need for two countability distinctions, rather than just one, it turns out that certain high-profile debates along these lines simply vanish. Mandarin Chinese, for instance, is claimed by Krifka (1995) and Chierchia (1998b) to "lack the mass-count distinction"; Cheng and Sybesma (1998) respond, in apparent contradiction, that "the count-mass distinction is encoded in Chinese." In a two-distinction theory, there need be no contradiction after all: Mandarin has a parts-based distinction but not a sums-based one (Doetjes 1997).[13] In particular, all nouns are cumulative in Mandarin, but nouns differ in the nature of their minimal parts. Because all nouns are cumulative, there is no general singular/plural distinction in the language, and no nouns combine with numerals directly (see e.g. Chierchia 1998b). At the same time, because nouns differ in the nature of their minimal parts, they differ in their ability to combine with count adjectives, just like in English (13).[14]

(16) Zhangsan xihuan xiao(-de) shu/*rou.
Zhangsan like small book/meat
'Zhangsan likes small books/*meat.'

Also just like in English, an additional consequence of the parts-based distinction shows up in the interpretation of quantity comparatives (Cheung, Li, and Barner 2010). If we take the relevant thesis about minimal parts to be divisiveness, this body of facts suggests that Mandarin noun denotations come in two varieties: atomic join semilattices for nouns like *shu* 'book' (compare English *footwear*) and non-atomic join semilattices for nouns like *rou* 'meat' (compare English *meat*).

The Mandarin facts reveal that languages may lack one of the two countability distinctions. This raises the question of whether a language may lack *both* distinctions, or, alternatively, lack a parts-based distinction while nevertheless possessing a sums-based distinction. We must ask: are there languages where no nouns are cumulative? Are there languages where all nouns are equally quantized?

[12] This corresponds to Pesetsky and Torrego's (2001) 'valued but uninterpretable' features.

[13] See Chierchia (2010) and Landman (2011) for related approaches to Mandarin.

[14] Thanks to Yiwen Zhang and Yimei Xiang for help with this data.

Over the next three sections, I will build an indirect argument for *no*: even in languages which present to the learner (and the linguist!) as lacking each distinction, evidence of both sums- and parts-based differences emerges on close examination. The data, I submit, furnish a poverty of the stimulus argument for countability distinctions as a language universal. That is, the subtlety of the crucial evidence suggests that the acquisition of countability distinctions may not be attributable purely to linguistic experience on the part of the language learner. Instead, a linguistic universal is involved – one grounded in independently attested strategies used by child learners to acquire new words' meanings. In the next two sections, I build this case primarily with the help of evidence from Nez Perce.

3 Countability in Nez Perce, part 1: Are there any countability distinctions?

We begin with a series of reasons to think that Nez Perce might in fact be a language without any countability distinctions. In this section, I first introduce some background properties of the language, and then present three *prima facie* arguments that all Nez Perce nouns receive the same type of semantic analysis. These feature numerals, number marking, and combinations with count adjectives. On each test, we will see that all Nez Perce nouns behave like core English count nouns, suggesting the initial hypothesis that all Nez Perce nouns have quantized denotations.

3.1 Introducing Nez Perce

Nez Perce is a Sahaptian language spoken in Idaho, Washington, and Oregon, USA. The language is highly endangered; recent estimates count no more than 30 native speakers, all above the age of 65 (Harold Crook, p.c.). The data in this paper come from fieldwork on the Nez Perce Reservation in Lapwai, Idaho. Data were collected over five field trips, 2011–2015, from two native speaker consultants. Examples are presented here in the practical orthography used by the language program of the Nez Perce Tribe. A table of correspondences to IPA may be found in Deal (2016a).

Nez Perce has flexible word order, especially at the clausal level, and rich systems of both agreement (head-marking) and case (dependent-marking). Of special relevance for this project is concord, which is capable of encoding number, animacy (gender), and case. The morphosyntax and morphophonology of concord in Nez Perce have recently been analyzed in Deal (2016b). In analyzing number marking, I will make a proposal about the LF structures behind concord later in this section.

Countability distinctions in Nez Perce have not been described in previous research. Accordingly, a wide variety of nouns were investigated for this project. Rather than using the labels 'count' and 'mass' (and 'aggregate'), I will describe Nez Perce nouns pretheoretically as either 'object nouns' (correlates of core English count nouns) or 'substance nouns' (correlates of core English mass nouns). A non-exhaustive sampling of the nouns investigated is provided below.

(17) A sampling of substance nouns

kike't	*blood*	nuukt	*meat*	tiipip	*frosting*	'itx̂	*clay*
'ipeex̂	*bread*	maayx	*sand*	samq'ayn	*fabric*	siis	*soup*
heecu	*wood*	qahas	*milk*	tuutnin'	*flour*	tehes	*ice*

(18) A sampling of object nouns

taam'am	*egg*	laatis	*flower*	'ileeptekey	*sock*
walc	*knife*	'aatamoc	*car*	tiim'en'es	*pencil*
miya'c	*child*	haama	*man*	'ipneekut'es	*cup*
soox̂	*spoon*	nicka'niicka'	*strawberry*	wix̂si'likeecet'es	*chair*

All nouns may (and frequently do) appear bare in argument position. Nez Perce does not have articles, definite or indefinite.[15]

(19) Weet lalx hii-we-s 'ipneekut'es-pe?
Y.N coffee 3SUBJ-be-PRES cup-in
'Is there coffee in the cup?'

(20) Weet hii-we-s kine saaslaqs?
Y.N 3SUBJ-be-PRES here moose
'Is there a moose around here?'

I will now demonstrate three respects in which Nez Perce lacks any familiar combinatoric distinction between substance nouns and object nouns.

3.2 Nouns and numerals

Contemporary Nez Perce is not a classifier language; nouns may combine with numerals without any overt classifying or measuring expression.[16] The direct combination of an object noun with a numeral is seen in the Nez Perce examples in (21).

(21) a. naaqc himeeq'is walc
one big knife
'one big knife'

b. kii lepit ciickan
DEM two blanket
'these two blankets'

[15] The following abbreviations are used in glosses: ACC accusative case (equivalent to the case glossed as 'objective' in Crook (1999), Deal (2010) et seq.), ADV adverbializer, CISLOC cislocative, COMP comparative, DEM demonstrative, DIST distributive, EMPH emphatic, GEN genitive case, HORT hortative particle, HUM human, IMPER imperative, IMPERF imperfective aspect, NOM nominative case, OBL oblique case, P perfect/perfective aspect (see Deal 2010, Sect. 2.3), PART participle, PL plural, PRES present tense, REM.PAST remote past tense, SG singular, S.PL plural subject agreement prefix, Y.N yes-no question particle, 1REFL 1st person reflexive, 2/1 2nd person subject and 1st person object portmanteau agreement (see Deal 2015), 2SG 2nd person singular, 3GEN 3rd person genitive subject agreement, 3SUBJ 3rd person subject agreement, 3/3 3rd person subject and 3rd person object portmanteau agreement.

[16] This claim is defended at length in Deal (2016b), in response to Aoki's (1994) informal description of certain morphemes as classifiers.

This behavior is familiar for quantized nouns in non-classifier languages. By contrast, in familiar non-classifier languages, homogeneous nouns may combine with a numeral directly if and only if the noun may be coerced into countability–that is, if it may be interpreted as a property of subkinds of the stuff present in the homogeneous denotation (sorting), as in (22a), or as a property of conventionally packaged units of the stuff present in the homogeneous denotation (packaging), as in (22b).

(22) Coercion of homogeneous nouns:
   a. This brewery makes two beers.
   b. We would like two beers, please.

There is an extensive literature on coercion of both types.[17]

In Nez Perce, the combination of substance nouns with numerals is by outward appearances just as direct as for object nouns; however, this combination does not depend on any familiar type of coercion of the substance noun. In (23), *'itx* 'clay' combines with a numeral, and the interpretation involves counting two portions of clay. Both are of the same type, and neither is a conventional package. Compare, in this context, English (24).

(23) (Speaker is toying with two nearly identical pieces of white modeling clay.)

   'Ee wee-s lepit 'itx̂, kii kaa yox̂.
   2SG.CLITIC have-PRES two clay, DEM and DEM.
   'You have two pieces of clay, this one and that one.'

(24) # You have two clays.

Likewise, in (25), *tuutnin'* 'flour' combines with a numeral, and the interpretation involves counting by piles, rather than conventional packages (e.g. bags) or subkinds. (This interpretation is reinforced by the adjective *himeeq'is* 'big'. The portion of flour being described is big, but no subkind of flour is big.) Compare, in this context, English (26).

(25) (Describing a photograph of a pile of flour on a table)

   Naaqc himeeq'is x̂ayx̂ayx̂ tuutnin' hii-we-s.
   one big white flour 3SUBJ-be-PRES
   'There's one big pile of white flour.'

(26) # There's one big white flour.

In (27), *kike't* 'blood' combines with a numeral, and the interpretation involves counting by drops. Compare, in this context, English (28).

(27) (Discussing a nosebleed)

   Lepit kike't hi-sseew-n-e.
   two blood 3SUBJ-drip-P-REM.PAST
   'Two drops of blood fell.'

[17] See e.g. Bunt (1985), Pelletier and Schubert (1989/2003), Doetjes (1997, Sect. 2.1.2), Huddleston and Pullum (2002, Chap. 5 Sect. 3.1), Nicolas (2002, ch. 7), Borer (2005), Wiese and Maling (2005), Chierchia (2010), Landman (2011, Sects. 9-11) Grimm (2012, Sect. 3.6.3).

(28) # Two bloods fell.

Finally, in (29), *heecu* ‘wood’ combines with a numeral directly, and the interpretation involves counting by blocks. Compare, in this context, English (30).

(29) (Describing a photograph of a box containing two touching blocks of wood)

lepit heecu ’itet’es-pe
two wood box-in
‘two pieces of wood in a box’

(30) # (I see) two woods in a box.

These data show that it is possible to count substances in Nez Perce by the portions the substance occurs in, even when these portions do not represent distinct subkinds and do not correspond to conventional packages.[18] As these data show, the pattern holds for substances of various types: flexible solids (clay), powders (flour), liquids (blood), and inflexible solids (wood).

The portions by which a substance is counted are not fixed once and for all; rather, context and world knowledge play a role in determining an apportionment scheme. Countable portions of bread, for instance, could be loaves or merely slices. In the following examples, consultants were asked what type of portions they would take to be counted in two different contexts, an out-of-the-blue context and a sandwich-making context. Out of the blue, bread is counted by loaves, but in the context of making sandwiches, it is counted by slices:

(31) a. Out of the blue:

’Iin-im wee-s piilept ’ipeex̂.
1SG-GEN have-PRES four bread
(lit. ‘I have four bread.’)

ARD: Would you think I have four slices or four loaves?
Speaker: Four loaves.

b. We are making sandwiches and I say:

Pii-’ni-m lepit ’ipeex̂!
2/1-give-CISLOC.IMPER two bread
(lit. ‘Give me two bread!’)

ARD: What would you give me?
Speaker: If I heard that, I’d probably figure you wanted slices.

Given this flexibility of counting schemes, we should expect that conventional packages *could* be used for counting, even though this is not strictly necessary. Coffee, for instance, may be counted by mugs; water may be counted by bottles. The pattern in (32) is like in English.

[18] Example (29) also shows that what is counted need not be maximally self-connected portions in a simple mereotopological sense; two blocks are counted as two, rather than one, even when they touch. Compare the notion of apportionment discussed in Lima (2014), as well as richer notions of connectedness discussed by Grimm (2012).

(32) (Describing pictures of three cups of coffee or three bottles of water:)

mitaat lalx / kuus
three coffee / water
'three coffees / waters'

Similarly, substances may be counted by subkinds. In (33), a subkind interpretation is facilitated by the presence of the adjective *pennex̂sep* 'varied, different'.

(33) Watiisx mitaat pennex̂sep siis hip-∅-e.
1.day.away three different soup eat-P-REM.PAST
'Yesterday I ate three different kinds of soup.'

In (34), milk is counted by subkinds, and the NP is modified by the phrase *pennex̂sep kiinewit* 'of different tastes, various in taste'.

(34) (Pointing out that there are three different kinds of powdered creamer available for coffee:)

Wi-s-iix mitaat qahas pennex̂sep kiinewit.
have-PRES-PL three milk different taste
'We have three milks of different tastes.'

Are we looking, then, at two phenomena – on one hand, familiar sorting and packaging coercions, and on the other hand, some new type of phenomenon involving counting by flexible schemes? One persistent observation about coercion is that it is selective; certain nouns may undergo packaging and sorting coercions, whereas other nouns may not. In English, for instance, *butter* does not readily undergo a packaging coercion, despite being sold in conventional packages (namely, in the U.S., 4 oz sticks). Likewise, *blood* does not readily undergo a sorting coercion, despite comprising several distinct subtypes.

(35) This recipe calls for three *(sticks of) butter.

(36) This lab studies one *(type of) blood.

Similar effects in German and Icelandic are discussed by Wiese and Maling (2005), and in Dutch by Doetjes (1997). Notably, no constraints of this type have been identified in Nez Perce. Counting by packages is possible both for conventionally packaged liquids, like coffee and water, and other types of substances, such as butter. (The Nez Perce expression for butter is *qahasnim wee'ikt*, lit. 'grease from milk'.)

(37) (Describing a picture of three identical sticks of butter:)

mitaat qahas-nim wee'ikt
three milk-GEN grease
'three sticks of butter'

Counting by subkinds is possible both for foods like soup and milk and for other types of substances, such as blood.

(38) (Discussing what could be uttered at a bloodbank:)

Wi-s-iix lepit kike't, O kaa A.
have-PRES-PL two blood, O and A
'We have two blood types, O and A.'

Counting of substances is completely generalized in Nez Perce. Counting by conventional packages and subkinds is just as generalized as other types of substance counting; it does not display the selectivity characteristic of familiar coercions.

These findings reveal a systematic difference in how substance nouns combine with numerals in Nez Perce versus in more familar languages. In Nez Perce, substance nouns behave as though apportioned – they allow counting by quantities of the substance. The quantities in question are determined by context and world knowledge, and can, but need not, correspond to conventional packages or subkinds. These data suggest the initial hypothesis that all nouns in Nez Perce are lexically quantized.

3.3 Plural

Similar observations arise from the distribution of number marking—though, as I will show, not all morphological number marking proves to be equally relevant.

Like many languages, Nez Perce marks plural not just on nouns but also on nominal modifiers and verbs. That is, it is a number-marking language with number agreement and number concord. Compare singular (39a) to plural (39b), where plural is marked on four different lexical items.

(39) a. Yox̂ kuhet 'aayat hii-we-s 'eemtii.
DEM tall woman 3SUBJ-be-PRES outside
'That tall woman is outside.'

b. Yox̂-me ki-kuhet ha-'ayat hi-w-s-iix 'eemtii.
DEM-PL PL-tall PL-woman 3SUBJ-be-PRES-PL outside
'Those tall women are outside.'

Following Sauerland (2003) and much work on the syntax of nominal concord, I will assume that at most one [PL] feature is semantically interpreted per plural nominal, even though plural may be morphologically exponed multiple times.[19] Following Ritter (1991) and many others, I furthermore assume that this single [PL] feature originates on a functional head in the nominal projection, rather than on the noun itself. The syntax and LF structures I assume for the subjects of (39a,b), respectively, are shown in (40a,b). (The absence of a [PL] feature on Num is indicated with a dash.)

(40) a. [*yox̂* 'that' [Num: – [*kuhet* 'tall' *'aayat* 'woman']]]

b. [*yox̂* 'that' [Num: [PL] [*kuhet* 'tall' *'aayat* 'woman']]]

From this perspective, information about the plural *form* of the noun *per se* is not available to the semantics. Morphological form is a PF matter, determined in a PF

[19] The precise conditions on this multiple exponence are explored in Deal 2016b.

component of grammar. This means we must recast the idea that a noun's meaning determines whether it has a plural form. What a noun's meaning determines is whether or not it may co-occur with a plural Num head in its minimal nominal projection. When a noun co-occurs with plural Num, a [PL] feature is present for interpretation at LF and potentially at PF as well. We see pattern (41) in English because [PL] features in nominal projections are generally realized on nouns in this language.

(41) a. cat, cats
b. blood, *bloods

Crucially, to look for a pattern like this in another language, there is no particular reason to limit our attention to nouns. A plural affix on a noun furnishes one type of evidence that the nominal contains a [PL] feature, but so does a plural affix on a nominal modifier or even on a verb. This type of reasoning is familiar from English examples like (42), where we use the morphology of demonstratives or verbs, rather than nouns, to conclude that the nouns *moose* and *sheep* may co-occur with [PL].

(42) a. These moose scared those sheep.
b. The moose are standing in the roadway.

In the rest of this section, I will show that most Nez Perce nouns behave like *moose* and *sheep*: they do not have morphological plural forms, but there is nevertheless good reason to think that they may co-occur with [PL] on Num. In Nez Perce, [PL] can be diagnosed most consistently with the help of adjective morphology. Nominal and verbal morphology provide less reliable diagnostics in view of an interaction between number marking and animacy (gender). As I discuss in Deal 2016b, plural marking on nouns and verbs is tightly constrained by animacy. The distribution of plural marking by animacy class and lexical category is shown in (43).

(43) The distribution of plural marking by animacy class and lexical category:

Animacy class	Nominal plural	Verbal plural	Adjectival plural
Human	Y (mostly)	Y	Y
Non-human animate	n	Y	Y
Inanimate	n	n	Y

I will now briefly review the data that support this characterization of plural marking on nouns and verbs. Then, I will show how adjectival plural provides evidence that all Nez Perce nouns may co-occur with [PL] on Num.

3.3.1 Plural on nouns

The nouns that show morphological plural marking in Nez Perce all belong to the human class, a pattern that is crosslinguistically common.[20] [21] A selection of nouns

[20] But see Deal 2016b for discussion of [+HUMAN] noun types lacking plural.

[21] In some languages allowing noun plurals only for human-class nouns, plural markers encode definiteness along with plurality. (See e.g. Kurafuji 2004.) This does not seem to be the case in Nez Perce. Nez

with morphological plural forms is given in (44).[22] In nominals headed by these nouns, noun morphology provides evidence regarding the presence of [PL] on Num.

(44)

Singular	*Plural*	*Gloss*
lawtiwaa	lawtiwaa-ma	‘friend(s)’
’aayat	ha-’ayat	‘woman/women’
haama	ha-ham	‘man/men’
teeq’is	ti-teeq’is	‘elder(s)’
pit’iin’	pi-pit’in’	‘girl(s)’

Nouns outside the human class do not possess plural forms. This is shown for non-human animates in (45a) and inanimates in (45b). In nominals headed by these nouns, noun morphology provides no evidence regarding [PL] on Num.

(45) a. Non-human animates

Noun	*Gloss*
’iceyeeye	‘coyote(s)’
picpic	‘cat(s)’
’imes	‘deer (sg or pl)’
ciq’aamqal	‘dog(s)’
sik’em	‘horse(s)’

b. Inanimates

Noun	*Gloss*
tiim’en’es	‘pencil(s)’
piswe	‘rock(s)’
timaanit	‘apple(s)’
tiim’es	‘book(s)/paper(s)’
’iniit	‘house(s)’

There are no substance nouns with plural forms, and this fact should now be unsurprising. The fact that substance nouns don’t take plural affixes follows immediately from their membership in the inanimate class.

3.3.2 Plural marked on verbs

Plural marking on verbs also shows an animacy effect. It is found only with animate arguments. The argument itself need not mark plural overtly; it only needs to belong

Perce lacks articles, and bare nouns may generally have definite or indefinite interpretations. Plural nouns are no exception. Definite and indefinite interpretations are shown in (i) for bare singular nouns, and in (ii) for bare plurals. These facts hold irrespective of whether the noun marks plural via a prefix or a suffix.

(i) Haama kaa ’aayat hi-pa-’ac-∅-a.
man and woman 3SUBJ-S.PL-enter-P-REM.PAST
‘A man and a woman came in.’

Haama hii-we-s kuhet, ’aayat hii-we-s qetu kahat’o.
man 3SUBJ-be-PRES tall woman 3SUBJ-be-PRES COMP short
‘The man is tall, the lady is shorter.’

(ii) Hi-w-s-iix ha-ham kaa ha-’ayat ’eemtii,
3SUBJ-be-PRES-PL PL-man and PL-woman outside
‘There are men and women outside,’

kaa paa-tk’ay-c-ix-∅ ha-ham-na ha-’ayato-nm.
and 3/3-watch-IMPERF-PL-PRES PL-man-ACC PL-woman-ERG
‘and the women are watching the men.’

[22] These examples demonstrate the three allomorphs of plural in the nominal projection: *-me/ma* for kinship terms (plus a few lexical exceptions); *he/ha-* otherwise for nouns beginning with glottal segments (/h/ or /’/); and *Ci-*, where C reduplicates the initial consonant, otherwise. See Deal 2016b.

to the animate class. Because the plural subject in (46) belongs to the animate class, verbal agreement in plural is obligatory.

(46) Lepit picpic hi-w-s-iix / *hii-we-s 'iniit-pe.
two cat 3SUBJ-be-PRES-PL / *3SUBJ-be-PRES house-in
'Two cats are in the house.'

In (47), on the other hand, the subject belongs to the class of inanimates, and verbal agreement in plural is rejected.

(47) Lepit cepeepy'uxtin' hii-we-s / *hi-w-s-iix 'iniit-pe.
two pie 3SUBJ-be-PRES / *3SUBJ-be-PRES-PL house-in
'Two pies are in the house.'

These facts receive a straightforward explanation if "plural" marking on verbs is in fact a portmanteau realization of plural number and animate gender. It requires that [PL] be present on Num within the argument, but it also requires that the argument belong to the animate noun class.

Against this backdrop, the facts on substance nouns are once again unsurprising. Nominals headed by substance nouns do not control verbal plural agreement. This simply follows from the fact that substance nouns belong to the inanimate class, and nominals headed by inanimate nouns, whether or not they contain [PL], do not control verbal "plural" agreement.

3.3.3 Plural marked on attributive adjectives

This brings us to the most informative type of plural marking in Nez Perce, namely that found on adjectives. Many (though not all) Nez Perce adjectives have plural forms. As in many languages, plural marking on adjectives uses the same set of affixes used for plural on nouns (*-me*, *he-* and reduplicative *Ci-*; see Deal 2016b). Also as in many languages, both singular and plural forms exist for a range of adjectives expected to be inherently distributive, such as *kuhet* 'tall', *cilpcílp* 'round', and *limeq'is* 'deep'.[23] These facts together make it clear that adjectives mark a contrast of number, rather than (say) distributivity.

Plural marking on attributive adjectives is unrestricted by the animacy class of the head noun. We see a plural adjective modifying a human-class noun in (39b), repeated below.[24] (The plural adjective is bolded.)

(48) Yox-me **ki-kuhet** ha-'ayat hi-w-s-iix 'eemtii. *=(39b)*
DEM-PL PL-tall PL-woman 3SUBJ-be-PRES-PL outside
'Those tall women are outside.'

[23] Preliminary investigation suggests that plural marking furthermore does not disambiguate between collective and distributive readings of adjectives like *cininis* 'heavy'.

[24] As expected, the plural adjective *kikuhet* 'tall$_{PL}$' may modify *ha'ayat* 'women' but not *'aayat* 'woman'. When the noun is unambiguously singular, the adjective must be singular as well:

(i) Yox kuhet / *ki-kuhet 'aayat hii-we-s 'eemtii.
DEM tall / *PL-tall woman 3SUBJ-be-PRES outside
'That tall woman is outside.'

Plural adjectives may also modify animate- or inanimate-class nouns. Plural adjectives modifying inanimate-class nouns are particularly interesting, since in this case, plural is expressed morphologically *only* on the adjective. In (49), for instance, the subject is headed by *taam'am* 'egg', which (like all nouns of this animacy class) has no plural form and cannot control "plural" verb agreement. The plurality of this argument is visible morphologically only on the (bolded) plural adjective. (Compare English (42a), where plurality is visible morphologically only on the demonstrative.)

(49) Himeeq'is 'itet'es-pe hii-we-s [**ki-kuckuc** taam'am].
big bag-in 3SUBJ-be-PRES PL-small egg
'In the big bag there are little eggs.'

Such data reveal that any Nez Perce argument, regardless of animacy, may contain a [PL] feature. I propose that morphological concord rules spread the [PL] feature (along with gender and case features) thoughout the nominal at PF, depositing a [PL] feature on the noun as well as on any modifying adjectives and demonstratives. The noun's animacy class determines if and how plurality is morphologically realized on the noun itself, but it has no effect on how plural is morphologically realized on adjectives.[25] At LF, the structure of an inanimate plural nominal and an animate plural nominal are parallel. Compare the LF structure of the subject of (48), introduced above, to the LF structure of the subject of (49):

(50) a. [*yox̂* 'that' [Num: [PL] [*kuhet* 'tall' *'aayat* 'woman']]]
b. [Num: [PL] [*kuckuc* 'small' *taam'am* 'egg']]

Nouns that possess morphological plural forms (e.g. *'aayat* 'woman') are thus treated at LF exactly like nouns that do not (e.g. *taam'am* 'egg'). This provides a unified treatment of the combination of both types of nouns with plural-marked adjectives.

Plural adjectives are of interest in assessing countability distinctions as they allow us to ask whether Nez Perce shows a distributional distinction akin to English (51).

(51) a. cat, cats
b. blood, *bloods

What we find is that NPs consistently permit [PL] in Nez Perce, as demonstrated by adjective morphology, regardless of whether the head noun is a substance noun or an object noun. Plural substance NPs describe pluralities of portions of the substance, where again, context and world knowledge play a leading role. In (52), plural occurs in an NP headed by *sitx̂* 'mud'; the sentence introduces a plurality of portions of red mud. Again, familiar packaging and sorting coercions are not involved; these portions are of the same subkind and do not correspond to conventional packages. Compare, in this context, English (53).

[25] See Deal 2016b for an implementation and for an argument that concord does indeed deliver [PL] features to nouns in plural DPs regardless of their morphological ability to expone number overtly (Sect. 3.6).

(52) (Discussing road construction)

He'ilpe'ilp sitx̂ hii-we-s x̂uysx̂uys 'iskit-pe.
PL.red mud 3SUBJ-be-PRES slippery road-on
'There are red muddy spots that are slippery on the road.'

(53) # Red muds are slippery on the road.

In (54), plural occurs in an NP headed by *tuutnin'* 'flour', describing a plurality of portions of good flour. The flour is not in packages and is all of the same type. Compare, in this context, English (55).

(54) (Discussing a picture of several people's piles of flour)

'ilex̂ni ti-ta'c tuutnin'
a.lot PL-good flour
'a lot of good portions of flour'

(55) # a lot of good flours

Just as with numerals, it is possible (though not obligatory) for the portions of a substance to correspond to conventional packages. Sentence (56), for instance, might be used in an art store to request a plurality of packages of blue sand. Here, as in the 'butter' example in (37), we see that conventional packages may be used to pick out portions even for non-liquid substances; compare Nez Perce (56) to English (57).

(56) Yiyoosyiyoos maayx wewluq-se-∅.
PL.blue sand want-IMPERF-PRES
'I want quantities of blue sand.'

(57) # I want blue sands.

Overall, once we know where to look for a distributional distinction in number marking in Nez Perce, we see that substance nouns and object nouns behave the same way. These facts again reveal a systematic difference between Nez Perce and more familiar languages.

3.4 Count adjectives

In reviewing the distribution of English aggregate nouns, we have seen that numerals and number marking assess a sums-based countability distinction, i.e. one based on cumulativity. To investigate a parts-based distinction using distributional tests, we must look to the interpretation of count adjectives. In Nez Perce, what we find is that count adjectives may combine both with substance nouns and with object nouns. *Himeeq'is* 'big', for instance, may combine with the substance noun *kuus* 'water' to describe a big puddle or portion of water. Compare Nez Perce (58a) to English (59).

(58) a. himeeq'is kuus
big water
'(the) big portion of water'

cf. b. himeeq'is picpic
big cat
'(the) big cat'

(59) # big water

The same can be seen in (60) with *kuckuc* ‘small’. Note that these nominals contain both a count adjective and [PL].

(60) a. ki-kuckuc kuus
PL-small water
‘(the) small portions of water’
Consultant: “Like little puddles.”

cf. b. ki-kuckuc laatis
PL-small flower
‘(the) small flowers’

These data are as expected on our initial hypothesis that all nouns in Nez Perce have quantized denotations.

4 Countability in Nez Perce, part 2: Return of the countability distinctions

In the previous section, we have seen three reasons to suspect that Nez Perce may be a language lacking in countability distinctions. All nouns combine with numerals in what looks to be the same way; this is not merely due to familiar packaging or sorting coercions. In terms of number marking, all nouns present the possibility of combination with a plural adjective, revealing the presence of [PL] in the NP. Finally, all nouns may combine with count adjectives. Our initial hypothesis responds to this data by assigning quantized denotations to all nouns in Nez Perce. After all, distributionally, all Nez Perce nouns have the behavior of core English count nouns.

In this section, I show how consideration of a broader set of Nez Perce facts flips this simple picture on its head. It turns out that Nez Perce shows sensitivity both to a sums-based distinction and to a parts-based distinction in noun meaning after all. The real task is to reconcile the existence of these semantic distinctions with the non-existence of distributional distinctions concerning numerals, number marking, and count adjectives. I begin with a modest proposal for how this might be done. After that, I lay out the evidence that the Nez Perce countability system is not so exotic after all.

4.1 A modest proposal

Suppose, contrary to what we hypothesized in Sect. 3, that object nouns in Nez Perce have a special status: they alone denote sets of atoms in their root form. By ‘root form’ I mean the core open-class lexical representation of the noun, which may or may not be semantically equivalent to the noun root once it has combined with various (perhaps silent) pieces of functional morphology. Following the practice of Distributed Morphology, I will indicate noun roots using the symbol $\sqrt{}$.[26] In this notation, my proposal is that roots like $\sqrt{}$*picpic* ‘cat’ and $\sqrt{}$*tiim’en’es* ‘pencil’ have quantized denotations.

[26] I intend no stand here on whether roots have syntactic category. I will talk about them as though they do, but this choice is not crucial.

In contrast to object nouns, the roots of substance nouns do not denote sets of atoms; their denotations are homogeneous. On this hypothesis, the meanings of core English count roots and mass roots are identical with those of their Nez Perce counterparts as far as mereological properties are concerned: $\sqrt{cat}$ and its Nez Perce counterpart $\sqrt{picpic}$ both have quantized denotations, whereas $\sqrt{blood}$ and its Nez Perce counterpart $\sqrt{kike't}$ both have homogeneous denotations.

(61) $[\![\sqrt{cat}]\!] = [\![\sqrt{picpic}]\!] =$ the set of all cat-atoms

(62) $[\![\sqrt{blood}]\!] = [\![\sqrt{kike't}]\!] =$ the set of all portions of blood

Pluralization and counting with substance nouns is more flexible in Nez Perce than in English because Nez Perce allows a more general type of homogeneous→quantized meaning shift than English does. The shift that Nez Perce makes available is fully productive (unlike English packaging and sorting coercions), so there is little cause to record it in the lexical entries of nouns. In principle, it could be accomplished purely in the semantic component, by the analogue of a type-shifting rule;[27] alternatively it could be accomplished in the ordinary compositional semantics with the help of a silent syntactic piece. I will provide an implementation of the latter type.

My proposal, then, is that pluralization and counting with substance nouns involve a silent piece α (for "atomization"), which intervenes between the core NP and numerals, [PL], or count adjectives.[28] The role of α is to map homogeneous denotations to quantized ones. Intuitively, this should allow us (for instance) to map bread *qua* substance to the set of loaves of bread, but it should also allow us to map bread *qua* substance to the set of slices of bread or subkinds of bread. Let us then treat α as introducing a variable over atomization functions AT:

(63) $[\![\alpha_n]\!]^g = \lambda P \lambda x.AT_n(P)(x)$
where AT_n *= g(n) = the* n^{th} *atomization function*

At minimum, an atomization function must meet two conditions: atoms must instantiate the property of which they are an atomization, and no element of an atomization may overlap (or properly include) another element of that atomization.

(64) Conditions on atomization functions:
a. $AT_n(P)(x) \rightarrow P(x)$
b. $[AT_n(P)(x) \wedge AT_n(P)(y) \wedge x \neq y] \rightarrow \neg\exists z[z \leq x \wedge z \leq y]$

Condition (64b) ensures that the atomization of any property is quantized. Assuming that counting eschews overlap (Kratzer 1989, Chierchia 1998b, Landman 2011), this condition also ensures that atomized denotations are countable.

We will now see how this proposal accounts for combinations of substance nouns with numerals, [PL], and count adjectives. Substance root $\sqrt{kike't}$ 'blood' combines with a numeral in (27), repeated below along with the LF structure of the substance nominal. (Recall that I assume, following Krifka (1989, 1995), that no [PL] feature is present at LF in nominals with numerals.)

[27] Such a rule in this instance would not actually shift types; it would simply encode the function in (63).

[28] The role of α is similar to the role played by a singulative for Mathieu (2012) and Grimm (2012).

(65) a. Lepit kike't hi-sseew-n-e. *=(27)*
two blood 3SUBJ-drip-P-REM.PAST
'Two drops of blood fell.'

b. [*lepit* 'two' [Num:− [α_n $\sqrt{}$*kike't* 'blood']]

Sentence (65a) is true in a context iff there are at least two elements of the contextually-provided atomization of *blood* that fell.[29]

(66) $|\{x : AT_n(blood)(x) \wedge fell(x)\}| \geqslant 2$

Substance root $\sqrt{}$*sitx̂* 'mud' combines with plural in (52), repeated below along with the LF structure of the substance nominal. (I depict the adjective $\sqrt{}$*'ilp'ilp* 'red' as attaching below α_n, but this choice is not crucial.)

(67) a. He'ilpe'ilp **sitx̂** hii-we-s x̂uysx̂uys 'iskit-pe. *=(52)*
PL.red mud 3SUBJ-be-PRES slippery road-on
'There are red muddy spots that are slippery on the road.'

b. [Num: [PL] [α_n $\sqrt{}$*'ilp'ilp* 'red' $\sqrt{}$*sitx̂* 'mud']]

Supposing plural contributes Link's (1983) * operator (simple closure under sum), the sentence is true iff there is an element of $^*AT_n(\lambda x.red(x) \wedge mud(x))$ that is slippery on the road:

(68) $\exists y[^*AT_n(\lambda x.red(x) \wedge mud(x))(y) \wedge slippery\text{-}on\text{-}the\text{-}road(y)]$

Finally, substance root $\sqrt{}$*kuus* 'water' combines with a count adjective in (58a), again repeated below with its LF structure.[30]

(69) a. himeeq'is kuus *=(58a)*
big water
'(the) big portion of water'

b. [$\sqrt{}$*himeeq'is* 'big' [α_n $\sqrt{}$*kuus* 'water']]

We saw above that the distinctive property of count adjectives relates strictly to parts, rather than to sums. For concreteness, let us suppose that such adjectives cannot be combined with constituents whose denotations lack minimal parts. This restriction can be encoded lexically as a presupposition on the adjective:

(70) $[\![\sqrt{big}]\!] = [\![\sqrt{himeeq'is}]\!] =$
$\lambda P \lambda z : \exists x[P(x) \wedge \neg\exists y[y \neq x \wedge y \leq x \wedge P(y)]].\ P(z) \wedge big(z)$

Unlike $\sqrt{}$*'ilp'ilp* 'red' in (67), which in principle could attach either above or below α_n, $\sqrt{}$*himeeq'is* 'big' can only attach above α_n, where its complement denotes $\lambda x.AT_n(water)(x)$. The combination in (69b) denotes the property of being both big and an element of the contextually provided atomization of *water*:

[29] Note that $\geqslant$ here stands for a standard inequality relation, by contrast with $\leq$, which stands for the mereological parthood relation.

[30] I ignore the possible definite reading, which presumably reflects either a null D or an ι type-shift.

(71) $\lambda z.AT_n(water)(z) \wedge big(z)$

We have now seen how the results of the previous section can be made compatible with the hypothesis that Nez Perce indeed makes countability distinctions in its nominal lexicon: some nouns are inherently quantized whereas others are inherently homogeneous. On this hypothesis, Nez Perce nouns come to denote sets of atoms in two distinct ways. Object nouns are born that way—their roots come from the lexicon already quantized—but substance roots must use α_n. Nouns also come to have cumulative denotations in two distinct ways. Substance nouns are born that way—their roots come from the lexicon already homogeneous—but object roots must combine with a semantically interpreted [PL]. The situation is summarized in (72).

(72)

Denotation is a set of atoms	*Denotation is a join semilattice*
Substance root + α_n	Substance root by itself
Object root by itself	Object root + [PL]

On the hypothesis explored in this section, the reason that Nez Perce appears to lack any countability distinctions is simply that α_n is always inaudible. The complements of numerals, [PL] Num heads, and count adjectives are all environments in which a nominal denotation must be a set of atoms. Candidate denotations come from the left-hand column in (72). It happens that the morphology of Nez Perce does not make it possible to distinguish the simplex forms in this column (object roots) from the complex ones (substance roots plus α_n).

It is time now to consider the right-hand column in (72) – the column in which object and substance roots are differentiated by their combination with [PL]. Unlike α_n, [PL] is an element that Nez Perce sometimes makes overt. To see the difference emerge between object and substance roots, we need to find an area of the grammar that calls for cumulative predicates. We predict that object roots will require plural in such cases, but substance roots will not. Quantificational structures provide the environment that bears out this prediction.

4.2 Quantifiers and cumulativity

Nez Perce has six D-quantifiers. Two of these are universal quantifiers (the difference between which is not presently clear); others are translation equivalents of ‘a lot / many / much’, ‘a few / a little’, ‘how many / how much’, and a partitive ‘some’. All quantifiers show a special form for gender concord with [+HUMAN] nouns, featuring an agreement suffix which is underlyingly *-me* or *-we*.[31] Gender concord with [+HUMAN] nouns is generally optional (see Deal 2016b).

[31] Forms *-ma* and *-wa* result from vowel harmony. The form *’oykal-oo* results from harmony and coalescence: *’oykalawe* > *’oykalawa* > *’oykaloo* (Aoki 1994, p. 191). On Nez Perce phonology, see Crook (1999).

(73)

General form	Human form	Gloss
’oykala	’oykal-oo	all
la’am	la’am-wa	all
’ileχ̂ni	’ilχ̂nii-we	a lot
miil’ac	miil’ac-wa	a few
mac	mac-wa	how many
tato’s	tato’s-ma	some (of)

All quantifiers combine with all nouns, and (crucially) all quantifiers require their complements to be cumulative. We will now see that object roots and substance roots give rise to cumulative NPs in different ways. Object roots must combine with [PL] to be cumulative, but substance roots are simply born cumulative.

All quantifiers require their object NP complements to contain [PL]. Accordingly, nouns that have plural forms must take those forms when preceded by a quantifier. Recall that all such nouns belong to the [+HUMAN] class.

(74) ’oykal-oo ha-’ayat/*’aayat
all$_1$-HUM PL-woman/*woman.SG
‘all the women’

(75) la’am-wa ha-’ayat/*’aayat
all$_2$-HUM PL-woman/*woman.SG
‘all the women’

(76) ’ileχ̂ni ha-ham/*haama
a.lot PL-man/*man.SG
‘a lot of men’

(77) miil’ac-wa ha-ham/*haama
few/little-HUM PL-man/*man.SG
‘a few men’

(78) Mac-wa ma-may’ac/*miya’c wee-(s)?
how.much/many-HUM PL-child/*child.SG have-PRES
‘How many kids do you have?’

(79) tato’s ha-’ayat/*’aayat
some PL-woman/*woman.SG
‘some of the women’

The schematic LF structure of these examples is shown in (80).

(80) [Q [Num: [PL] $\sqrt$OBJECT-ROOT]]

Evidence of this same structure can be seen outside the [+HUMAN] class once adjectives are introduced. The adjective provides a morphological locus for the overt expression of plural, making it possible to assess whether [PL] is indeed present on Num. In all of the following examples, plural-marked adjectives are notably preferred to singular adjectives.[32]

[32] The somewhat graded unacceptability of singular forms here contrasts with the clear unacceptability of singular forms for nouns showing N-level plurals. It seems plausible that this difference reflects a small

(81) ’oykala ??k’uupnin’ / k’i-k’uupnin’ tiim’en’es
all$_1$ broken / PL-broken pencil
‘all broken pencils’

(82) la’am ??kuckuc / ki-kuckuc tiim’en’es
all$_2$??small / PL-small pencil
‘all small pencils’

(83) ’ileχ̂ni ??tiyaaw’ic / ti-tiyaw’ic wiχ̂si’likeecet’es
a.lot ??sturdy / PL-sturdy chair
‘a lot of sturdy chairs’

(84) miil’ac ??ta’c / ti-t’ac wiχ̂si’likeecet’es
few/little ??good / PL-good chair
‘a few good chairs’

(85) mac ??’ilp’ilp / he’ilpe’ilp ’aatamoc
how.much/many ??red / PL.red car
‘how many red cars’

(86) tato’s ??himeeq’is / titilu laatis
some big / big.PL flower
‘some of the big flowers’

The schematic LF structure of these examples is exactly as in (80), simply with an adjective added:

(87) [Q [Num: [PL] [$\sqrt{}$ADJECTIVE $\sqrt{}$OBJECT-ROOT]]]

Overall, we see a consistent pattern across the set of object nouns: [PL] must be present in the complement of a quantifier.

Against this backdrop, the behavior of substance NPs with quantifiers is sharply contrasting. *All quantifiers combine with substance NPs that do not contain* [PL], as revealed by the absence of plural marking on adjectives:

(88) a. ’oykala ta’c hipt
all$_1$ good food
‘all good food’

b. ’oykala cimuuxcimux sitχ̂
all$_1$ black mud
‘all black mud’

(89) a. la’am χ̂ayχ̂ayχ̂ ’ipeeχ̂
all$_2$ white bread
‘all white bread’

b. la’am tiiwenin’ c’ayn
all$_2$ stinky manure
‘all stinky manure’

(90) a. ’ileχ̂ni cimuuxcimux samq’ayn
a.lot black fabric
‘a lot of black fabric’

b. ’ilexni yoosyoos tiipip
a.lot blue frosting
‘a lot of blue frosting’

degree of optionality in concord for adjectives. It should not be taken to reflect inconsistency in consultants’ judgments on the crucial facts: the preference for plural adjectives with object nouns is consistent between the two consultants, across elicitations conducted in 2012 and 2013, and across a range of object nouns, adjectives and quantifiers. See Deal (2016b) for other cases where the participation of adjectives in concord is less obligatory than for nouns.

(91) a. miil'ac cimuuxcimux lalx
few/little black coffee
'a little black coffee'

b. miil'ac x̂ayx̂ayx̂ maayx
few/little white sand
'a little white sand'

(92) mac 'ilp'ilp samq'ayn
how.much/many red fabric
'how much red fabric'

(93) tato's ta'c hipt
some good food
'some of the good food'

The LF structure of these examples contrasts with (87) in lacking a [PL] feature on Num. Num contributes no semantic content in these cases:

(94) [Q [Num: – [$\sqrt{}$ADJECTIVE $\sqrt{}$SUBSTANCE-ROOT]]]

These facts show that what Nez Perce quantifiers require of their complements is not plurality but cumulativity. They require object roots to combine with plural, but they impose no such requirement on substance roots. The pattern is one familiar from quantifiers in various languages, including English and French:

(95) a. all blood
b. all cat*(s)

(96) a. combien de sang [French]
how.many of blood
'how much blood'
b. combien de chat*(s)
how.many of cat*(s)
'how many cats'

Nez Perce presents a highly generalized version of this pattern, extending it to all D-quantifiers.[33]

The data thus far concern whether [PL] is *mandatory* in the complement of a quantifier, not whether it is merely possible. Should we expect [PL] to be available in the complement of a quantifier when the root is a substance noun? Indeed we should, given that substance roots may freely combine with α_n. A substance root in combination with α_n has a non-cumulative denotation, like an object root on its own. Accordingly, it must combine with [PL] in a quantifier complement.

As expected, we find that substance roots may coexist with [PL] in quantifier complements, and whenever they do so, an atomized reading surfaces for the substance noun. Compare (97a), with a non-plural adjective and a substance noun, to the minimally different (98a), where the adjective is marked plural. In (97a), repeated

[33] Two potential explanations for this fact deserve further exploration. First, it might be that all Nez Perce quantifiers require their complements to be kind-denoting, and only cumulative predicates may be mapped to kinds, e.g. via Chierchia's (1998b) $\cap$ operator. Second, it might be that all Nez Perce quantifiers are degree quantifiers in the sense of Doetjes (1997), requiring their complements to provide a part-whole structure which can be mapped onto a degree scale.

from (90) above, the quantifier is able to combine directly with the NP because the NP denotation is cumulative. Num contributes no semantic content. The LF structure and schematic result of compositional interpretation are shown in (97b,c).

(97) a. ’ileχ̂ni cimuuxcimux samq’ayn
a.lot black fabric
‘a lot of black fabric’

b. [Q [Num: – [$\sqrt{}$*cimuuxcimux* ‘black’ $\sqrt{}$*samq’ayn* ‘fabric’]]]

c. $Q(\lambda x.black(x) \wedge fabric(x))$

In (98a), by contrast, the substance NP combines with α_n, introducing an atomization of $\lambda x.black(x) \wedge fabric(x)$. The atomized property is not cumulative and therefore must combine with plural before it combines with the quantifier. The LF structure and schematic result of compositional interpretation are shown in (98b,c).

(98) a. ’ileχ̂ni cicmuxcicmux samq’ayn
a.lot PL.black fabric
‘a lot of pieces of black fabric’

b. [Q [Num: [PL] [α_n [$\sqrt{}$*cimuuxcimux* ‘black’ $\sqrt{}$*samq’ayn* ‘fabric’]]]]

c. $Q(^{*}AT_n[\lambda x.black(x) \wedge fabric(x)])$

The overall empirical picture on combinations of quantifiers, adjectives and nouns is summarized in (99). LF structures for the three well-formed options are given in (87) (cell B), (94) (cell C) and (98b) (cell D).

(99) Quantifier, adjective, noun: grammaticality judgments

	Q A(non-pl) N	Q A.pl N
Complement headed by object $\sqrt{}$	* CELL A	✓ CELL B
Complement headed by substance $\sqrt{}$	✓ CELL C	✓ (α-based structure) CELL D

The missing cell, cell A, corresponds to LF structure (100):

(100) [Q [Num: – [$\sqrt{}$ADJECTIVE $\sqrt{}$OBJECT-ROOT]]] ✗

This structure is ill-formed because the complement of the quantifier is not cumulative. The crucial contrast is between this structure and the minimally different (94) with a substance noun (cell C in table (99)), repeated below.

(101) [Q [Num: – [$\sqrt{}$ADJECTIVE $\sqrt{}$SUBSTANCE-ROOT]]] ✓

The contrast is explained by treating object roots as basically quantized and substance roots as basically homogeneous.

I conclude that Nez Perce has a countability distinction in terms of cumulativity.

4.3 Adjectives, quantity comparatives, and atomicity

The results of the previous section are in principle compatible with either of two views about Nez Perce substance roots. On one view, substance roots differ from object roots *only* in their inherent cumulativity. (This corresponds to the vision of mass noun semantics from Chierchia 1998b.) On the other view, substance roots differ from object roots both in their inherent cumulativity and in the nature of their minimal parts: substance root denotations are homogeneous. I will now present the evidence that this latter view is correct.

In the discussion of English aggregate nouns in Sect. 2.2, we saw two phenomena that distinguish NP denotations according to the nature of their minimal parts. One involved combination with count adjectives; the other involved the interpretation of quantity comparatives. It is this latter phenomenon that allows us to empirically probe the minimal parts of substance noun denotations. Recall that comparatives furnish a diagnostic for minimal parts based on the particular scale involved in the comparison. In English, quantity comparisons with nouns like *cat* and *footwear* are assessed on a scale of numerosity, whereas those with nouns like *water* are assessed on a scale of volume. The choice of scale correlates with the nature of the minimal parts in the noun denotation.

(102) a. A has more cats / footwear than B. [assessed on numerosity]
b. A has more water than B. [assessed on volume]

According to Bale and Barner (2009), comparatives like (102) involve a measure function variable μ, relating the set of cats/instances of footwear/portions of water that A has and the set of cats/instances of footwear/portions of water that B has. Iff the two sets contain atoms, μ is fixed as the numerosity comparison function m_1:

(103) $m_1(X)(Y)$ =1 iff X and Y are join semi-lattices and $|\{x : x \text{ is an atom in } X\}| > |\{y : y \text{ is an atom in } Y\}|$[34]

Otherwise, μ is contextually determined, and may be fixed in various contexts as volume comparison, etc.

In Nez Perce, quantity comparatives are formed using the quantifier *'ileχ̂ni* 'a lot' together with the comparative word *qetu* '-er'.[35] A simple example featuring a substance noun is provided in (104). (For reasons to become clear, I temporarily withhold a free translation.)

[34] I use 'atom' here where Bale and Barner (2009) use 'individual'. See their paper for a discussion of their usage of that term.

[35] This corresponds straightforwardly to Bresnan's (1973) decomposition of English *more* as *many/much + -er*. Similarly, Nez Perce 'less' comparatives feature *qetu* '-er' plus *miil'ac* 'few/little'; compare Bresnan (1973), Heim (2006) on the decomposition of *less*. In (i), *qetu* is surface-discontiguous with *miil'ac*:

(i) Qetu 'im-im-x miil'ac wee-s lalx.
COMP 2SG-OBL-than little have-PRES coffee
'I have less coffee than you.'

(104) A-nm ’uu-s qetu ’ilex̂ni kuus B-x.
A-GEN have-PRES COMP a.lot water B-than

Suppose the measure of comparison for this example is numerosity: A must have more portions of water than B does. This suggests that the two sets compared by μ contain atoms. But how does the grammar provide these two sets? One possibility is that the denotation of $\sqrt{}$*kuus* ‘water’ contains minimal parts; the noun combines directly with *qetu ’ilex̂ni* ‘more’. On this hypothesis, the atoms used for numerosity comparison come directly from the root denotation. The other possibility is that $\sqrt{}$*kuus* ‘water’ is homogeneous and the combination of the noun and quantifier is mediated by α_n. On this hypothesis, the atoms used for numerosity comparison come from α_n in combination with the root.

Our investigation of quantifiers and cumulativity has revealed a method for empirically distinguishing these two hypotheses. We have seen that all Nez Perce quantifiers require their complements to be cumulative. This holds of *’ilex̂ni* ‘a lot’ (see (76), (83), (90)); presumably it holds no less of the complex quantifier *qetu ’ilex̂ni* ‘more’. If the complement of *qetu ’ilex̂ni* ‘more’ must be cumulative, it cannot simply consist of a substance root plus α_n, because this has a quantized denotation. [PL] must be present in the complement of the quantifier whenever α_n is. The two candidate LFs for the relevant portion of (104) are therefore as shown in (105):

(105) a. Hyp. 1: [*qetu ’ilex̂ni* ‘more’ [Num: - [$\sqrt{}$*kuus* ‘water’]]]
b. Hyp. 2: [*qetu ’ilex̂ni* ‘more’ [Num: [PL] [α_n $\sqrt{}$*kuus* ‘water’]]]

When adjectives are introduced into LFs like these, the result is what we saw above in (94) and (abstracting away from particular lexical items) (98b):

(106) a. [Q [Num: – [$\sqrt{}$ADJECTIVE $\sqrt{}$SUBSTANCE-ROOT]]]
b. [Q [Num: [PL] [α_n [$\sqrt{}$ADJECTIVE $\sqrt{}$SUBSTANCE-ROOT]]]]

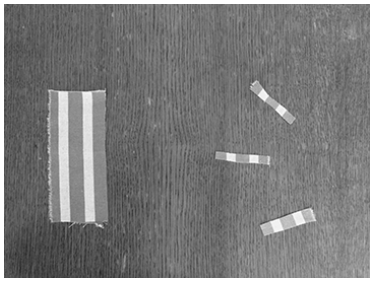
These structures are empirically distinguishable: the presence of an adjective makes it possible to morphologically assess whether or not [PL] is present. In turn, if we know that [PL] is present with a substance root in a quantifier complement, we know that α_n is present. We can therefore assess the hypothesis that numerosity comparison with substance nouns requires α_n by assessing whether numerosity comparison with substance nouns requires an adjective to mark plural.

Here are the predictions, in sum: if $[\![\sqrt{}$*kuus*$]\!]$ ‘water’ is atomic (cf. $[\![\sqrt{}$*footwear*$]\!]$), then numerosity comparison should be possible in structure (106a). In this structure an adjective cannot be marked plural. (There is no [PL] feature to be transferred to the adjective by concord.) If, on the other hand, $[\![\sqrt{}$*kuus*$]\!]$ ‘water’ is non-atomic (cf. $[\![\sqrt{}$*water*$]\!]$), numerosity comparison should be possible only in structure (106b). In this structure an adjective must be marked plural.

A methodology for systematically exploring the interpretation of quantity comparisons is given by Barner and Snedeker (2005). In a series of experiments on English speakers, since replicated in other languages,[36] Barner and Snedeker present

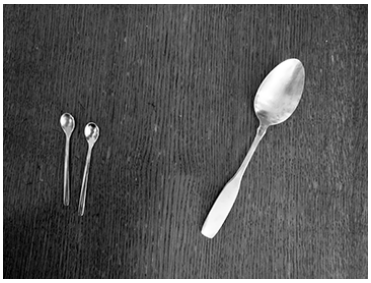
[36] See Inagaki and Barner (2009) on Japanese, Cheung et al. (2010) on Mandarin, Lima (2014) on Brazilian Portuguese.

qahas ‘milk’



samq’ayn ‘fabric’

Fig. 1 Sample substance photos used in the quantity judgment task



soox̂ ‘spoon’

’ileeptekey ‘sock’

Fig. 2 Sample object photos used in the quantity judgment task

participants with pictures divided into two sides. Participants are told that everything on one side of the pictures belongs to one character, whereas everything on the other side belongs to another. They are asked to choose which of the two characters has more. One character always has a single large object (or portion of stuff), whereas the other has multiple small objects (or portions of stuff) of the same kind. If the question *Who has more N?* is answered by pointing to the side with a single large object or portion, the participant has interpreted the quantity comparison in terms of volume. If the question is answered by pointing to the side with multiple objects or portions, the participant has interpreted the quantity comparison in terms of numerosity.

To implement this methodology in Nez Perce, seven test stimuli were constructed. The stimuli feature seven substances named by commonly used Nez Perce words: dirt (*’itx̂*), flour (*tuutnin’*), milk (*qahas*), cloth (*samq’ayn*), paper (*tiim’es*), water (*kuus*), and sugar (*cicyuk’is*). In order to ensure that all objects were interpreted on the same visual scale, the stimuli consisted of photographs of objects or portions on opposite sides of a wooden surface. Two example stimuli are shown in Figure 1. In addition to these test items, 10 additional stimuli were constructed, featuring objects rather than substances. Two examples of these stimuli are shown in Figure 2. The 17 photographs were arranged in pseudo-randomized order, varying objects versus substances as well as the side of the larger object/portion. While looking at each picture, two Nez Perce speakers (tested individually) provided answers to quantity judgment questions featuring adjectives and nouns.

In line with the findings from previous studies, quantity judgments with object nouns were reliably assessed in terms of number. Recall that when a quantifier complement containing an adjective is headed by an object root, the adjective is always plural (see (99)). An example question with an object root is shown in (107) with the corresponding schematic LF.

(107) Object root condition:

a. ’Isii-nm ’uu-s qetu ’ilex̂ni ti-ta’c ’ileeptekey?
who-GEN have-PRES COMP a.lot PL-good sock?
‘Who has more good socks?’

b. [Q [Num: [PL] [$\sqrt{}$ADJECTIVE $\sqrt{}$OBJECT-ROOT]]]

Comparison in terms of numerosity is correctly predicted here because the denotation of the object root $\sqrt{}$*’ileeptekey* ‘sock’ contains atoms.

When a quantifier’s complement is headed by a substance noun, an adjective contained in that complement need not be plural (see (99)). To assess the atomicity of substance root denotations, the baseline condition, shown in (108a), was a plural adjective condition. (The pluralized adjective is bolded.) The presence of plural morphology on the adjective indicates the presence of [PL] in the structure; in a quantifier complement headed by a substance noun, this requires α_n. The relevant portion of the schematic LF structure is shown in (108b).

(108) Plural adjective / substance root condition:

a. ’Isii-nm ’uu-s qetu ’ilex̂ni **ti-ta’c** qahas?
who-GEN have-PRES COMP a.lot PL-good milk?
‘Who has more portions of good milk?’

b. [Q [Num: [PL] [α_n [$\sqrt{}$ADJECTIVE $\sqrt{}$SUBSTANCE-ROOT]]]]

Given that α_n must be present in this structure, the complement of the quantifier has atoms in its denotation, and numerosity-based answers are predicted. This prediction is borne out: answers in the plural adjective / substance root condition were strictly based on numerosity, not volume (100% of responses).

For the comparison between Hypotheses 1 and 2 in (105)/(106), the crucial test case is the non-plural adjective / substance root condition. In this condition, as shown in (109), the absence of plural morphology on the adjective indicates the absence of [PL] in the structure. Without [PL], α_n cannot be present in a quantifier complement. Therefore, the interpretation of the quantity comparison must be based on the denotation of the root alone.

(109) Non-plural adjective / substance root condition:

a. ’Isii-nm ’uu-s qetu ’ilex̂ni **ta’c** qahas?
who-GEN have-PRES COMP a.lot good milk?
‘Who has more good milk?’

b. [Q [Num: – [$\sqrt{}$ADJECTIVE $\sqrt{}$SUBSTANCE-ROOT]]]

The finding for the non-plural adjective / substance root condition (109) contrasts markedly with the plural adjective / substance root condition (108). Answers in the

non-plural adjective / substance root condition were based strictly on volume, rather than on numerosity (100%). This provides evidence that substance roots by themselves do not have denotations that include atoms. In this they contrast with object roots, as shown in (107).

The overall conclusion is that Nez Perce noun roots show a countability distinction in terms of minimal parts. The results are summarized in table (110).

(110) Quantifier, adjective, noun: interpretation of comparison

	Q A(non-pl) N	Q A.pl N
Complement headed by object $\sqrt{}$	n/a (ill-formed)	**number** (107)
Complement headed by substance $\sqrt{}$	**volume** (109)	**number** (108)

The findings should be contrasted with the predictions that would be made if all nouns had atomic denotations in Nez Perce: we would expect numerosity-based comparison across the board. In actual fact, numerosity comparison somehow becomes unavailable when the quantity judgment question contains a substance root with a non-plural adjective.

One aspect of these findings that should be highlighted is the impact of the linguistic form of the quantity judgment question. Notably, the very same visual stimulus elicits a numerosity response for question (108) but a volume response for question (109). This finding is similar to what Barner and Snedeker (2005) report for English nouns like *rope(s)* and *rock(s)*. In their study, the same images elicit different responses for the question *Who has more rope?* versus *Who has more ropes?* Here, like in Nez Perce, plural marking in the morphology correlates with whether, in the semantics, the quantifier's complement contains atoms.

We have seen repeatedly that the PF realization of plural in Nez Perce is significantly more restricted than in English. In Nez Perce, when an adjective is *not* present in a quantity judgment question with a substance root, the result is structural ambiguity—a [PL] feature may be present in the LF, or not, with no change to the surface form. Example (111a) may receive either of the partial schematic LFs in (111b,c).

(111) No-adjective / substance root condition:

a. 'Isii-nm 'uu-s qetu 'ilex̂ni qahas?
who-GEN have-PRES COMP a.lot milk?
'Who has more (portions of) milk?'

b. [Q [Num: – $\sqrt{}$SUBSTANCE-ROOT]]

c. [Q [Num: [PL] [α_n $\sqrt{}$SUBSTANCE-ROOT]]]

Faced with this ambiguity, the two Nez Perce speakers consulted for this project pursue two different strategies. One speaker reliably gives volume-based answers in the no-adjective / substance root condition, suggesting she assumes (111b) for the LF of the question. The other speaker reliably gives numerosity-based answers in this condition, suggesting she assumes (111c) for the LF of the question. The first

strategy may result from a general avoidance of the null α_n structure in the absence of clear morphosyntactic evidence; the second strategy may result from the nature of the task, in particular the clear portioning-out of substances in the visual arrays.

4.4 Nez Perce countability: final review

In the vast literature on countability distinctions crosslinguistically, the emphasis is usually on number marking and numeral constructions. The initial data on number and numerals in Nez Perce suggest a system of noun denotations very different from English, as we saw in Sect. 3. This section started off with a reanalysis of those facts that makes Nez Perce root denotations considerably less exotic. Object roots like $\sqrt{}$*picpic* 'cat' and $\sqrt{}$*tiim'en'es* 'pencil' are quantized, just like their counterparts are in English. Substance roots like $\sqrt{}$*kuus* 'water' and $\sqrt{}$*samq'ayn* 'fabric' are homogeneous, just like their counterparts are in English. On this theory, Nez Perce has both countability distinctions found in English. The difference between the languages is small, and located in the functional lexicon. Nez Perce has a silent piece α_n that introduces variables over atomization functions. English does not.[37]

As far as numerals and number marking go, the hypothesis that Nez Perce makes countability distinctions is merely tenable. Where this hypothesis has started to have an empirical advantage is in two more complex types of data: the distribution of plural marking on adjectives in quantificational structures (Sect. 4.2), and the interpretation of quantity comparisons with adjectives (Sect. 4.3).

On the first count, we have seen that all Nez Perce quantifiers require cumulative complements. Object roots must be pluralized to combine with quantifiers; substance roots need not be. This supports a countability distinction in terms of sums. This pattern is distributionally quite subtle because plural is generally visible not on the noun itself, but only on adjectives that modify it.

On the second count, we have seen that quantity comparatives featuring object roots are always assessed in terms of numerosity, whereas quantity comparatives featuring substance roots may be assessed in terms of volume. Following Bale and Barner (2009), quantity comparatives are assessed in terms of numerosity whenever the quantifier combines with a complement whose denotation includes atoms. The finding on quantity judgments thus supports a countability distinction in terms of parts. This pattern, too, is quite subtle, because substance root quantity comparatives are assessed in terms of numerosity when α_n is present. The distinction between structures with and without α_n is visible only when an adjective is present.

The subtlety of the evidence for these distinctions raises serious questions for language acquisition. How exactly do Nez Perce speakers arrive at quantized denotations for object roots but homogeneous denotations for substance roots? How do they learn to posit α_n? Must they consider (and somehow rule out) the hypothesis that the language they are learning has no countability distinctions at all? In Sect. 6, I will

[37] Presumably English introduces atomization functions with nouns like *quantity*, *piece*, and *portion*, though I do not enter into a full analysis of these items here; see Chierchia (2010) for a proposal about how *quantity* is interpreted. Nez Perce lacks any overt nouns of this type. English coercions also presumably involve atomization functions, though these are restricted to packaging- and sorting-based atomization.

suggest some answers. First, it will be useful to briefly compare the Nez Perce situation with the situation in Yudja, another language where all nouns can freely combine with numerals.

5 Yudja: a perspective

Yudja is a Tupí language with about 300 speakers spread over six villages within the Xingú Indigenous Park, Matto Grosso, Brazil. Countability in Yudja has been discussed at length in recent work by Lima (2014). While Yudja and Nez Perce are not genetically or areally related, Lima's findings reveal that the countability phenomena of the two languages are nevertheless noticeably similar. Accordingly, I suggest that both languages should receive the same style of analysis—one based on the approach to Nez Perce developed just above.

In this section, I first divide the Yudja data and their (re)analysis into two parts. The first part features properties expected to diagnose a sums-based distinction: numerals and number marking. The second part features properties expected to diagnose a parts-based distinction: count adjectives and quantity comparatives. The facts in each area are readily accounted for on an approach to Yudja that involves countability distinctions at the root level plus covert α_n, just as developed for Nez Perce in the previous section. Having extended the Nez Perce analysis to Yudja, I conclude with a discussion of why Lima's analysis of Yudja could not, alternatively, be extended to Nez Perce, and note one potential Yudja-internal advantage of the present approach.

5.1 Numerals and number marking

We begin by assessing how nouns combine with numerals. In Yudja, as in Nez Perce, all nouns combine with numerals without any visible intermediary. There is no obvious difference in how object roots and substance roots behave. Compare (112), with object root $\sqrt{ba'ï}$ 'paca', to (113), with substance root $\sqrt{yukïdï}$ 'salt'.

(112) Txabïu ba'ï wãnã. (Lima 2014, p. 38)
three paca ran
'Three pacas ran.'

(113) Maria txabïu yukïdï apa. (Lima 2014, p. 38)
Maria three salt drop/fall
'Maria dropped three portions of salt.'

Also as in Nez Perce, substance nouns may be counted by salient portions, whether or not these correspond to conventional units (see Lima 2014, pp. 50–62 for further examples and discussion). The following examples show counting by non-conventional units; compare Nez Perce examples (23), (25), (27), and (29).

(114) (Maria was serving rice for the children and while she was doing that two small portions of rice fell over the chair)

Yauda awatxi'i pïkaha txade l-apa. (Lima 2014, p. 56)
two rice chair above INT-drop
'Two small portions of rice fell over the chair.'

(115) (João cut his finger and three drops of blood fell on the floor: one near the river, one near the house and another near the school.)

Txabïu apeta pe∼pe∼pe. (Lima 2014, p. 58)
three blood drip∼RED
'Three drops of blood dripped.'

If numerals require quantized complements, as we concluded in Sect. 2.3, then Yudja substance nouns must either be born quantized, or be subject to a rule or compositional strategy that maps them to quantized denotations. Following Chierchia 2015 and (in part) Lima 2014, I adopt the latter analysis.[38] In particular, I propose to analyze Yudja examples like (113)–(115) exactly like Nez Perce (65), repeated below with its schematic partial LF and overall sentence denotation:

(116) a. Lepit kike't hi-sseew-n-e. [Nez Perce]
two blood 3SUBJ-drip-P-REM.PAST
'Two drops of blood fell.'

b. [*lepit* 'two' [Num:− [α_n $\sqrt{}$*kike't* 'blood']]

c. $|\{x : AT_n(blood)(x) \wedge fell(x)\}| \geqslant 2$

My overall proposal for Yudja is just as for Nez Perce. Object roots in Yudja are quantized; substance roots are homogeneous; the lexicon contains α_n. Any NP in Yudja may have a quantized denotation, and this arises lexically for object roots but compositionally for substance roots. The elements of the quantized denotation for substance nouns are contextually determined, depending on the assignment of a particular atomization function to α_n.

We now turn to number marking. In Yudja, overt plural morphology is only possible for [+HUMAN] nouns. The example below shows the plural marker on *senahï* 'man'; *kota* 'snake' cannot take the plural suffix.

(117) Senahï-i kota ixu. (Lima 2014, p. 34)
man-PL snake eat
'(The) men eat(s)/ate a/the/some snake(s).'

These data are similar to Nez Perce, where plural on nouns is likewise restricted to the [+HUMAN] class. In both languages, [PL] features are available, and in limited environments, the morphology reveals them. In both languages, substance nouns don't have plural forms simply because they don't belong to the [+HUMAN] noun class. The absence of a plural form for substance nouns is uninformative regarding countability.

[38] Lima (2014) proposes that substance roots combine with a functional head n_{KO} in these examples, which maps them to sets of atomic portions of the substance *and sums thereof.* A [$n_{KO} + \sqrt{}$] constituent for Lima is therefore cumulative, though it does contain atomic parts. Recall that this is the profile of a denotation like $[\![\sqrt{}$*footwear*$]\!]$, which does not support direct combination with numerals.

One difference between the languages concerns agreement and concord. Unlike Nez Perce, Yudja does not expone plural on verbs or on adjectives. This means that the quantifier-adjective-noun paradigm that revealed a sums-based countability distinction in Nez Perce (Sect. 4.2) cannot be used to find positive evidence for a countability distinction in Yudja. If Yudja in fact makes countability distinctions in its root denotations, as I claim, these distinctions cannot be learned from the morphological distribution of plural. (In Sect. 6, I will propose that at least one of these distinctions does not have to be learned at all.) However, at the same time, the (very limited) morphological distribution of plural in Yudja poses no challenge for the claim that Yudja in fact makes countability distinctions at the root level.

5.2 Adjectives and quantity comparatives

Let us now consider phenomena that depend not on sums but on parts. In Yudja, as in Nez Perce, all nouns may combine with count adjectives, substance nouns again receiving an apportioned reading:

(118) Ma de urahu xãã / asa dju a'u? (Lima 2014, p. 184)
who big bowl / flour have
'Who has a big bowl / portion of flour?'

These data are parallel to Nez Perce (58), repeated below.

(119) a. himeeq'is kuus
big water
'(the) big portion of water'

b. himeeq'is picpic
big cat
'(the) big cat'
[Nez Perce]

The adjectives in these examples require their complements' denotations to contain minimal parts. This requirement is met by object roots by themselves, but by substance roots in combination with α_n; partial LFs for the Yudja examples in (118) are given in (120).

(120) a. [$\sqrt{}$*urahu* 'big' $\sqrt{}$*xãã* 'bowl']
b. [$\sqrt{}$*urahu* 'big' [α_n $\sqrt{}$*asa* 'flour']]

In quantity comparatives in Yudja, adult speakers assess comparison primarily in terms of numerosity both for object and for substance nouns.[39] (Lima reports data from 18 adult participants.) Example quantity judgment questions are shown in (121), and overall results are shown in (122).[40]

(121) Ma de bitu xãã / asa dju a'u? (Lima 2014, pp. 120–121)
who more bowl / flour have
'Who has more bowls / (portions of) flour?'

[39] Results for children are noticeably different; see Lima (2014, Sect. 3.4) for discussion.

[40] Lima also reports data on a separate category that she calls 'aggregate nouns', such as *abeata* 'clothes' and *wã'e* 'ceramics'. Results for these nouns were not significantly different from either object nouns or substance nouns, and so I omit this category for simplicity here.

(122) Percentage of judgments based on numerosity (Lima 2014, p. 122)

	Adult speakers (n=18)
Object nouns	85
Substance nouns	83

These findings suggest that both object and substance roots give rise to structures whose denotations contain minimal parts. Just as for count adjectives, object roots provide minimal parts in virtue of their lexical denotations; substance roots do so in virtue of their combination with α_n. The strong preference for numerosity-based comparison with substance roots suggests that the presence of α_n is preferred, or assumed by default, in the context of the comparative quantifier *bitu* 'more'. Overall, the Yudja speakers behave like the Nez Perce speaker who reliably gave numerosity-based responses to quantity judgment questions without adjectives (e.g. (111)): they assume by default that α_n is present, even in the absence of positive evidence.

5.3 A Nez Perce take on Yudja, or a Yudja take on Nez Perce?

So far we have seen that Yudja may, after all, have semantic countability distinctions at the root level, but that the morphology of α_n and [PL] conspires to conceal them. In Nez Perce, while α_n is always covert, [PL] is routinely overt on adjectives; this makes it possible to confirm countability distinctions through morphological evidence. In Yudja, both α_n and [PL] are always covert (outside of the [+HUMAN] noun class, at least), and overt morphological evidence cannot be mustered. Absence of evidence not being evidence of absence, this situation does not require us to conclude that there are natural languages without countability distinctions. At the same time, it pushes us to ask just how different Nez Perce and Yudja could possibly be, given that Nez Perce but not Yudja has morphological evidence for countability distinctions.

One way to approach this question is to contrast the analysis of Yudja just provided with the theory developed by Lima (2014). On Lima's analysis, all roots in Yudja are treated in a formally identical way, as denoting kinds. Non-kind-level denotations come about when roots combine with a null functional element, *n*, which map kinds to sets of atoms and sums thereof. Notably, substance nouns and object nouns are formally identical on this view, both at the root level and in combination with functional material. That is to say that substance nouns and object nouns are equal regarding sums, equal regarding parts, and equal in how they come to have the type of denotation they have (i.e. via lexical specification or via combination with functional material). This view is summarized in (123).

(123) Lima (2014) on Yudja

Denotation is a kind	*Denotation is a set of atoms and sums thereof*
Substance root	Substance root + *n*
Object root	Object root + *n*

On this analysis, there are no countability distinctions in Yudja.

Could this style of analysis be extended to Nez Perce? No. We have seen that Nez Perce makes a countability distinction regarding *sums* in its quantifier-adjective-noun

combinations (Sect. 4.2). We have also seen that Nez Perce makes a countability distinction regarding *parts* in the interpretation of quantity comparatives with adjectives (Sect. 4.3). Neither finding can be accounted for without a distinction between substance roots and object roots.

This leaves two possibilities: either Nez Perce and Yudja are simply different, with Nez Perce but not Yudja making countability distinctions and containing α_n, or (as outlined thus far in this section) both Nez Perce and Yudja have countability distinctions and a null element α_n. If, following the first possibility, Nez Perce has countability distinctions but Yudja does not, the learner must find some trigger that enables her to converge on the correct grammar in each case. What in Nez Perce tells the child that she is not learning Yudja? What in Yudja tells the child that she is not learning Nez Perce? Constructions with quantifiers, adjectives, and nouns are extremely rare in Nez Perce, and therefore seem unlikely to be the answer. (I elaborate on this point in Sect. 6 and the Appendix.) The question is avoided if both languages have countability distinctions, as per the analysis developed earlier in this section. Children learning either Yudja or Nez Perce must learn that their language contains α_n; they must learn how and when plural is pronounced in their language. But they do not need to decide between a no-distinctions theory and a distinctions-plus-α_n theory. In the next section I will suggest that the no-distinctions theory is actually off the table in language acquisition, given certain innate strategies for acquiring the meaning of novel nouns.

Before doing so I would like to point out a small empirical advantage of the distinctions-plus-α_n theory internal to the analysis of Yudja. On this theory, a root like $\sqrt{}$*asa* 'flour' is itself homogeneous; it becomes quantized only in combination with α_n. If the root could appear in a quantity comparative *without* α_n, as it does in Nez Perce (109), we would expect the comparison to be assessed in terms of volume, rather than numerosity. And indeed, the availability of non-atomic denotations for substance nouns proves relevant for the interpretation of single-portion comparatives like (124). In this quantity judgment task, participants were asked to choose between two sides that did not differ in numerosity; they differed only in volume. Lima reports that of 20 adult Yudja speakers surveyed, 88% picked the larger pile in this instance.

(124) Context: there is one large pile of flour and one small pile of flour.

Ma de bitu asa dju a'u? (Lima 2014, p. 132)
who more flour have
'Who has more flour?'

This result is surprising if the only non-kind-level denotation for *asa* 'flour' is a set containing atomic portions of flour and sums thereof. (For Lima (2014), the atoms are maximal self-connected portions.) Because such a set contains atoms, the comparison should be assessed in terms of number, rather than volume. But given that each side has the same number of maximal self-connected portions of flour, this interpretation leads to a conflict with the presupposition of the question. In English, this situation simply leads to an infelicitous question:

(125) Context: as in (124).

Who has more piles of flour?

Lima does not report that her consultants find question (124) objectionable, and their responses are not at chance. Rather, what their responses suggest is that they have interpreted (124) as simply containing $\sqrt{asa}$ 'flour' as the complement to *bitu* 'more', rather than $[\alpha_n\ \sqrt{asa}]$. In other words, when their preference for α_n in the complement of *bitu* 'more' leads to an inappropriate presupposition, they abandon the preference, and the homogeneous nature of $\sqrt{asa}$ 'flour' starts to shine through. Single-portion comparatives thus provide evidence that Yudja speakers have access to an interpretation of a quantity judgment question that lacks α_n and so allows assessment in terms of volume.[41]

6 Conclusions: semantic variation and language acquisition

This study has two main conclusions. One concerns what countability distinctions are; the other concerns the extent to which they vary crosslinguistically.

The first conclusion is very simple: countability distinctions come in more than one variety. Therefore, in order to assess crosslinguistic variation in countability, we must be clear about what distinction we are assessing. The distribution of numerals and number marking reflects one countability distinction; count adjectives and quantity comparatives reflect another. On this point my conclusion follows many antecedents (e.g. Doetjes 1997, Bale and Barner 2009, Rothstein 2010, Landman 2011, Grimm 2012). On the basis of English aggregate nouns like *footwear*, I have adopted a particular take on the two distinctions, which links plural and number marking to a countability distinction based on sums, in particular cumulativity; in contrast, count adjectives and the interpretation of comparatives are linked to parts, in particular to the nature of minimal parts. This may of course ultimately turn out to be the wrong way to go in terms of encoding the two distinctions. That in itself would not obviate the need for two distinctions rather than simply one "mass/count distinction."

The second conclusion concerns whether there are languages that lack countability distinctions. Versions of a 'yes' answer have circulated in the field for many years; for instance, seminal work by Krifka (1995) and Chierchia (1998b) held up Mandarin Chinese as a language "without the mass-count distinction." As we have seen, the recognition of two countability distinctions rather than just one refines this picture. As Doetjes (1997), Cheung et al. (2010), and Landman (2011) have now shown, the absence of countability distinctions in Mandarin is only partial. Mandarin

[41] A follow-up prediction is that single *object* comparisons should allow no such strategy. If asked to compare a single large bowl and a single small bowl, for instance, Yudja speakers should reject (i), just as English speakers reject its English translation:

(i) Ma de bitu xãã dju a'u?
who more bowl have
'Who has more bowls?'

Lima does not report data on this type of quantity judgment task.

is a language without a sums-based distinction (all root denotations are cumulative) but with a parts-based distinction (some root denotations but not others contain minimal parts). A similar situation seems to hold in Japanese (Inagaki and Barner 2009). Languages of this type suggest that there is some variation in the extent to which languages encode countability.

Are there languages that lack countability distinctions altogether? In particular, are there languages in which all noun roots behave like English core count roots? The main empirical project of this paper has been to build an argument for 'no', and the form of that argument goes by way of the question of language acquisition. We have seen that there is a human language, Nez Perce, where

(126) a. all nouns may appear bare in argument position (Sect. 3.1)
b. all nouns combine with numerals using the same surface morphosyntax (Sect. 3.2)
c. all NPs allow plural marking on adjectives in the same way (Sect. 3.3)
d. all nouns can combine with count adjectives like 'small' and 'large' (Sect. 3.4)
e. all nouns can combine with all quantifiers (Sect. 4.2)

These generalizations cover a range of high-frequency patterns. In all of these areas, Nez Perce fails to show the distributional differences between object and substance nouns that jointly constitute the standard diagnostics for countability. But we have also seen that Nez Perce is *not* a language without countability distinctions. There are two areas where countability distinctions emerge in this language:

(127) a. In a [Quantifier [Adjective Noun]] structure, the adjective must be plural-marked if the noun is an object noun, but not if the noun is a substance noun (Sect. 4.2)
b. In a quantity comparative, comparison may be assessed on volume with a substance noun, but only on numerosity with an object noun (Sect. 4.3).

I have argued that the first of these patterns reflects a countability distinction related to sums, whereas the second reflects a countability distinction related to parts. In both cases, the crucial evidence comes from the form and interpretation of [Quantifier [Adjective Noun]] structures, in particular those with non-plural adjectives. The key results are summarized in (99) and (110), repeated below.

(128) Quantifier, adjective, noun: grammaticality judgments *((99) above)*

	Q A(non-pl) N	Q A.pl N
Complement headed by object $\surd$	*	✓
Complement headed by substance $\surd$	✓	✓ (α-based structure)

(129) Quantifier, adjective, noun: interpretation of comparison *((110) above)*

	Q A(non-pl) N	Q A.pl N
Complement headed by object $\surd$	n/a (ill-formed)	**number**
Complement headed by substance $\surd$	**volume**	**number**

In contrast to the high-frequency patterns listed in (126), [Quantifier [Adjective Noun]] structures are essentially unattested in ordinary conversation and in corpora of traditional stories. (Quantitative evidence for this claim is reviewed in the Appendix.) This suggests that Nez Perce speakers have probably encountered very few [Q [A N]] structures in the course of language acquisition, and correspondingly, that exposure to those structures is unlikely to be the cause of countability distinctions in their adult grammars. Furthermore, we have seen some preliminary evidence of a countability distinction in Yudja as well (Sect. 5.3), in spite of the absence of any known morphosyntactic trigger in that language. Altogether, these facts suggest that semantic distinctions related to countability emerge whether or not a language learner encounters major morphosyntactic evidence. Positing one or more semantic countability distinctions may simply be a built-in step in the process of acquiring a natural language.

This conclusion dovetails with experimental results by Soja et al. (1991), based on the early acquisition of English. In a series of experiments, Soja and colleagues show that young toddlers who have not yet mastered the syntax of countability (e.g. determiner use and plural) use a cognitive distinction between objects and substances to guide their induction of the meaning of novel words. When presented with a novel word in the context of a novel object, children conclude that the word also describes other objects of the same type; when presented with a novel word in the context of a novel substance, children conclude that the word also describes other portions of the same substance. Children show the same patterns of induction whether the novel word is presented in distinctive count/mass syntax (such as "a blicket" vs. "some blicket") or in neutral syntax ("my blicket"). Soja and colleagues conclude that children come to the task of language acquisition with a basic cognitive distinction between objects and substances already in place, and that this distinction forms the basis for two central acquisition procedures:

(130) *Procedure 1* (Soja et al. 1991, pp. 182–183)

Test to see if the speaker could be talking about a solid object; if yes, conclude the word refers to individual whole objects of the same type as the referent.

Procedure 2

Test to see if the speaker could be talking about a non-solid substance; if yes, conclude the word refers to portions of substance of the same type as the referent.

If strategies along this line reflect a universal of language acquisition, it is no longer a mystery how Nez Perce or Yudja speakers could have arrived at a special representation for substance nouns in the absence of useful linguistic input. They have simply followed an innate strategy of language acquisition which predisposes them to adopt distinct semantic profiles for object- and substance-denoting nouns.

It is straightforward to link the Soja et al. procedures to the particular semantics proposed here for object and substance roots. This can be done as in (131), following the lead of Chierchia (1994).

(131) *Procedure 1′*

Test to see if the speaker could be talking about an object; if so, conclude that the extension of the noun root contains atoms of the same type as the referent.

Procedure 2′

Test to see if the speaker could be talking about a substance; if so, conclude that the extension of the noun root is a g-homogeneous join semilattice of stuff of the same kind as the referent.

On this version, the object/substance distinction guides learners to posit a countability distinction in terms of parts. Presumably only this distinction should arise as a function of innate strategies, if languages like Mandarin Chinese and Japanese do not make a countability distinction in terms of sums. The distinction in terms of sums must somehow be triggered in languages like English and Nez Perce, and the readiest candidate for a morphosyntactic trigger is the existence of pure [PL] features in the NP. In a language with pure [PL] features (i.e. [PL] features independent of definiteness), object root denotations are sets of atoms; object root denotations are quantized.

In a language with ample syntactic evidence of countability distinctions, the results from the strategies in (131) are capable in principle of being overruled or complemented by language-specific choices that a child can learn from the input. An English-speaking child must somehow learn, for instance, that *rice* is mass but *bean* is count. The possibility of rote learning in languages with rich morphosyntactic countability diagnostics makes room for some arbitrariness in countability distinctions, along with the persistent connection between semantic countability and the cognitive difference between substances and individuals. All children start with the strategies in (131), ignoring any evidence from their particular language (if any such evidence is available); subsequently, those learning languages with rich morphosyntactic evidence make appropriate revisions and extensions. If, in the absence of evidence to the contrary, learners simply apply the strategy in (131), the result will be that every language has some homogeneous roots and some atomic roots, and that the difference tracks the cognitive object/substance distinction in broad terms, but nothing further – as seems correct.

The picture that emerges is one that affirms the underlying unity of human languages and the deep connections between language and the way that humans perceive the world. If our discussion is on the right track, then while there may be languages without any surface morphosyntactic difference correlated with countability, there could not be a natural language without any countability distinction in the semantics of its nominal roots. Innate strategies for acquiring root meaning make it impossible to learn a language with no countability distinctions.

Appendix: Quantifier, Adjective, Noun in a Nez Perce corpus

To assess the frequency of [Quantifier [Adjective Noun]] structures in naturally occurring Nez Perce, a corpus study was conducted. The corpus was a digitized version of the largest modern collection of Nez Perce texts, Aoki and Walker's (1989) *Nez*

Perce oral narratives, comprising 630 pages of interlinear text with free translation. Each of the six D-quantifiers introduced in Sect. 4.2 was searched for, taking into account phonological alternations. Results were tabulated based on the category of the word(s) immediately following the quantifier. Quantifiers followed by periods or words other than nouns or adjectives were tabulated separately (category "Q –" in (132)). Spurious lexical matches (e.g. *mac'ayo* 'ear' for *mac* 'how many') were discarded. Results are presented in (132) as raw string counts.

(132) Raw string counts, Aoki and Walker (1989) corpus

Quantifier	String type			
	Q –	Q N	Q A	Q A N
'oykala 'all'	32	6	3	1
la'am 'all'	158	52	5	2
'ilex̂ni 'many/much'	67	38	1	0
miil'ac 'few/little'	4	3	0	0
mac 'how many/much'	24	0	0	0
tato's 'some (of)'	6	1	0	0
TOTAL all quantifiers	291	100	9	3

While the Aoki and Walker (1989) corpus contains interlinear glosses, it does not contain syntactic annotation for constituency. Therefore, in order to keep the search procedure simple and replicable, no attempt was made to exclude matching strings that were not constituents. The following examples, for instance, contain Q N strings that are clearly non-constituents, given (among other things) their free translations and the absence of plural marking on the [+HUMAN] noun following the quantifier.[42] In presenting the examples here, I have added basic constituent boundaries for clarity. These examples were binned as Q N, meaning that the raw Q N string count in (132) overestimates the actual occurrence of [Quantifier Noun] constituents.

(133) Ha-ani-∅-ya [$_{object}$ 'ilex̂ni] [$_{subject}$ 'aayat].
3SUBJ-make-P-REM.PAST [many] [woman]
'The woman made many.' (Aoki and Walker 1989, p. 600)

(134) Kee [$_{subject}$ 'oykal-oo-m] [$_{object}$ haama] wi-s-ii-ne.
HORT [all$_1$-HUM-GEN] [man.NOM] have-IMPRF-PL-REM.PST
'Let everyone have a man.' (Aoki and Walker 1989, p. 188)

The same overestimation problem applies to the three Q A N strings identified: these are clearly not constituents, but rather strings wherein quantifiers happen to find themselves adjacent to [Adjective Noun] constituents (or even [Adjective] [Noun] structures). In the first instance, *'oykala* 'all$_1$' is glossed by Aoki and Walker (1989) as 'all over', and the subsequent string *ta'c 'iniit* 'good house' is not plural (despite being headed by an object root; cf. (81)–(86)). Both factors suggest that the quantifier does not form a constituent with the adjective and the noun.

[42] In addition, in (133), verb agreement identifies the subject as clearly singular (given that it is animate); a subject containing the quantifier *'ilex̂ni* 'many' would not be singular. In (134), the quantifier and the noun do not match in case.

(135) Q'o' [*adverbial* 'oykala] [*object* ta'c 'iniit] 'e-w-s-iix
quite [all.over] [good house] 3GEN-have-PRES-PL

kaa pe-wwetes nukt.
and DIST-earth meat.
'They have a good house and meat everywhere.' (Aoki and Walker 1989, pp. 600–601)

In the second instance, the quantifier again seems to have an adverbial use; the sentence expresses an individual's desire to become a (single) handsome person, not a group of handsome people. Once again, the [Adjective Noun] constituent following the quantifier is not plural, despite being headed by an object root. This again suggests that no [Quantifier [Adjective Noun]] constituent is present here.

(136) Kaa ta'c qo' ke-x wice-s 'inaa-samq-it wispool-nim
then good quite HORT-1 become-PRES 1REFL-dress-PART buckskin-GEN
[*adverbial* la'am] [*object* ta'c titooqan].
[all_2] [good person]
'Let me become dressed up in good buckskin. Let me be a handsome person.' (Aoki and Walker 1989, p. 514)

In the third and final instance, the quantifier *la'am* 'all_2' bears a glottal stop suffix which unambiguously marks an adverbial use (Aoki 1994, pp. 320, 959). The sentence is an adjectival passive construction where the adjectival passive participle is *'inyiin* 'given'. It is likely that there is not even an [Adjective Noun] constituent here.

(137) Kaa kal'a hi-wee-ke [*adverbial* la'am-'] [*participle* 'in-yiin]
then just 3SUBJ-be-PAST [all_2-ADV] [give-PART]

[*object* we'niikt] pa-kkoonapii-nix.
[name] DIST-that.way-EMPH
'They were all given names, each in that very way.' (Aoki and Walker 1989, p. 404)

I conclude that, while the Aoki and Walker (1989) corpus contains Q A N *strings*, along with a variety of syntactic structures more complex than those encountered in daily life, it nevertheless does not contain [Quantifier [Adjective Noun]] *constituents*, regardless of plural marking on the adjective.

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