L1 Acquisition of Count-Mass Distinctions in English and the Interplay between Ontology, Semantics, and Syntax

英語に於ける第一言語獲得時の可算・不可算の習得

～オントロジー，概念，文法の相互関係の観点から～

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1. Introduction

The count/mass distinction in English is complex and dauntingly difficult to master for L2 learners, especially for those whose native languages make neither the count/mass nor singular/plural distinction. The difficulties come from the complexity of mapping between ontology (i.e. language-independent cognitive disposition), semantic categorization (i.e. conceptualization), and syntax (i.e. language specific grammatical categories, or linguistic convention). Semantically, it is generally agreed that a count noun refers to an individuated countable object and a mass noun to an unindividuated substance or a notion and that the syntactic count/mass distinction prototypically reflects the ontological and semantic object/substance distinction.

L2 learners would find no problems if there were no mismatch between ontology, semantics, and syntax. There are, in fact, many mismatches. The most typical example is superordinate mass nouns, such as '*furniture*', which syntactically behave as mass nouns but perceptually denote multiple objects. Other mapping mismatches include: 1) perceptually countable entities making mass nouns (e.g. *toast*); 2) dual class membership nouns with both a count and a mass sense, referring to a same physical entity (e.g. *rope*); 3) similar physical entities making count or mass nouns (e.g. *pebbles* vs. *gravel*); 4) superordinate count/mass nouns (e.g. *vehicle* vs. *furniture*); 5) abstract entities (e.g. *idea* vs. *advice*); 6) events (*explosion* vs. *sleep*); 7) aggregate count/mass nouns (*oats* vs. *chaff*); 8) pluralia tantum (e.g. *groceries*); 9) NP-type nouns (e.g. '*school*' in '*She is in school*.').

Several factors are involved in the mapping failure, among which the most important is the fact that the count/mass distinction allows a wide range of semantically malleable entities and that conceptualization can exert influence on count/mass distinctions, causing a shift in conceptual space and turning a typical count noun into a mass noun or a typical mass noun into a count noun. Another important factor is that the count/mass distinction is asymmetric. Mass nouns can denote individuals (e.g. *furniture*) as well as nonindividuals (e.g. *string*), while count nouns denote only individuals. Some linguists and developmental psychologists (Gordon 1985, 1988; Barner & Snedeker 2005, 2006) cast doubt on the claim that the count/mass distinction is based on the object/substance distinction. Children's notion of individuation is rigid and covers a wider range of entities than the notion of a whole object (e.g. holes, parts of an objects), while their notion of substance is neither

clear nor strong.

Is there any ontological or conceptual basis for these seemingly arbitrary phenomena? If ontology alone determines the count/mass distinction, then all languages that make the distinction should share the same system. In fact, count/mass distinctions vary from language to language. If conceptualization is the determining factor, any count noun can be a mass noun and any mass noun can be a count noun. There should be no syntactic constraints and should be no problems with '**I ate two toasts*.' or '**I saw two lightnings*.' If syntax plays the determining role, the count/mass distinction should be as rigidly fixed as gender or the past tense markers, and there should be no room for conceptualization. The purpose of this paper is to explore how English-speaking children acquire count/mass distinctions and clarify the interplay between ontology, semantics, and syntax with regard to the acquisition of count/mass distinctions.

2. Language acquisition, ontology, and syntax

2.1. Prelinguistic ontological knowledge

Mapping between ontology, semantics, and syntax has been discussed from two opposing views of nativism and empiricism. Nativists presuppose the innate language-independent cognitive disposition and claim that ontology affects conceptualization (semantic categorization), which in turn affects syntax. Empiricists deny innate knowledge, claiming that syntax affects semantic categorization. A typical empiricist view is expressed by Quine (1960), who claims that children's acquisition of the count/mass distinction develops from morpho-syntactic features of a particular language and is not based on the prelinguistic knowledge of the object/substance distinction. Quirk et al (1985: 248) take the same view: "[T]he justification for the count/mass distinction is based on the grammatical characteristics of the English noun."

A lot of research has been done by developmental psychologists to determine whether the count/mass distinction is rooted in prelinguistic knowledge or whether syntax provides the foundations for the conceptual development of the distinction. Studies by developmental psychologists clearly deny the Quinian view and indicate that the object/substance distinction and the concept of individuation are prelinguistic. Spelke (1990, 1994) and Spelke et al. (1994) showed that concrete objects are individuated prelinguistically. Soja et al. (1991) found that English-speaking 2-year-olds differentiate objects and substances before they acquire count/mass syntax and that no effect of syntax was found on the children's object/substance distinction.

In these experiments with English-speaking children, the possibility of the influence of syntax cannot be eliminated. Imai and Gentner (1997) tested Japanese-speaking children, whose language does not make the syntactic count/mass distinction, and compared the results with those of English-speaking children. They found that both Japanese and English-speaking children at the age of two distinguished complex objects from substances and treated complex objects as individual entities.

Wynn (1992) found that 5-month-old infants can perform simple arithmetical operations with Mickey Mouse dolls, such as $1+1=2$ and $2-1=1$. This indicates that infants, presumably in the

prelinguistic stage, have the concept of individuation. She concluded (1992: 750): "Infants are predisposed to interpret the physical world as composed of discrete individual entities... Thus, the notion of 'individual entity' plays a prominent role in infants' conceptualization and representation of the physical world." Wynn et al. (2002) found that 5-month-old infants can individuate collective entities and treat a collection as an individual for enumeration purposes, which suggests that infants have an abstract concept of individuation. This ability of individuation may not be species-specific. Hauser (2000) demonstrated that wild rhesus monkeys without training can perform a virtually identical version of Wynn (1992)'s tasks.

The object/substance distinction and the concept of individuation are prelinguistic and perhaps innate. Then, the next question is if there is one-to-one mapping between prelinguistic knowledge and syntax and when children start to map syntactic information onto their conceptual categorization of objects and substances.

2.2. Interplay between ontology and syntax

Morpho-syntactically, count and mass nouns are distinguished basically by three features: 1) count nouns cannot stand alone in the singular while mass nouns can; 2) count nouns can be pluralized while mass nouns cannot; 3) count nouns can occur with the indefinite article while mass nouns cannot. Kouider et al. (2006) found that 24-month-old infants, but not 20-month-olds, distinguish the meaning of the singular and plural markers. Children understand that the plural marker *are* (or perhaps *are some*) in "*Look, there are some blickets*." refers to a plurality of objects and that the singular marker *is* (or perhaps *is a*) in "*Look, there is a blicket*." refers to a single object. They also found that 36-month-olds can rely on noun plural morphology alone ("*Look at the blickets*." vs. "*Look at the blicket*.") to distinguish one object from a plurality of objects.

As for the count/mass distinction, Gordon (1988) found very early evidence for a count/mass distributional distinction (the earliest use of mass nouns at the age of 1 year and 11 months) through his analysis of the longitudinal speech data of two children (SM from 1; 9 to 3; 6 and HS from 2; 3 to 3; 5). Soja (1992) tested two groups of children, a 2-year-old group and a 2 ½ year-old group to investigate how they construe objects and substances in two different conditions: 1) the matching condition, in which objects were labeled with count nouns and substances with mass nouns; 2) the conflicting conditions, with objects in mass syntax and substances in count syntax. Both groups responded on the object trials according to shape in both matching and conflicting syntax (2-year-olds = 77% in conflicting syntax vs. 86% in matching syntax; 2 ½-year-olds = 76% vs. 90%). On the substance trials, both groups responded at a chance level in conflicting syntax (2-year-olds = 45%; 2 ½-year-olds = 51%), while in matching syntax, a significant effect of syntax was found on 2 ½-year-olds (91% vs. 2-year-olds = 68%).

Barner & Snedeker (2006) tested 3-year-old children and adults to see if they use count/mass syntax to guide word extension and quantification with three types of stimuli (simple objects, complex objects, nonsolid substances) in matching and conflicting syntax. They found no difference between 3-year-olds and adults for word extension, while they found that children were affected by referent type more than adults for quantity judgment.

The adults extended items used in count syntax by shape 75% of the time and the children 74%, compared to 24% (adults) and 44.8% (children) for items used in mass syntax. The adults used mass-count syntax to guide quantity judgment, basing judgments on number 91.7% of the time and children 75% for items used in count syntax, compared to 13.5% (adults) and 53.1% (children) for items used in mass syntax. Children responded at a chance level with nonsolid substances in count syntax for both word extensions and quantity judgments, while with complex objects in mass syntax, they based their judgments on shape and on number 60-75%. Mass syntax did not force an unindividuated construal of objects in 3-year-old children and count syntax did not force an individuated construal of nonsolids.

For the adults, there was a significant effect of syntax on their quantity judgment of all three types of stimuli especially in conflicting syntax. They based their quantity judgment of simple objects on number almost 0% in mass syntax compared to about 75% for children; of complex objects in mass syntax, 30% (adults) vs. 75% (children); of nonsolid substances in count syntax, 80% (adults) vs. 50% (children). These data show a clear and significant influence of syntax on adults in quantity judgment, but not in word extension. It appears that adults retain the shape/individuation bias and they base their judgment on shape in word extension in a similar way to 3-year-old children.

Yoshida & Smith (2005) tested 2-year-old Japanese-speaking children to examine how the presence of correlated linguistic cues to category structure influences learning about perceptual cues. The children were taught novel names for solids in shape-based categories and for nonsolids in material-based categories. The children were divided into four groups depending on the following conditions: 1) both training and test with correlated linguistic cues, 2) training with cues and test without cues, 3) training without cues and test with cues, 4) both training and test without cues. They found that children without training overgeneralized the names by shape for both solids (78%) and nonsolids (68%). Children in all four conditions extended names for solids by shape, while their performance with nonsolids depended on their training condition. Only children with training showed material-based extensions for nonsolids and the children with both training and test with cues showed a significantly higher performance rate (77%) compared with children tested without cues (46%).

These findings suggest that children's conceptual categorization of solid objects is relatively rigid and stable to the extent that they ignore conflicting syntactic information, while that of nonsolid substances requires syntactic encouragement. This is supported by Soja et al. (1991), who found that 2-year-olds were more consistent with a solid object than with a non-solid substance in differentiating objects from substances. Children's ontological knowledge of solid objects and concept of individuation mostly coincide with the semantic and syntactic categorization of count nouns, while that of nonsolid substances does not fit very well into the grammatical categorization of mass nouns. Children at the age of 2, 2 ½, and 3 years have not acquired the semantic categorization of mass nouns and they need syntactic encouragement to conceptualize nonsolid substances as a semantic category of mass nouns.

2.3. Conceptual and grammatical categorization of collective nouns

Gordon (1985) tested four different age groups of children (2, 3, 4 and 5 years old) to investigate how they recognize superordinate mass nouns (e.g. *furniture*), which syntactically behave as a mass noun but perceptually refer to multiple objects. He predicted that children would recognize superordinate mass nouns as a class of objects and miscategorize them as count nouns. Against his prediction, children recognized superordinate mass nouns as mass nouns and superordinate count nouns (e.g. *toy*, *pet*, *flower*) as count nouns. Very few made morpho-syntactic errors ("**Furnitures*" to "*Do you know what you get in a furniture store?*").

Barner & Snedeker (2006) tested 3-year-old children with count-mass flexible terms (*string*, *chocolate*, *paper*, *stone*), and found that children based judgments on number more often in count syntax than in mass syntax (77.1% vs. 43.8%). In another set of experiments with the same flexible terms with 4-year-olds, Barner & Snedeker (2005) found the results 95% vs. 25% (adults: 97% vs. 3%).

Bloom et al. (1995) tested three different age groups (4-, 5-year-olds, and adults) to examine how collective nouns (e.g. *family*) are conceptualized in relation to syntax. They found the effects of syntax on the conceptualization of multiple objects as a collection or individuals. Seeing a zip-loc bag containing four objects labeled with a novel word in a singular count syntax or a plural count syntax, they showed a main effect of syntax. They interpreted the novel words as collective nouns, 73% in the singular syntax and 23% in the plural syntax. 4-year-olds showed no main effect (60% vs. 35%), while a main effect was found in 5-year-olds (73% vs. 13%) and a strong effect in adults (98% vs. 20%). They also found a gradual increase with age in the tendency to construe a singular noun as referring to a collection and no such increase in the tendency to treat the plural count noun as an object name.

These findings suggest, with regard to the count/mass distinction, that syntax starts to influence the construal of familiar collective nouns at the age of two and that children become able to extend the semantic categorization of mass nouns to novel words at around five. This is supported by Imai and Gentner (1997), who found that English-speaking children from 2 years onward projected nouns according to common shape for simple and complex objects, while Japanese children showed a strong material bias from late 2 years old on.

2.4. Linguistic knowledge and perceptual alteration

It appears that children do not have a clear semantic categorization of mass nouns prelinguistically and they acquire it as they grow older with more linguistic experience (i.e. syntactic information). On the other hand, they prelinguistically have the concept of individuation and solid objects, which coincide with the grammatical categorization of count nouns in English, and the shape bias is encouraged by the language. Children born in a classifier language, such as Japanese and Yucatec (refer to Lucy & Gaskins 2001), are encouraged to develop the material bias. English-speaking children apply a shape bias to a broader range of things than Japanese speaking children (Imai & Gentner 1997).

Based on the findings of Imai & Gentner (1997), Yoshida & Smith (2003) suggested that

linguistic knowledge may alter the way of perceptual information to be weighted and conceptualized, and propose the boundary shift hypothesis, which claims that the linguistic boundary between individuals and nonindividuals influences the perceptual boundaries between ontological kinds of solid objects and nonsolid substances. Imai (2000), with the data of Imai & Gentner (1997) and Imai & Mazuka (1997, as cited in Imai 2000), concluded: "it is when the perceptual affordance of the entity is weak and ambiguous that language exerts its maximum influence." (p. 157).

Gentner & Boroditsky (2001: 230) propose the individuation continuum, which lists semantic entities from the easiest to individuate at the left end to the most difficult at the right end, starting with humans as the easiest, then animals, vehicles, and amorphous entities (e.g. water) at the other end. A similar diagram of the continuum of perceptual properties is proposed by Yoshida & Smith (2003: 33), with a person at one end and water at the other end. Gentner & Boroditsky (2001) argues that as we move rightward, more experience with language is required to individuate semantic entities. Yoshida & Smith (2003) suggest that everyone, regardless of their linguistic background, is strongly biased to conceive of a moving, talking, arguing person as animate and splashing water as a substance. They argue that the learned properties of these two kinds at both ends of the continuum are so dense that they are almost immune to effects of language.

Children have the prelinguistic knowledge of the object/substance distinction and the concept of individuation, and adults retain this shape/individuation bias. The English language encourages this bias, while classifier languages encourage the material bias. The individuation continuum has a wide range of semantically malleable entities and the linguistic boundary between individuals and nonindividuals varies from language to language. These arguments predict that typical individuated objects (i.e. a separately movable bounded solid object: e.g. cars, dogs) are most likely to be conceptualized cross-linguistically as countable and typical nonsolid substances (e.g. water) as uncountable and that conceptualization of count/mass malleable entities (e.g. superordinate terms, abstract entities) varies from language to language.

2.5. Cross-linguistic study of count-mass distinctions

Thirteen different languages (ten language families) are examined to investigate how typical count nouns, mass nouns, and count/mass flexible nouns in English behave in other languages (Table 1). In the questionnaire, a native speaker of each language was asked to translate English sentences with listed nouns into their languages: e.g. I have advice/*I have an advice/*I have one advice/*I have two advices/*I have advices. Twenty English nouns are examined, which include two typical concrete count nouns (*dog*, *car*), one typical concrete mass noun (*water*), two count/mass flexible concrete nouns (*cake*, *rope*), and fifteen mass nouns that are often cited in ESL grammar books as count/mass confusing nouns to L2 learners. The count/mass distinctions of the English nouns are based on five learners' dictionaries (listed in the bibliography). Table 1 provides a general view of how count/mass distinctions vary from one language to another, and minute details of usage are left out (e.g. some mass nouns may behave as a count noun when referring to the type).

In Table 1, the languages are arranged horizontally in the order that the language in the left end has most mass nouns and that in the right end has least. (Nouns with both count and mass

Table 1

Germanic		Turkic		Bantu		Italic		Germanic		Slavic		Japonic		Germanic		Finno-Ugric		Greek		Sino-Tibetan		Italic				Austronesian	
English		Turkish		Bemba (Zambia)		Spanish		Dutch		Serbian		Japanese		German		Finnish		Greek		Chinese		French		Italian		Malay	
dog	C	köpek	C	imbwa	C/ZS	perro	C/ZS	hond	C	psa	C	inu	C/ZS	Hund	C	koira	C	skilo	C/ZS	gou	C	chien	C	cane	C	anjing	C/ZS
car	C	araba	C	motoka	C/ZS	coche	C/ZS	auto	C	automobil	C	kuruma, jidousha	C/ZS	Auto	C	auto	C	aftokinito	C/ZS	che	C/ZS	voiture	C	macchina	C	kereta	C/ZS
rope	C/N	ip	C	Sg: myodo Pl: myando	C	cuerda	C/ZS	touw	C/N	konopca	N	rohpu	C/N	Stick	C	köydellä	C/N	schini	C/N	bang-ze	C/ZS	corde	C/N	corda	C/N	tali	C/N
cake	C/N	kek	C/N	keke	C/N	pastel	C/ZS	cake cake-jes	C/N Pl.	tortu, kolac	C/N	keiki	C/N	Kuchen	C/N	kakku	C/N	turta	C/N	dan-gp	C/ZS	gateau	C/N	torta	C	kek	C/N
water	N	su	C/N C:bottle	amenshi	N	agua	N	water	N	vodu	N	mizu	N	Wasser	N	vettä	N	nero Pl: nera	C/N C:bottle	Shui	N	eau Pl: eaux	N C:bottle	acqua	N	air	N
furniture	N	mobilya	C	Sg: icipe Pl: ifipe	C	mueble	C/N	meubels	C	namestaj	N	kagu	C/ZS	Möbel Möbelstuck	N C	huonekalu	C	epiplo	C	jiaju	N	meuble	C	mobilia	C	perabot	C/N
information	N	bilgi	N	Sg: icebo Pl: ifyebo	C	información	N	informatie	N	informaciju	C	jouho	C/N	Information	C	tieto	C	pliroforia	C	xinxi	C	information	C	informazione	C	maklumat	C/N
advice	N	tavsiye	C/N	Pl: ifyebo	N	consejo	N	advies	C/N	savet	C	adobaisu jogen	C/N	Sg:Rat	C	neuvo	C	simvouli	C	jianyi	C/ZS	conseil	C	consiglio	C	nasihat	C/N
evidence	N	delil	N	Sg: icikomo Pl: ifikomo	C	evidencia	N	bewijs	N	dokaz	C	shouko	C/N	Beweise	C/N	todiste	C	apodixi	C	zhengju	C/ZS	preuve	C	evidenza	C	bukti	C/N
news	N	haber	N	ilyashi	N	noticia	C/N	nieuws nieuwtje	N C	vest	C	nyusu	C/N	Neuigkeiten	C	uutinen	C	neo	C	xinwen	C/ZS	nouvelles	Pl.	notizia	C	berita	C/N
equipment	N	alet	N	Sg: ichibombelo Pl: ifibombelo	C	equiamiento	C/ZS	materiaal uitrusting	N C	opremu	N	dougu	N	Ausrustung	C	väline	C	exoplismo	N	shebei	C/ZS	équipement	C/N	equipago	C	peralatan	C/N
homework	N	ödev	C/N	inchito	N	deberes	Pl.	huiswerk	N	domaci zadatak	C	shukudai	C/N	Hausarbeit	C	kotiläksy	N	diavasma	N	zuoye	N	travail devoir	C/N C	lavoro	C	kerja rumah	C/N
research	N	arastirma	N	fwayafwaya	N	investigación	C/N	onderzoek	C/N	istrazivanje	C	kenkyu	C/N	N/A		tutkimusta	C	erevna	C/N	yanjiu	C/ZS	recherche	C/N	ricerca	C/N	penyelidikan	C/N
work	N	is	C/N	inchinto	N	trabajo	C:job N:work	werk	N	posla	C:job N:work	shigoto	C/N	Arbeit	C/N	työ	C	dulia	C/N	gongzuo yao-zuo	C	travail	C/N	lavoro	C	kerja	C/N
fun	N	eğlence	N	nyangala	N	diversion	N	plzier lol	N N	N/A		N/A		Spaß	N	hauskaa	N	N/A		gaoxing-de-shi	C	plaisir	N	divertimento	C	N/A	
music	N	müzik	N	Sg: ulwimbo Pl: inyimbo	C	música una adj ~	N	muziek muziekjes	N Pl.	muziku	N	ongaku	N	Musik	N	musiikkia	N	musiki	N	N/A		musique	N	musica	N	muzik	N
education	N	eğitim	N	amasambililo	N	educación	N	onderwijs opleiding	N C	obrazovanje	N	kyouiku	N	Ausbildung	N	koulutus	C/N	morfosi	N	N/A		éducation	N	educazione istruzione	N	pendidikan pelajaran	N C
knowledge	N	bilgi	N	amano	N	conocimiento	N	kennis	N	znanje	N	chishiki	N	Wissen	a+N	tieto	N	gnosi	N	zhishi	N	connaissances	Pl.	conoscenza	a+N	pengetahuan	N
money	N	para	N	indalama	N	dinero	N	geld	N	novac	N	okane	N	Geld	N	raha	C/N	lefta	Pl.	qian	N	argent	N	soldi	N	duit	N
violence	N	siddet	N	ukuchenana	N	violencia	N	geweld	N	nasilja	N	bouryoku	N	Gewalt	N	väkivaltaa	N	via	N	baoluan	N	violence	N	violenza	N	keganasan	N

ABBREVIATIONS

C: Countable, can be used with numerals.

N: Non-count, cannot be used with numerals.

C/N: Both Count & Non-count

C/ZS: Countable & Zero article+Singular (bare) form with a generic meaning.

N/A: No equivalent word is Available.

Pl: Plural form.

Sg: Singular form.

a+N: Indefinite article + Noun

senses, abbreviated C/N, are not counted). Vertically, two nouns at the top (*dog*, *car*) are typical count nouns in English, next two nouns with dual class membership (*rope*, *cake*), the fifth (*water*) is a typical mass noun, and the rest are arranged in the order that the topmost noun (*furniture*) has a count sense in most languages and the noun at the bottom (*violence*) has a mass sense in most languages. A noun is defined as count if it accepts the direct construction with numerals or the construction with a sortal numeral classifier[1)] and numerals, and it is defined as mass if it does not.

As predicted, '*dog*' and '*car*' are considered to be countable in all fourteen languages. '*Water*' is considered uncountable in all languages excluding three languages that allow both count and mass uses for '*water*'. '*Cake*' has both count and mass senses in most languages. '*Music*', '*education*', '*knowledge*', and '*money*' are uncountable in almost all languages. Count/mass distinctions of other nouns vary from language to language except for '*violence*', which is uncountable in all languages. The closest language to English in terms of the count/mass distinction is Turkish and the most remote is Italian, excluding Malay that allows most nouns to have both count and mass senses.

The count/mass distinction does not seem to have any relation to language families or geographical areas. Table 1 shows that the distinction is language specific and cross-linguistically arbitrary, except that ontologically typical objects are likely to be treated as count nouns universally. The data in Table 1 agree with Markman (1985), who gave a similar questionnaire to 18 native speakers of 18 languages (7 language families) (asking if they say "two X-s"). She found that 34% of superordinate category terms (e.g. *furniture*, *weapon*, *tools*) were mass nouns across languages while 99.3% of lower level category terms (e.g. *chair*, *apple*, *hat*) were count nouns. 42 out of 48 lower category terms denote a separately movable bounded solid object (exceptions are: *house*, *apartment*, *church*, *school*, *oak*, and *palm*). Her findings support the prediction that typical solid objects should make count nouns universally and the count/mass distinction of superordinate nouns varies across languages.

3. Conceptualization and syntactic constraints

3.1. Semantic object/substance distinction and Syntactic count/mass distinction

It is generally agreed among linguists that the conceptual basis of the count/mass distinction of concrete nouns lies in bounding in physical space (Biber et al. 1999, Crystal 1995, Celce-Murcia & Larsen-Freeman 1999, Hewson 1972, Huddleston & Pullum 2002, Jesperson 1924, Langacker 1987, 1991a, b, Lee 2001, Matthews 1997, Quirk et al. 1985, Swan 2005, Taylor 2002, Trask 1993, Wierzbicka, 1988, 1996). Semantically, a count noun refers to an individuated countable entity, and a mass noun to a nonindividuated mass or notion. Developmental psychologists (Barner & Snedeker

1) There are two types of classifier: sortal and mensural numeral classifiers. A noun in a classifier language is judged countable if it accepts a sortal numeral classifier. Most languages have mensural classifiers (Haspelmath et al. 2005: Ch. 55), such as 'two glasses of water', but they do not show that the noun is countable. With 'two glasses of water', it is the number of glasses that is counted but not 'water', while with a Japanese noun phrase, 'ni (two) satsu-no (classifier) hon (book)', what is counted is the number of books, but not the sortal classifier 'satsu'.

2006, Gordon 1985, Gentner 2001) cast doubt on the claim that children's acquisition of the count/mass distinction is based on the object/substance distinction.

Bloom et al. (1995) and Bloom (2001) suggest that children possess a notion of individuation, which is more abstract than a notion of whole object. For instance, 3-year-old children can recognize not only discrete physical entities but also parts of objects and holes as individual entities, and they can count them (Giralt et al. 2000). Barner & Snedeker (2006) argue that the semantic count/mass distinction develops from quantification but not from the physical characteristics of a referent. They draw a distinction between a perceptual individual and a linguistic individual, arguing that these two concepts often do not coincide, e.g. '*furniture*', which is perceptually plural but linguistically singular. Mass nouns can denote individuals (e.g. *furniture*) as well as nonindividuals (e.g. *string*), while count nouns denote only individuals. Barner & Snedeker (2006) propose the number asymmetry hypothesis, which states that mass syntax is semantically unspecified with regard to individuation while nouns used in count syntax are forced to quantify over individuals. The definition of 'object' is not clear, and Yoshida & Smith (2003: 31) argues that 'object' in English is whatever is bounded (i.e. discrete and countable), which includes solids, nonsolids, temporally bounded events (e.g. *sounds*), and abstract entities (e.g. *dreams*).

Mapping works very well both with prototypical count nouns and with prototypical mass nouns. There are, however, many cases where mappings between syntax and semantics break down: perceptually countable entities making mass nouns (e.g. *toast*), physically similar entities making count or mass nouns (e.g. *pebbles* vs. *gravel*), superordinate categories (e.g. *vehicle* vs. *furniture*), etc. The simple mapping between the semantic object/substance distinction and the syntactic count/mass distinction cannot explain these mismatches. In order to explain these mismatches between semantics and syntax, several hypotheses are proposed. Among them are cognitive linguists (Langacker, Taylor) who argue for a strong influence of conceptualization, semanticists (Wierzbicka, Goddard) who argue for semantic motivation, and developmental psychologists who argue for semantic theories (Soja, Burns & Soja), for syntactic influence (Gordon, Barner & Snedeker), and for perceptual motivation (Middleton et al.).

3.2. Conceptual basis of the count/mass distinction and syntactic constraints

Cognitive linguists take the view that the count/mass distinction is based on the object/substance distinction. Taylor (2002: 367) says: "The conceptual basis of the count-mass distinction is fairly transparent; it has to do with the distinction between an individuated 'object' and an unindividuated 'substance'." They argue for a very strong influence of conceptualization and claim that the count/mass distinction depends on the speaker's construal. Taylor (2002: 368) says: "[T]he count-mass distinction is a matter of how speakers construe a thing." Langacker (1991b: 72) says: "Given proper circumstances, almost any count noun can be construed as designating a homogeneous, unbounded mass and thereby come to function as a mass noun grammatically." Their arguments are simple: the count/mass distinction is based on the object/substance distinction and almost any physical entity can be conceptualized as a substance; therefore almost any count noun can be a mass noun.

Facing semantic/syntactic mismatches, Wisniewski et al. (2003) propose the cognitive individuation hypothesis, which holds that the count/mass distinction depends on the speaker's interpretation of the referent either as an individual or as a non-individuated entity. Their view and Middleton et al. (2004) are similar to that of cognitive linguists, and they take a semantic approach and support Wierzbicka (1988). Middleton et al. (2004) found, in their study of count and mass noun aggregates (e.g. *chaff* vs. *oats*), that the conceptual basis of the distinction is systematically related to the ease of distinguishability (i.e. how easy it is to distinguish the elements of an aggregate) and the mode of interaction (i.e. how people interact with the elements).

Wierzbicka (1988: 555-560) semantically divides concrete nouns in English into 14 classes according to their countability and claims that the meaning she postulates has predictive power. She argues that once we find the same grammatical behavior shared by a group of words is governed by a semantic rule, we can tell the semantic rule that a new word is expected to obey from its grammatical behavior (1996: 392). Can we? Take '*toy*' for example, which is a superordinate count noun and grammatically behaves in the same way as those that belong to the Countables Only group (e.g. *bottle*) according to her classification. Semantically, however, it should belong to the Singularia Only group (heterogeneous classes of objects: e.g. *furniture*) since 'toy' can refer to various objects (e.g. a doll, a Playstation, a video game, etc.) or it should belong to the Pluralia Only group (groups of objects: e.g. *groceries*) since a toy set (e.g. Thomas the Tank Engine with Thomas, Percy, Toby, a railway station, rails, a signal, etc.) refers to things limited in quantity, bounded in space, not fully countable, temporary groupings, and not transferable, which satisfies Wierzbicka's definition of this group.

Middleton et al. (2004) supports Wierzbicka, and claims that there is a conceptual basis for the count/mass syntax of names for aggregates. They found that the conceptual basis of the distinction is systematically related to the ease of distinguishability (i.e. how easy it is to distinguish the elements of an aggregate) and the mode of interaction (i.e. how people interact with the elements). People interact with single elements of count noun aggregates (e.g. grapes, toothpicks), while they interact with multiple elements of mass noun aggregates (e.g. rice, grass). In terms of spatial contiguity, beans are perceptually more distinguishable than individual grains of rice. If it is the case, then, how do we distinguish '*clothes*' from '*clothing*'? They are often used interchangeably. What about '*furniture*'? Do English speakers interact with chairs, tables, etc. in the same way as interacting with rice and grass? Besides, each piece of furniture is highly distinguishable. Somehow these words are missing in their lists.

Facing the name for an entity with its syntax conflicting with its conceptualization, Wisniewski et al. (2003) propose the cognitive individuation hypothesis, which holds that the count/mass distinction depends on the speaker's interpretation of the referent either as an individual or as a non-individuated entity. However, as Barner & Snedeker (2005, 2006) show, mass nouns like '*furniture*' and '*homework*' denote individuals, and they still keep their grammatical mass status. When their hypothesis finds an enigma (e.g. *bacon*, *aspirin*) that cannot be solved, they resort to linguistic convention and etymology to explain the unsystematicity. In the end, they had to admit that "the count-mass distinction is not entirely conceptually based" (Middleton et al. 2004: 382).

Burns & Soja (2000) argue for semantic theories. They found that 5-year-old children distinguished novel NP-type nouns (e.g. '*school*' in '*She is in school*.') from novel count nouns with semantic information alone. Children appropriately chose the bare form of a noun 68.75% without syntactic information and 86% with some syntactic information. Soja (1994) found, in her analysis of the longitudinal transcribed speech data of four children (three children from 2; 3 to 5; 0 and one child from 1; 7 to 4; 0), that the children never used a pronominal adjective with a bare NP-type noun (* '*at biggest school*'). Their arguments do not apply to count/mass distinctions, which allow a wide range of semantically malleable entities. There is no malleable part in the mapping between the syntax and semantics of NP-type noun. Once children know that NP-type nouns refer to cultural institutions that involve ritualized, habitual, events, they can automatically apply this rule to a novel cultural institution.

Prediction is possible only with those grammatical categories that have the systematically organized one-to-one linkage between semantics and syntax, such as past tense and plural markers. The count/mass distinction has a very wide range of semantically malleable entities. As long as the count/mass distinction has some malleable part and there is room for conceptualization to exert its influence, it is impossible to predict semantics from syntax or syntax from semantics. There are some constraints, whether conceptual or linguistic, that prevent some mass nouns from gaining count senses and count nouns from mass senses.

It is true that typical count nouns can turn to mass nouns. For instance, '*cat*', which refers to a separately movable bounded solid object, can be used in a mass sense when it loses its discreteness as a cat, as in '*After I ran over the cat with our car, there was cat all over the driveway*.' (Langacker 1991b: 72). This does not mean, however, that any count noun can be a mass noun when the referent loses its boundedness. A car is a car even when it is in a smashed or dismantled condition against the claims of Allan (1980: 547) and Taylor (2002: 378). Taylor (2002: 367) claims that a car will turn into car parts, not a car any more when dismantled. Allan claims that a car becomes uncountable when it is smashed, and he gives an example: '*The scrapyard is full of smashed car awaiting recycling*.' I suspect no one would say, for example, '*Dismantled car takes up far more space than you think*.' instead of '*A dismantled car*...' with an indefinite article, and I also suspect most people would say: '*The scrapyard is full of smashed cars*...' in the plural form. Also, I do not think anyone would accept the mass use of 'tree' and say: '*I found shattered tree*.' There are many count nouns that never accept the mass use in the current usage. These constraints may be explained by such notions as spatial congruity, mode of interaction, perceptual saliency, conceptual space, etc., but semantic analysis of count/mass distinctions cannot help but turn out to be an explanation of what is already known. It cannot be predictive.

3.3. Diachronic changes and regional differences in count/mass distinctions

The grammatical behavior of a particular noun may change diachronically and may vary regionally with regard to its count/mass distinction. A typical mass noun 'revenge' used to have both a count and a mass use about 400 years ago. Shakespeare wrote: "Though *my revenges* were high bent upon him." (*All's well that ends well*, Act V, Scene 3); "And Caesar's spirit, ranging for

revenge." (*The Life and Death of Julies Caesar*, Act III, Scene 1).

A recent example is 'e-mail', which has both count and mass senses in the current usage. The word 'e-mail' (or 'email') used to have only a mass sense, presumably inheriting its usage from 'mail', which is uncountable referring to letters and packages collectively. The British National Corpus (BNC) with 100 million words, which was completed in 1994, has only one instance of the count use ('an E-mail') and 18 instances of 'e(-)mail message(s)'. The Collins WordbanksOnline (WBO), a sub-corpus of the Bank of English, with 56 million words from 1990 to 1998, has 16 count instances (6 instances of 'an e-mail' and 10 'emails') and 19 instances of 'e(-)mail message(s)'.

Checking five dictionaries published within the last five years (listed in the bibliography) has found that all of them list the count use in their definitions, which suggests that 'e-mail' used to have only a mass sense until around the mid 1990s. *LDOCE* 3rd Edition (1995) defines it as "[uncountable] a system that allows people to send messages to each other by computer." Its 4th edition (2003) adds a second meaning: "[uncountable and countable] a message that is sent from one person to another using the email system." *OALD* 7th Edition (2005), *Cambridge Advanced Learner's Dictionary* 2nd Edition (2005) and other dictionaries follow *LDOCE*. This mass-to-count shift of the meaning of 'e-mail' shows that in the age of the Internet it is conceptualized as an individuated entity referring to a message or a letter sent by the e-mail system, and this semantic shift is mapped onto syntax.

3.4. Regional differences of count/mass uses

'*Mashed potato(es)*', '*scrambled egg(s)*', and '*bathroom scale(s)*' show regional differences of count/mass distinctions (Table 2). BNC, which comprises only British English, has 38 occurrences of '*mashed potato*' and 31 '*mashed potatoes*'. WBO's British subcorpuses (39 million words) have 18 '*mashed potato*' and 16 '*mashed potatoes*', while American subcorpuses (9.5 million words) have no singular instance and 16 plural instances. Sanseido Corpus (a corpus of tens of millions of words. The exact number of words is not available) has 1 singular instance in its British subcorpus (which accounts for 40% of the corpus) and 44 plural instances in its American subcorpus (60% of the corpus). As for 'scrambled egg(s)', BNC has 29 singular and 34 plural instances. WBO's British subcorpuses have 11 singular and 24 plural instances, while its American subcorpuses have 0

Table 2.

		BNC	WBO		Sanseido		Amazon	
		UK 100 m	UK 39 m	US 9.5 m	UK 40%	US 60%	UK —	US —
mashed	potato	38	18	0	13	1	—	—
	potatoes	31	16	16	12	44	—	—
scrambled	egg	29	11	0	6	0	—	—
	eggs	34	24	6	12	7	—	—
bathroom	scale	0	0	0	0	3	39	96
	scales	13	9	2	7	1	61	0

singular and 6 plural instances. Sanseido's British corpus has 6 singular and 12 plural instances while its American corpus has 0 singular and 7 plural instances. These data show that British people are split over the count/mass distinction of '*mashed potato(es)*' and '*scrambled egg(s)*', while American people prefer the count use for both. These findings suggest that Americans have opted for a semantic shift to construe the substance state of potato and egg as a multiple structure, while the British have not decided which way to go and remain in the random stage.

Wisniewski et al. (2003: 611) argue that Americans use the plural form to characterize how the substance originated because they do not want to incorrectly imply that the act of cooking (e.g. mashing, scrambling) was applied to a substance. To support their claim, they show the percentage of hits in their web search for *'(some) scrambled eggs*' compared with *'(some) scrambled egg*', which turned out to be 89% (out of 38,374 hits) and that for *'(some) mashed potatoes*' vs. *'(some) mashed potato*', which was also 89% (out of 116,620 hits). I tried a Google search and found roughly the same results for '*(some) scrambled egg(s)*', but I did not find a significant difference for '*mashed potato(es)*' and '*(some) grated carrot(s)*', and found that the balance is reversed for '*(some) grated apple(s)*' (Table 3). I do not believe that this type of web search provides reliable data (e.g. not necessarily written by native English speakers), but standing on their footing, these web search results of mine do not support their theory.

Table 3

	mashed		grated		some grated		grated		some grated	
	potato	potatoes	carrot	carrots	carrot	carrots	apple	apples	apple	apples
hits	1,020,000	1,400,000	130,000	164,000	998	711	40,900	16,000	209	10

The substance originating theory seems to apply only to a limited number of foods in American English. Table 2 shows that the singular and the plural use of '*mashed potato(es)*' and '*scrambled egg(s)*' are almost equally divided in British English. It could be argued that American English keeps the traditional expression and British English is making a semantic shift to construe them as substances. *The Oxford English Dictionary (OED)* suggests that both British and American English used to use '*mashed potatoes*' in the past. Hanna Glasse (1747), who is British, used '*mashed potatoes*' in *The Art of Cookery*. Mary Randolph (1824), who is American, also used the plural form in *The Virginia House-wife*. Considering the fact that *The Art of Cookery* continued to be published until 1843 for about 100 years, the cookbook must have been very popular in England and the American colonies at that time and probably the plural form was the standard. If it is the case, it may suggest that British English is shifting toward the singular to properly reflect the mass state of the food, while American English still keeps the traditional plural form. The same can be said of '*scrambled egg(s)*'. *The OED* finds the plural form written by an English journalist, George Augustus Sala in *Daily Telegraph*. 9 Feb. 1864.

'*Scale(s)*' is another example that shows a regional difference in the count/mass distinction. '*Scales*' used to refer to 'a pair of scales', reflecting its bipartite structure. The device is still called '*scales*' in British and Australian English, although it does not keep the bipartite structure any more

(Wierzbicka 1996: 390). On the other hand, the singular form is overwhelmingly used in American English. Wierzbicka (1996: 388) asked a number of children and teenagers in Australia why they thought the device is called '*scales*' rather than '*scale*'. To her surprise, they all came up with the same answer: it is because of all the little numbers they see in the device. The mismatch between syntax and perception has led American people to take the solution to change its syntax from '*scales*' to '*scale*' to reflect a semantically proper construal of the device as an individuated object. British people opted halfway for a semantic shift to retain the original morpho-syntax, from seeing the device as a bipartite structure to construing it as a multiple structure.

BNC data in Table 2 suggest that British English speakers have a strong tendency to use the plural form (13 vs. 0). The data on the American usage is somewhat limited, and then I searched for product names with either '*bathroom scale*' or '*bathroom scales*' at Amazon.com and Amazon.co.uk. I found, among the first 100 best-selling bathroom weighing devices with '*bathroom scale(s)*' as part of their product names, 61 products with '*bathroom scales*' and the rest 39 with '*bathroom scale*' at Amazon.co.uk, while not a single instance of the plural was found at Amazon.com (Table 2). This suggests that Americans overwhelmingly prefers the singular form, while the British show a slightly stronger preference for the plural. It seems impossible to predict whether a mismatch between semantics and syntax causes a shift in semantics or in syntax.

4. Conclusion and pedagogical implications for second language acquisition

Children have the concept of individuation and solid objects prelinguistically. On the other hand, they do not have a clear semantic categorization of mass nouns prelinguistically, and they acquire it as they grow older with more linguistic experience and syntactic information. Children become sensitive to the count/mass and singular/plural distinction at the age of two and become able to extend the semantic categorization of mass nouns to novel words at around five. It is clear that children acquire the semantic categorization of mass nouns through syntactic information, but not through semantic analysis.

The count/mass distinction is too complex for L2 learners to try semantic analysis. Some general rules are proposed to distinguish count nouns from mass nouns, such as bounding, distinguishability, and the mode of interaction. These notions are very abstract and elusive, and the understanding of these notions is gained only after L2 learners have acquired a large and wide vocabulary. Instead, they should learn to be sensitive to syntactic information of count/mass distinctions, especially those learners whose languages do not have the count/mass distinction, the singular/plural distinction, and the indefinite article. It is probably best to understand that the count/mass distinction is word specific. Special attention is required to the indefinite article and the plural markers, which are the only syntactic cues that make count nouns distinguishable from mass nouns.

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