Check for updates

Article

second language research

Second Language Research
2018, Vol. 34(2) 147–177
© The Author(s) 2017
Reprints and permissions:
sagepub.co.uk/journalsPermissions.nav
DOI: 10.1177/0267658317717581
journals.sagepub.com/home/slr
SAGE

L1 Korean and L1 Mandarin L2 English learners' acquisition of the count/mass distinction in English

Sea Hee Choi
University of Illinois at Urbana-Champaign, USA

Tania Ionin
University of Illinois at Urbana-Champaign, USA

Yeqiu Zhu
Nanjing University, China

Abstract

This study investigates the second language (L2) acquisition of the English count/mass distinction by speakers of Korean and Mandarin Chinese, with a focus on the semantics of atomicity. It is hypothesized that L1-Korean and L1-Mandarin L2-English learners are influenced by atomicity in the use of the count/mass morphosyntax in English. This hypothesis is tested in two experiments, one comparing Korean and Mandarin speakers in their L2 (English) and the other investigating count/mass morphosyntax in native Korean and Mandarin Chinese. In both experiments, participants are tested on their suppliance of plural marking with count and mass NPs. The findings are fully consistent with the view of atomicity as a semantic universal: learners overuse plural marking with mass atomic nouns such as *furniture* more than with mass non-atomic nouns such as *water*. Even though plural marking is associated with atomicity in Korean but not in Mandarin, the same patterns are observed in L1-Korean and L1-Mandarin L2-English learners. We conclude that learners' performance is not due to L1-transfer, but rather to the role of the semantic universal of atomicity in L2-acquisition.

Keywords

atomicity, count nouns, English, Korean, Mandarin, mass/count distinction, mass nouns, number, plurality, syntax/semantics mappings

Corresponding author:
Sea Hee Choi, Department of Linguistics, University of Illinois at Urbana-Champaign, 4080 Foreign Language Building, 707 S Mathews Ave. MC-168, Urbana, IL 61801, USA
Email: schoi76@illinois.edu

I Introduction

The semantics of the count/mass distinction has been much investigated in the theoretical literature (e.g. Borer, 2005; Chierchia, 1998a, 1998b, 2010), but has received relatively little attention in the literature on second language (L2) acquisition (but see, for example, Hwang and Lardiere, 2013; Inagaki, 2014). The count/mass distinction is a particularly interesting area for investigating the role of first language (L1) transfer and the role of semantic universals in L2-acquisition, in light of cross-linguistic differences in how nominal semantics maps to count/mass morphosyntax. It is well-established that L1-transfer plays an important role in L2-acquisition in general (see, amongst others, Schwartz and Sprouse, 1994, 1996) and in the L2-acquisition of semantics in particular (for an overview, see Slabakova, 2008). At the same time, the L2-acquisition of nominal semantics has also been argued to be constrained by semantic universals (Ionin et al., 2004). In this article, we examine the acquisition of the count/mass distinction in English, which has obligatory plural marking, by speakers of Korean and Mandarin Chinese, which have optional and/or restricted plural marking. We show that the count/mass distinction is less grammaticalized in Korean and Mandarin than in English, and that there is a three-way distinction among these languages in the mapping between semantics and morphosyntax in the domain of plural marking. These differences allow us to make specific predictions for how L1-transfer and semantic universals influence the course of L2-acquisition of English plural marking. We test our predictions with L1-Korean and L1-Mandarin L2-English learners. The highly similar performance of the two groups leads us to conclude that the semantic universal of atomicity influences L2-acquisition of English plural marking by speakers of Generalized Classifier languages, independently of the exact semantics of plural marking in the learners' L1.

II Background

In this section, we briefly outline the characteristics of the count/mass distinction in English, Korean and Mandarin Chinese, with a focus on the distribution of plural markers in all three languages. We also provide a brief overview of prior L2-literature on the acquisition of the count/mass distinction.

1 The count/mass distinction in English

The count/mass distinction is a grammatical distinction; in a plural-marking languages such as English, every noun is classified as either count or mass, and there are many morphosyntactic diagnostics for the status of a noun as count vs. mass. Count nouns in English can combine with the indefinite article, numerals, plural marking, and the quantifier *many* (1a) and cannot appear in bare (determiner-less) singular form, with the quantifier *much*, or (in singular form) with measure nouns (1b). The opposite is true for mass nouns, as shown in (2) and (3).

(1) a. I bought a computer / computers / one computer / two computers / many computers / several computers.
b. * I bought computer / much computer / a pound of computer / a piece of computer.

(2) a. * I bought a sugar / sugars / one sugar / two sugars / many sugars / several sugars.
b. I bought sugar / much sugar / a pound of sugar.

(3) a. * I bought a furniture / one furniture / furnitures / two furnitures / many furnitures / several furnitures.
b. I bought furniture / much furniture / a piece of furniture.

While the count/mass distinction is morphosyntactic in nature, it has a counterpart in semantics. Jackendoff (1991) and Langacker (1999), among others, argue that the relevant semantic property underlying the count/mass distinction is that of boundedness. Entities that denote animate beings or objects, and which are typically denoted by count nouns, are discrete and bounded: i.e. there is a clear boundary between one computer and another. On the other hand, entities that denote substances, and that are typically denoted by mass nouns, are not bounded: there is no boundary to water (unless one puts water in a container, in which case we have the shift to count morphosyntax, e.g. *a water* to mean *a cup*/*bottle of water, two coffees* to mean *two cups of coffee*, etc.). It is more difficult to determine boundedness for abstract nouns, since they denote entities that are invisible and untouchable (Amuzie and Spinner, 2013: 417). Recently, there have been several attempts to classify the boundedness of abstract nouns based on the boundedness of the verbs and adjectives from which the nouns are derived (e.g. Paradis, 2001, 2005). For example, stative verbs such as *know* and activity verbs such as *improve* give rise to unbounded abstract nouns such as *knowledge* and *improvement*. In contrast, achievement verbs such as *arrive*, which have a clear endpoint, give rise to bounded nouns such as *arrival*. In the case of abstract nouns not derived from verbs, we can see why, for example, *idea* or *method* are count nouns: an *idea* is bounded 'only in an individual's conceptualization' and a *method* is bounded in its way of doing certain things (Amuzie and Spinner, 2013: 417). In contrast, *happiness* is an unbounded mass noun, since there is no boundary to happiness.

A closely related concept to 'boundedness' is that of 'atomicity', which has been considered a key concept in distinguishing count nouns from mass nouns (Bunt, 1985; Landman, 1989, 1991; Chierchia, 2010). A noun is 'atomic' if and only if there exists the smallest element (the atom) with the property denoted by the noun. For example, *table* is atomic because there is an atomic entity (a table) that has the property *table*; parts of that entity do not have the property *table*: they might be table legs, parts of the table, but not the table. On the other hand, *water* is non-atomic because there is no smallest element that has the property *water*: water is divided into smaller parts, each of which still has the property *water*. For the remainder of the article, we will use the term 'atomicity' rather than the term 'boundedness', following the terminology used by Chierchia (1998a, 1998b, 2010) and Kim (2005).[1]

As discussed by Chierchia (2010), among others, atomicity (boundedness) does not map directly onto the English count/mass distinction. For example, *furniture* is a bounded, atomic noun: there is a clear boundary between one piece of furniture and the next, and not all parts of furniture are furniture (a table is furniture, but a table leg is not). Nevertheless, *furniture* is a mass noun in English (see (3)). The same issue arises for other concrete nouns, such as *jewelry*, as well as abstract nouns such as *information* (one

piece of information can, arguably, be distinguished from another, yet it is still a mass noun). Chierchia (2010) calls nouns such as *furniture* and *jewelry* 'fake mass nouns'.

There is variation among languages with obligatory plural marking as to which nouns are treated as count and which as mass: for example, *peas* and *beans* are count nouns in English, but their equivalents in Russian are mass nouns (Wierzbicka, 1985). Thus, the exact mapping between (non-)atomicity and the count/mass syntax appears to be language-specific (see also Iwasaki et al., 2010; Jackendoff, 1991).[2]

To sum up, English distinguishes between count and mass nouns in the morphosyntax, but does not have a one-to-one mapping between semantics and morphosyntax: while all count nouns denote atomic entities, not all mass nouns denote non-atomic entities. We now turn to the count/mass distinction in Korean and Mandarin Chinese, the native languages of the learners in our study.

2 The count/mass distinction in Korean

Korean patterns with a number of other languages, including Chinese and Japanese, in having a count/mass distinction which is not fully grammaticalized, unlike in English. Both object-denoting nouns like 'book' and substance-denoting nouns like 'sugar' can occur in bare singular form, as shown in (4); furthermore, the bare singular form is compatible with both singular and plural interpretations in indefinite contexts such as (4). Korean is a generalized classifier language, and all nouns, both object-denoting and substance-denoting, combine with a classifier in order to combine with a numeral, as shown in (5a) and (5b) (for [+human] nouns, the classifier is optional, and the numeral may combine directly with the noun, at least in the case of lower numerals, as shown in (5c); see also Zheng, 2011).[3]

(4) a. Na-nun chayk-ul sa-ss-ta
I-Top book-Acc buy-Past-Decl
'I bought a book/books.'
b. Na-nun selthang-ul sa-ss-ta
I-Top sugar-Acc buy-Past-Decl
'I bought sugar.'

(5) a. han can uy mwul
one Cl of water
'one cup of water'
b. han kay uy chayksang
one Cl of desk
'one desk
c. han (myeng uy) haksayng
one (Cl of) student
'one student'

In an influential theoretical proposal, Chierchia (1998a, 1998b) argues that classifier languages such as Korean, Chinese and Japanese lack the count/mass distinction: all nouns in these languages are mass, and classifiers are required for individuation.

Chierchia (1998b) formulates the Nominal Mapping Parameter, and argues that classifier languages have a different setting of this parameter than languages like English, which have obligatory plural marking and lack classifiers. According to Chierchia (1998a, 1998b), no language has both a generalized classifier system and plural marking.

Chierchia's (1998a, 1998b) proposal has been challenged by a number of more recent publications, which have shown that plural marking and classifiers can co-exist within a single language, such as Indonesian (Cheng, 2000), as well as Armenian, Akatek, Japanese, Korean, Persian, and Tajik (Gebhardt, 2009). Cheng and Sybesma (1998, 1999) argue that the count/mass distinction exists even in Chinese, the prototypical classifier language discussed in the literature (see also Li, 1999). Challenging Chierchia's (1998a, 1998b) proposal on theoretical grounds, Borer (2005) argues that all nouns in every language have a mass interpretation by default, and that classifiers and plural marking have the same function of turning mass nouns into count nouns. Chierchia (2010), differing from his earlier work, also discusses Chinese as having a count/mass distinction.

Turning specifically to Korean, Baek (2002) and Kim (2005) have also shown that Korean has both plural marking (*-tul*) as well as a generalized classifier system. Even though *-tul* differs from the English plural marker *-s* in many ways, Kim (2005) claims that it has a similar function in terms of marking plurality on count nouns.

a Properties of Korean plural marking. We will now briefly review the differences between *-s* and *-tul*. First, *-tul* is optional in indefinite contexts: as shown in (4), a bare singular noun can have a plural as well as a singular interpretation. Use of *-tul* makes the plural interpretation obligatory, as shown in (6), for both animate nouns (6a–6b) and inanimate ones (6c–6d).

(6) a. Chelswu-nun ecey chinkwu-lul manna-ss-ta.
Chelswu-Top yesterday friend-Acc meet-Past-Decl
'Chelswu met a friend/friends yesterday.'

b. Chelswu-nun ecey chinkwu-*tul*-lul manna-ss-ta.
Chelswu-Top yesterday friend-*Pl*-Acc meet-Past-Decl
'Chelswu met friends yesterday.' (modified from Kim, 2005: 5)

c. Chelswu-nun ecey chayk-ul sa-ss-ta.
Chulswu-Top yesterday book-Acc buy-Past-Decl
'Chelswu bought a book/books yesterday.'

d. Chelswu-nun ecey chayk-*tul*-ul sa-ss-ta.
Chelswu-Top yesterday book-*Pl*-Acc buy-Past-Decl
'Chelswu bought books yesterday.'

It is not entirely clear whether there is any difference in interpretation between the bare singular and plural *-tul* forms when both are used to denote a plural entity. Baek (2002) argues that *-tul* has a distributive interpretation. According to Baek (2002), while (7a), with a singular form, allows for both collective and distributive interpretations of *two students*, (7b), with a *tul*-marked plural, is unambiguous, allowing only the distributive reading. However, An (2007) disagrees, arguing that (7b) does have a collective interpretation. Finally, Zheng (2011) notes that in many contexts, the bare singular form and the plural form are synonymous.[4]

(7) a. twu haksayng-i pheyiphe-lul ceychwulhay-ss-ta.
two student-Nom paper-Acc submit-Past-Decl
✓ 'Two students submitted one (e.g. co-authored) paper.'
✓ 'Two students each submitted a paper.'
b. twu haksayng-*tul*-i pheyiphe-lul ceychwulhay-ss-ta.
two student-*Pl*-Nom paper-Acc submit-Past-Decl
? 'Two students submitted one (e.g. co-authored) paper.'
✓ 'Two students each submitted a paper.' (adapted from An, 2007: 2)

The biggest difference between *-s* and *-tul* is that the latter can be used with a variety of non-nominal expressions, such as verbs, adverbs and locative phrases (e.g. Baek 2002). Korean is thus argued to have two types of plural marking: 'intrinsic' plural marking, which is used with nouns, and 'extrinsic' plural marking, which is used with other categories. Since we focus exclusively on intrinsic plural marking in the present article, we will not address the issue of extrinsic plurals any further, but see Hwang and Lardiere (2013) for a study of how both types of plural marking are acquired by L1-English L2-Korean learners.

b Korean plural marking and atomicity. Another difference between English and Korean plural marking is that *-tul* can combine with a much wider range of nouns than plural *-s*. As shown in (8), *-tul* can combine with nouns that are mass in English, such as *furniture* and *evidence*.

(8) a. kakwu-*tul*-i acwu yeyppu-ta
furniture-*Pl*-Nom very pretty-Decl
'The pieces of furniture are very pretty.'
b. Chelswu-nun cungke-*tul*-ul cocakhay-ss- ta
Chelswu-Top evidence-*Pl*-Acc manipulate-Past-Decl
'Chelswu manipulated the pieces of evidence.'

According to Kim (2005), the difference between English and Korean is traceable to atomicity. Kim argues that while atomicity is a universal semantic concept, its morphosyntactic manifestations differ across language. In Korean, the mapping between atomicity and count/mass syntax is more direct than in English: atomic entities such as *khemphyuthe* ('computer'), *pangpep* ('method'), *kakwu* ('furniture'), or *cungke* ('evidence') map to count nouns, while non-atomic entities such as *mwul* ('water') or *hayngpok* ('happiness') map to mass nouns. A potential difficulty with this proposal is that Korean lacks clear diagnostics for count vs. mass nouns: unlike English, it does not have indefinite articles, it uses classifiers with all nouns (both atomic and non-atomic; see (5)), and it does not have different words for *many* vs. *much*. A possible diagnostic is suggested by Yi (2010), who proposes that the general classifier *-kay* can be used only with count nouns in Korean. However, this diagnostic is imperfect because *-kay* cannot appear with [+animate] (human or animal) nouns, and also does not typically combine with abstract nouns. This leaves *-tul* as the only reliable diagnostic of the count/mass distinction: according to Kim (2005), atomic nouns but not non-atomic ones are readily compatible with *-tul*.

However, as discussed by Kim (2005), *-tul* can in fact occur with non-atomic nouns such as *water* or *happiness* when they are coerced into a count interpretation, as in (9), as is the case in English as well. While Kim's account is restricted to concrete nouns, the same point can be made for abstract nouns: use of *-tul* with *happiness* in (9f) is possible when multiple instances of happiness are being discussed.

(9) a. chicu (cheese, a cheese) chicu-tul (cheeses)
b. wain (wine, a wine) wain-tul (wines)
c. cha (tea, a tea) cha-tul (teas)
d. khephi (coffee, a coffee) khephi-tul (coffees)
e. mwul (water, a water) mwul-tul (waters)
f. ilsang-uy cakun hayngpok-tul
daily life-Gen trivial happiness-Pl
'trivial instances of happiness of daily life' (Korea JoongAng Daily, 2010)

Kim (2005) argues that in Korean, a mass noun such as *mwul* 'water' can be converted into a count noun if it denotes a type of water or a container of water, and that subsequently, use of *-tul* becomes possible. To sum up, in principle nouns that denote atomic entities can occur with plural marking without any special context (e.g. *kakwu-tul* 'furniture-Pl' can occur in the same range of contexts as the singular *furniture* in English), whereas nouns that denote non-atomic entities can occur with plural marking only when a unit reading is intended (e.g. *khephi-tul* 'coffee-Pl' requires a similar type of context as *coffees* in English, as when one is ordering multiple cups of coffee).

3 The count/mass distinction in Mandarin Chinese

Mandarin Chinese, just as Korean, has a count/mass distinction which is not fully grammticalized. Both object-denoting nouns like 'book' and substance-denoting nouns like 'water' can occur in bare singular form, as in (10a, 10c). Like Korean, Mandarin is a generalized classifier language, and all nouns combine with a classifier in order to combine with a numeral, as in (10b, 10d).

(10) a. wo chu qu mai shu
I out go buy book
'I'll go out to buy a book/the book/books.'
b. wo mai-le liang ben shu
I buy-Asp two Cl book
'I bought two books.'
c. diban shang you shui
floor on have water
'There is water on the floor.'
d. zuozi shang you san bei shui
table on have three Cl-glass water
'There are three glasses of water on the table.'

a Properties of Mandarin plural marking. Mandarin has the plural marker *-men*, which differs in its behavior from both the English plural marker *-s* and the Korean plural

marker *-tul*. The Mandarin plural marker *-men* is optionally used with [+human] nouns (11a), and is obligatory with pronouns (11b–11c). Unlike *-tul, -men* is ungrammatical with [–human] nouns, both concrete and abstract, as shown in (12) (see Iljic, 1994).

(11) a. wo kandao xuesheng(-men)
I see student(-Pl)
'I saw (the) students.'
b. ni
you
'you (singular)'
c. ni-men
you-Pl
'you (plural)'

(12) a. shu(*-men), *book(s)* / jiaju(*-men), *furniture* / shui(*-men), *water*
b. zhengju(*-men), *evidence*/ yijian(*-men), *idea(s)* / fangfa(*-men), *method(s)*

b Classifiers: manifestation of atomicity in Mandarin Chinese. As shown above, the plural marker in Mandarin is limited to [+human] nouns; since all [+human] nouns are by definition atomic, *-men* cannot serve as a diagnostic for atomicity (i.e. it cannot distinguish between atomic and non-atomic inanimate nouns). However, atomicity does appear to be reflected in the Mandarin classifier system.

In Mandarin, as in Korean, classifiers can be used before all nouns, both count and mass. However, there is a distinction between mass classifiers and count classifiers. According to Cheng and Sybesma (1999), mass classifiers in Chinese 'create a unit of measure', as in (13a), while count classifiers 'simply name the unit' which is used to count the entity denoted by the noun, as in (13b). Diagnostics that have been proposed to distinguish mass and count classifiers include placement of the modification marker *de* and ability to combine with an adjective (Cheng and Sybesma, 1998, 1999).

(13) a. liang bei kafei
two Cl-cup coffee
'two cups of coffee'
b. liang zhang zuozi
two Cl table
'two tables'

The collective nouns *jiaju* 'furniture' and *shoushi* 'jewelry', which, as discussed above, are atomic, occur with the count classifier *jian* (14a–14b), just like prototypical count nouns such as *computer*; similarly, abstract atomic nouns such as *fangfa* 'method' and *xinxi* 'information' also occur with count classifiers such as *ge* and *tiao*, as illustrated in (14c–14d).

(14) a. Fangjian li zhiyou yi-jian jiaju.
room in only have one-Cl furniture.
'There is only one piece of furniture in the room.'

b. Zuozi shang you yi-jian shoushi
table on have one-Cl jewelry
'There is a piece of jewelry on the table.'
c. Wo you yi-ge fangfa
I have one-Cl method
'I have a method'
d. Wo you yi-tiao xinxi
I have one-Cl information
'I have a piece of information.'

Thus, there is evidence that in Mandarin, as in Korean, atomicity is encoded directly in the count/mass morphosyntax; however, in Mandarin, the role of atomicity is visible only in the domain of classifiers, and not in the domain of plural marking.

4 Summary: the count/mass distinction in English, Korean and Mandarin Chinese

The relevant properties of English, Korean and Mandarin are summarized in Table 1 (we focus here only on intrinsic plural marking in Korean). The relevant difference between English on the one side and Korean and Mandarin on the other is that the mapping between atomicity is direct in Korean and Mandarin (all atomic nouns are count, all non-atomic ones are mass), but indirect in English (which allows atomic mass nouns). The relevant difference between Korean and Mandarin is that atomicity is reflected in the system of plural marking in the former, but in the classifier system of the latter.

These contrasts allow us to make predictions for the acquisition of English count/mass morphosyntax by Korean speakers as well as Mandarin Chinese speakers. We turn to this next, after reviewing prior literature on the count/mass distinction in L2-acquisition.

5 Second language acquisition of the count/mass distinction

In this section, we first review prior studies on the L2-acquisition of the count/mass distinction, and then consider the possible effects of L1-transfer vs. semantic universals.

a Prior studies on the acquisition of the count/mass distinction. While there have been a number of L1-acquisition studies on the count/mass distinction (e.g. Barner and Snedeker, 2005; Bloom, 1994; Chien et al, 2003; Gordon, 1985; Imai and Mazuka, 2003; Nicolas, 1997; Papafragou, 2005; Papafragou, 2005; Soja, 1992), there have been relatively few studies on this topic in L2-acquisition (Athanasopoulos, 2006; Hiki, 1990, 1991; Hua and Lee, 2005; Inagaki, 2014; Snape, 2008; Yoon, 1993).

No prior study has looked at L1-Korean L2-English learners in this domain, but a number of studies have looked at L1-Japanese L2-English learners and, to a lesser extent, L1-Chinese L2-English learners. Given that Japanese is much like Korean in this domain (it is a generalized classifier language with optional plural marking), studies with L1-Japanese L2-English learners are relevant for our purposes. Hiki (1990, 1991) investigated how L1-Japanese L2-English learners judge countability of English nouns using

Table 1. The count/mass distinction in English, Korean and Mandarin Chinese.

	English	Korean	Mandarin Chinese
Classifiers	No (but has measure nouns)	Yes	Yes
Plural marking	Yes (*-s*)	Yes (*-tul*)	Yes (*-men*)
Obligatory/optional plural marking	Obligatory	Optional except with definites	Optional with [+human] nouns, impossible with [–human] nouns
Diagnostic for count/mass syntax	plural marking, numerals, indefinite article, *many* vs. *much*	plural marking	count vs. mass classifiers
The mapping between atomicity and count/mass syntax	Atomic nouns can be count or mass; Non-atomic nouns are mass	Atomic nouns are count; Non-atomic nouns are mass	Atomic nouns are count; Non-atomic nouns are mass

an editing task (in which participants edited a text which contained grammatical errors, including errors with nouns) and a writing task. Hiki found that learners had most difficulty with abstract nouns (e.g. *difficulty, fear, pleasure*) that can be used as count or mass, and also with substance-denoting nouns (e.g. *air, bread, wine*). In Yoon (1993), a study on the same topic, L1-Japanese L2-English learners were asked to judge the countability of nouns in a list without any context, and subsequently asked to complete a cloze test on the same nouns. Yoon found a high correlation between the two tasks, and used this to argue that Japanese learners of English were unaware that the countability of English nouns can be affected by context. Finally, Snape (2008) found that L1-Japanese L2-English learners at an intermediate proficiency level have great difficulty with mass nouns, especially with abstract mass nouns such as *evidence*. A similar finding was obtained by Hua and Lee (2005) for L1-Chinese L2-English learners, who were more accurate with concrete mass nouns than with abstract mass nouns, and had more difficulty with concrete mass nouns than with concrete count nouns. All of these studies suggest that mass nouns and abstract nouns pose particular difficulty for L2-English learners from generalized classifier L1s.

Finally, two studies have looked at the opposite direction, native English speakers learning a generalized classifier language. Hwang and Lardiere (2013) tested L1-English L2-Korean learners, examining the acquisition of the Korean plural marker *-tul*. They found that L1-English learners of Korean, especially at lower proficiency levels, had less difficulty with intrinsic plural marking than with extrinsic plural marking, consistent with L1-transfer from English. Kong (2012) tested L1-English L2-Chinese learners, and found that they overuse the general classifier *-ge* instead of using different separate count vs. mass classifiers; that is, the learners in Kong's study did not use classifiers to mark the count/mass distinction in Mandarin.

Importantly, while prior studies have found that acquisition of the English count/mass distinction is problematic for learners from classifier L1s, these studies did not examine the relationship between the count/mass distinction and atomicity. The one L2-study that

did consider atomicity (without using that term) is Inagaki (2014); however, this study investigated how learners perceive the meaning of count and mass nouns, rather than how they use the morphosyntax. Inagaki (2014) used a quantity judgment task with L1-Japanese L2-English learners, and compared them to the native English and native Japanese speakers tested by Inagaki and Barner (2009) (the task was originally used by Barner and Snedeker, 2005, with English-speaking children and adults). In this picture-based task, participants were asked a question of the form 'Who has more shoes / furniture / mustard?' and had to choose between one character who had two large objects or portions (e.g. two large shoes, two large pieces of furniture, two large blobs of mustard) and another character who had six small objects (e.g. six tiny shoes, six tiny pieces of furniture, six tiny blobs of mustard). Thus, one character always had the bigger volume, while the other had the bigger number of items. Prior studies had found that English-speaking children, English-speaking adults, and Japanese-speaking adults all judged substance-denoting mass nouns based on volume (two large blobs of mustard are more than six tiny blobs), but judged object-denoting count and mass nouns based on number (six tiny shoes or six tiny pieces of furniture are more than two large shoes or two large pieces of furniture). Inagaki (2014, Experiment 1) found the same performance with L1-Japanese L2-English learners. Thus, there is clear evidence that mass atomic nouns like *furniture* pattern with count nouns rather than with non-atomic mass nouns when it comes to quantity judgment, and that this is independent of language: both native speakers and learners base their judgments of nouns like *furniture* on the semantics of atomicity rather than on the count/mass morphosyntax of their language.[5] What Inagaki's study cannot tell us, however, is how L2-English learners from a generalized classifier L1 actually use the count/mass morphosyntax of English.

While Inagaki's study examined interpretation, we focus on use of the plural marking, and ask how speakers of a generalized classifier L1, in which the mapping between atomicity and count/mass morphosyntax is direct, acquire the count/mass morphosyntax of English.

b Transfer vs. semantic universals in the L2-acquisition of semantics. The role of L1-transfer in L2-acquisition is well-documented (e.g. Odlin, 1989; White, 2003). In the generative framework, the Full Transfer / Full Access Hypothesis of Schwartz and Sprouse (1994, 1996) posits that adult L2 learners transfer all categories and features of their L1 to their L2, but are also capable of acquiring new properties of the target language. On the more recent Feature Reassembly Hypothesis (Lardiere, 2009), L2-learners bring to the learning task a fully-assembled set of grammatical features from their L1; they then face the task of selecting any new features for their L2 that were not present in their L1 ('feature selection') as well as of reassembling existing features in new ways ('feature reassembly').

If L1-transfer is operative in the L2-acquisition of English plural marking, then we should expect different behavior from L1-Korean and L1-Mandarin L2-English learners in this domain. First, both groups should use plural *-s* only optionally with count nouns (since plural marking is optional in their L1s), but, with [–human], inanimate nouns, Korean speakers should use *-s* more than Mandarin speakers (given that the Mandarin *-men* is restricted to [+human] nouns). Second, Korean speakers, but not Mandarin

speakers, should overuse plural *-s* with atomic mass nouns, since in Korean, *-tul* is associated with atomicity.

While L1-transfer is a very important factor in L2-acquisition, it is certainly not the only one. In the domain of L2-acquisition of semantics, in particular, there is evidence that learners rely on semantic universals, in addition to relying on L1-transfer. With regard to L2-acquisition of articles, Ionin et al. (2004) found that L2-English learners from article-less L1s (Russian and Korean) are influenced by the semantic universal of *specificity* (associating 'the' with specific indefinites as well as with definites), while Ko et al. (2010) found that such L2-English learners are influenced by two distinct semantic universals (*specificity* and *presuppositionality*). In contrast, when the L1 (Spanish) does have articles, learners are influenced by L1-transfer, which overrides the effect of semantic universals: i.e. such learners correctly treat *the* as a marker of definiteness rather than specificity, because their L1 also has definite articles (Ionin et al., 2008).

While definiteness and specificity are semantic universals which underlie article choice, atomicity is a semantic universal which underlies plural marking, as discussed above. It is possible that atomicity would influence the course of L2-acquisition regardless of the exact semantics of plural marking in the learners' L1. If it does, then both L1-Korean and L1-Mandarin L2-English learners should associate plural *-s* with atomicity.

6 Hypotheses and predictions

In light of the above discussion, we formulate two possible hypotheses for our study, which give rise to different predictions.

(15) Hypothesis 1 (L1-transfer): L2-English learners transfer the semantics of plural marking from their L1 to their L2.

(16) Hypothesis 2 (universality): L2-English learners from generalized classifier L1s are influenced by the semantic universal of atomicity in their acquisition of English plural marking, regardless of how plural marking works in their L1.

Hypothesis 1 predicts different behavior from L1-Korean and L1-Mandarin L2-English learners. L1-Korean L2-English learners should (initially) treat English plural marking as encoding atomicity, since atomicity is encoded by the plural marker in their L1. This will result in optional use of the plural *-s* with both count nouns and mass atomic nouns, but not with mass non-atomic nouns. Input will eventually lead them to restrict *-s* to count nouns only. In contrast, L1-Chinese L2-English learners will (initially) restrict English plural marking to [+human] nouns only, since this is how plural marking works in their L1. Input will lead them to allow plural marking with [–human] count nouns as well, but they will have no reason to overuse *-s* with any mass nouns, either atomic or non-atomic. Thus, there should be two differences between the Korean and Chinese groups: (i) the Korean group should be more accurate than the Mandarin group at using plural *-s* with [–human] count nouns; and (ii) the Korean group should overuse *-s* with atomic mass nouns more than the Mandarin group.

In contrast, Hypothesis 2 predicts the same behavior from L1-Korean and L1-Chinese L2-English learners. Both groups will (initially) use English plural marking with both count nouns and mass atomic nouns, but not with mass non-atomic nouns. Input will lead them to restrict plural marking to count nouns only.

In order to test the predictions of these two competing hypotheses, we conducted a study in which we compared how L1-Korean and L1-Chinese L2-English learners use English plural marking; this study is reported in Section III. In order to be certain about how plural marking is used in the learners' L1s, we also conducted corresponding studies with native Korean and native Chinese speakers, testing them in their native languages; this study is reported in Section IV.

III Experiment 1: L1-Korean and L1-Mandarin L2-English learners

The goal of Experiment 1 was to test the predictions of the two hypotheses discussed in the previous section. Given that atomicity is encoded by the plural marking system of Korean but not the plural marking system of Mandarin, a comparison of L1-Korean and L1-Mandarin L2-English learners allows us to tease apart transfer-based vs. universal factors in the L2-acquisition of plural marking.

1 Methodology

a Procedure. We conducted an experimental study with L1-Korean and L1-Mandarin Chinese L2-English learners as well as a control group of native English speakers. Hypotheses 1 and 2 were tested by means of a Grammar Task (GT), described in detail below; participants also completed a Picture-Matching Task (PMT) on the interpretation of singular NPs, which will not be discussed in this article. The PMT investigated how L2-learners from generalized classifier languages perceive coerced mass nouns (*a water* vs. *water*), which is not directly relevant to this study (for more information about the PMT, please see Choi et al., under review). Participants were tested individually, in a single session, and were compensated for their participation. After filling out the consent form, participants completed the PMT, followed by the GT, a cloze test (for learners only), and a brief language background questionnaire. All tasks were presented on a computer screen. The GT was timed; learners were given 20 seconds to complete each test item, while native speakers were allowed 15 seconds per item (the timing was determined based on a pilot study). According to Ellis (2005), time pressure limits learners' ability to access metalinguistic knowledge, and increases reliance on implicit rather than explicit knowledge. The GT was presented via a programmed PowerPoint show, which automatically progressed to the next item after the allotted time interval had elapsed. Participants were not allowed to go back to previous test items. All the test items, instructions and examples were given in English. Participants were given a printed answer sheet on which they provided their response for each test item. The testing took about 1.5 hours for learners and under an hour for native speakers.

The cloze test used in this study was taken from Montrul (2001); it was based on a text passage adapted from *American kernel lessons: Advanced students' book*, by O'Neill et al. (1991), with every sixth word replaced by a blank, for a total of 40 blanks. Participants were asked to fill in the blanks with a word appropriate to the context. Given that Montrul found native speakers to perform at-ceiling in this cloze test, we did not administer the cloze test to our native speaker group. The cloze test was scored by means of an appropriate-word criterion.

b English Grammar Task. The GT contained 48 items (24 target items and 24 fillers). Each item consisted of a single English sentence with a word or phrase in parentheses. The participants were asked to provide the correct morphological form of the word or phrase, writing it on their answer sheet. They were instructed that they could keep the original form of the word if that form was grammatical for the sentence, or they could add an element such as a suffix, an article, or a preposition, which would make the word or phrase grammatical.

The 24 target items corresponded to six categories of four tokens each. The six categories were formed by crossing the factor 'countability' (3 levels: count, mass atomic, and mass non-atomic) with the factor 'concreteness' (2 levels: concrete and abstract). We are particularly interested in testing the effects of countability, given the prediction that learners are expected to overuse the plural marker *-s* more with mass atomic nouns like *furniture* than with mass non-atomic ones like *water*. We included the factor concreteness because, as described above, a number of studies (e.g. Hiki, 1991; Yoon, 1993) have shown that learners have more difficulty with abstract than with concrete nouns. We wanted to determine whether countability would affect concrete and abstract nouns to the same extent. A second reason to include abstract as well as concrete nouns was to check that our findings extended beyond nouns which denote superordinate categories, such as *furniture* (see footnote 2).[6]

The six categories of target items are exemplified in (17). Within each test category, half of the tokens contained a single noun in parentheses, and half contained an adjective+noun sequence.[7] Within each category, half of the items contained *more* in front of the target NP, and half contained *a lot of*. These two quantificational expressions were chosen because they give no clue as to the mass or count status of the target noun (unlike, e.g. *many* vs. *much*), and require the singular form for mass nouns (*a lot of* / *more water*) but the plural form for count nouns (*a lot of* / *more computers*). Additionally, these quantifiers are typically followed by indefinite nouns (*a lot of* can in principle combine with a definite, as in *a lot of the computers*, but this requires prior context). We thus controlled for definiteness, which, as discussed earlier, is related to use of plural marking in Korean. All target NPs were presented in object position, where indefinites are more natural than in subject position. The full list of items can be found in Appendix 1.

(17) Test categories in the English GT: sample items
   a. Count concrete: Paul donated a lot of (new computer) for homeless children last year.
   b. Count abstract: Kyle developed a lot of (new method) with his colleagues in the biochemical industry.

c. Mass atomic concrete: Lauren bought a lot of (new furniture) from Kronheim's for her new house.
d. Mass atomic abstract: This website provides a lot of (useful information) about the phenomena.
e. Mass non-atomic concrete: California farmers found more (underground water) in the southern area.
f. Mass non-atomic abstract: She may not be pretty but she has more (inner beauty) than any other girls.

The fillers included eight items which targeted definite uses of English nouns, and 16 items targeting verbal morphology. The 48 test items were arranged into four blocks, where each block contained one token from each test category plus six fillers, and randomized for order of presentation within the block (see Cowart, 1997); two test orders were created by switching the order between the two test halves. Each test order was administered to roughly half of the participants.

c Participants. Thirty-three L1-Mandarin L2-English learners (16 male and 17 female) and 33 L1-Korean L2-English learners (11 male and 22 female) participated in the study.[8] All L2-English learners resided in the USA at the time of the testing, and were students at a large Midwestern university in the USA. All the participants were intermediate to advanced learners who had arrived in the USA after the age of 18. All participants had previously studied English, which is required by the school curriculum in China, Taiwan, Hong Kong and Korea. An independent samples t-test on the cloze test proficiency scores of the two groups found that the L1-Mandarin L2-English learners had significantly higher proficiency than the L1-Korean L2-English learners ($t(64) = 3.25$, $p < .05$).

The control group consisted of 32 native English speakers (10 male and 22 females). All of them were recruited at a large Midwestern university in the USA, and all of them were over 18 at the time of testing. The background information of the participants is given in Table 2.

2 Results

The two types of responses that participants provided to the target items in the GT were singular vs. plural forms of the noun. Participants never inserted articles or other determiners before the target noun when making the correction.

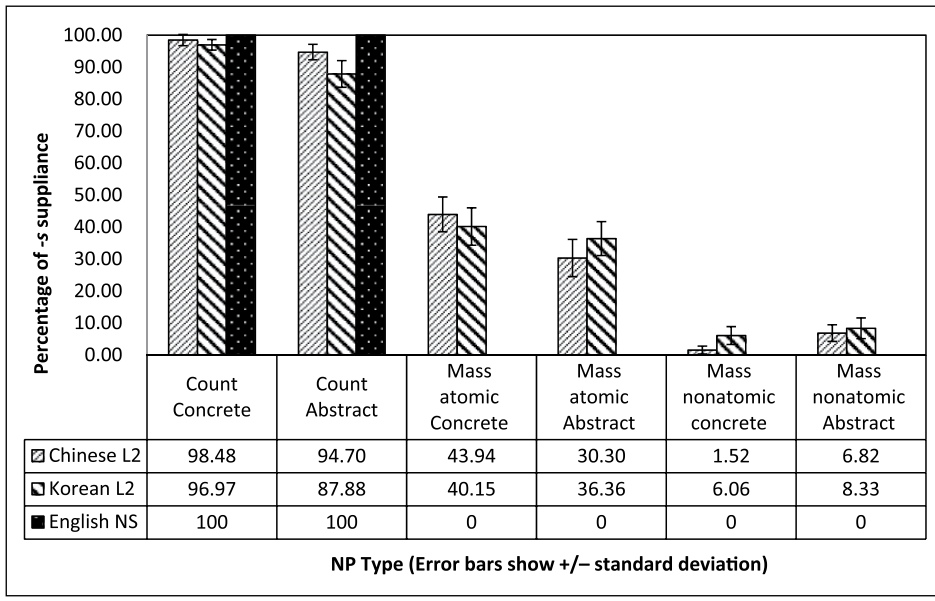
Given that the singular and the plural forms were the only two attested response options, the dependent measure for the Grammar Task was the percentage of suppliance of the plural marker *-s*. The results of all three groups are reported in Figure 1. As this figure shows, the two learner groups exhibited very similar patterns: they correctly used the plural marker *-s* with atomic count nouns, overused *-s* with atomic mass nouns, but did not exhibit overuse of *-s* with non-atomic mass nouns. Similar patterns were attested with concrete and abstract nouns.

A mixed ANOVA on the suppliance of the plural marker *-s* was conducted with countability (3 levels: count vs. mass-atomic vs. mass non-atomic) and concreteness (2 levels: abstract vs. concrete) as the within-subject variables, and learner group (2 levels: L1-Korean L2-English learners vs. L1-Mandarin L2-English learners groups) as the

Table 2. Participants' background information: Experiment 1.

Groups	N (male/ female)	Mean cloze test score (range)	Mean age at time of testing (range)	Mean length of stay in the USA in years (range)	Mean age of acquisition in formal setting (range)	Mean age of first exposure to English in the USA (range)
Native English controls	32 (10/22)	–	21 (18–31)	–	–	–
L1-Korean L2-English learners	33 (11/22)	70% (55–95%)	25 (18–34)	4.3 (0.5–12)	9.01 (5–14)	19.04* (10–32)
L1-Mandarin L2-English learners	33 (16/17)	80% (50–98%)	22 (18–30)	2.83 (0.5–6)	9.09 (5–10)	19.02 (18–30)

Notes. * There was one L1-Korean L2-English learner who came to the USA as a pre-adolescent and was thus exposed to English in an immersion setting before the age of 18 (at age 10); however, this learner subsequently returned to Korea, after only one year of stay in the USA. This participant then moved back to the USA again as an adult. We therefore classify this person as an adult L2-learner.



	Count Concrete	Count Abstract	Mass atomic Concrete	Mass atomic Abstract	Mass nonatomic concrete	Mass nonatomic Abstract
Chinese L2	98.48	94.70	43.94	30.30	1.52	6.82
Korean L2	96.97	87.88	40.15	36.36	6.06	8.33
English NS	100	100	0	0	0	0

Figure 1. English Grammar Task (GT) results, Experiment 1: Percentage of *-s* suppliance.

between-subjects variable. The native speakers of English were excluded from the analysis since they showed ceiling performance and no variability.

The ANOVA results are reported in Table 3. There was a significant effect of countability; post-hoc Bonferroni comparisons indicated that all three levels differed significantly from one another, with the most *-s* suppliance with count NPs, and the least *-s* suppliance with mass non-atomic NPs. There was also a significant effect of concreteness, with significantly more *-s* suppliance for concrete than for abstract NPs. There was also an interaction between countability and concreteness: the interaction plot shows that there was slightly more suppliance of *-s* with concrete than abstract nouns in count and mass-atomic categories, while the opposite was true for the mass non-atomic categories. There was no main effect of group, and no interaction between group and any other variable: i.e. the L1-Korean and L1-Mandarin groups exhibited the same patterns of performance.

3 Discussion

The results provide strong evidence for Hypothesis 2 rather than Hypothesis 1: the nearly identical behavior of the Korean and Mandarin Chinese groups indicates that atomicity affects both groups of learners equally, despite the fact that atomicity is encoded in the plural marking system of Korean but not the plural marking system of Mandarin. Before discussing these results further, we consider whether the description of Korean and Mandarin based on the theoretical literature is correct: it is important for us to be certain that atomicity is in fact encoded in the plural marking system of Korean but not that of Mandarin. We turn to this next.

Table 3. English Grammar Task (GT) results, Experiment 1: ANOVA output on the suppliance of *-s* marking.

Effect	*F*-statistic and *p*-value
countability	$F(2, 128) = 427.43$, $p < .001$*
concreteness	$F(1,64) = 8.88$, $p = .004$*
countability × concreteness	$F(2,128) = 7.33$, $p = .001$*
L2 group	$F(1,64) = .001$, $p = .999$
countability × L2 group	$F(2,128) = .863$, $p = .424$
concreteness × L2 group	$F(1,64) = .039$, $p = .843$
countability × concreteness × L2 group	$F(2,128) = 2.76$, $p = .067$

IV Experiment 2: native Korean speakers and native Mandarin Chinese speakers

The goal of Experiment 2 was to examine whether the plural marking system of Korean does in fact encode atomicity, while that of Mandarin Chinese does not. In order to establish this, we translated our Grammar Task into Korean and Mandarin and administered the two versions to Korean and Mandarin native speakers, respectively. In the case of the Mandarin speakers, we did not conduct a full experiment: we tested ten native Mandarin speakers on the Mandarin version of the GT, and they uniformly supplied the bare singular form for every single test item, in every category, with not a single suppliance of the plural marker *-men*. We therefore did not test any further participants, and concluded that, consistent with the literature, Mandarin does not allow the use of *-men* with [–human] nouns.[9] For the rest of this section, we report on the Korean version of the study.

1 Procedure: Korean study

The participants in the Korean study were tested on the Korean version of the GT (as well as the Korean version of the PMT, which will not be discussed in this article), and an extra task, a Grammaticality Judgment Task (GJT), with the tasks administered in the following order: consent form, language background questionnaire, PMT, GT, GJT. The GT was timed, with each item presented for 15 seconds; the task was presented on a computer screen, and participants filled in their responses on an answer sheet, exactly as in the English study. The GJT was untimed, and was presented on paper. The testing took place in a single session which lasted under an hour.

2 Participants: Korean study

Twenty-seven native speakers of Korean (16 male and 11 female), who had not taken part in the English study, participated in the Korean study. All participants resided in Korea at the time of the testing. While all participants had studied English (which is required by the school curriculum in Korea), they had not lived in an English-speaking environment and considered themselves to be functionally monolingual.

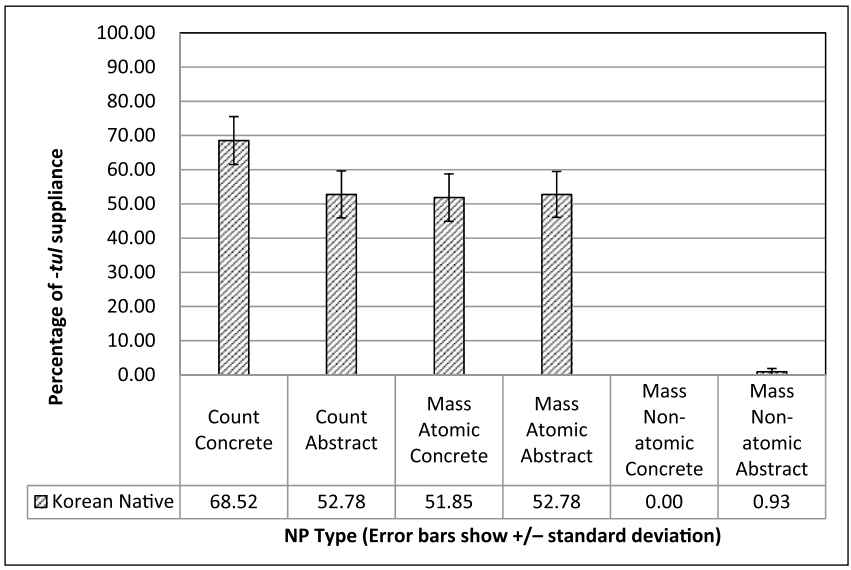


Figure 2. Korean Grammar Task (GT) results, Experiment 2: Percentage of *-tul* suppliance.

3 Korean Grammar Task: materials and results

The Korean GT was an exact translation of the English GT, with 24 test items and 24 fillers arranged in the same order as in the English GT (see Section III.1.b). The test categories were the same as in the English GT. Importantly, these categories were defined in terms of English rather than Korean: we expect that nouns that are classified as 'mass atomic' in English are in fact treated as count nouns in Korean (the Korean nouns used in the GT are given in Appendix 1).

An important difference with the English GT is that in the Korean GT, the bare form of the noun is always grammatical, in all target categories; the Korean GT is thus testing native Korean speakers' preferences with regard to the use of a bare singular noun vs. the use of *-tul*. The phrases *te manhun* 'more' and *manhun* 'a lot of' in front of the target noun emphasized the plural interpretation, and were intended to elicit use of *-tul* when *-tul* is grammatical. We predict that *-tul* would be used more in the categories classified as count and as mass atomic than in the mass non-atomic category. In fact, we predict no difference at all between the count and mass atomic categories, since both should correspond to count nouns in Korean.

As in the English GT, the dependent measure in the Korean GT was the percentage of suppliance of the plural marker (*-tul*). The results are reported in Figure 2; as it shows, Korean native speakers used the plural marker *-tul* most frequently for in the count concrete category, and hardly ever used *-tul* in the mass non-atomic categories. The count and mass atomic categories patterned very similarly, as expected, given that nouns in both categories are atomic and hence expected to be compatible with *-tul* in Korean.

Table 4. Korean Grammar Task (GT) results, Experiment 2: ANOVA output on the suppliance of *-tul* marking.

Effect	*F*-statistic and *p* -value
countability	$F(2,52) = 68.99$, $p < .001$*
concreteness	$F(1,26) = 2.98$, $p = .096$
countability × concreteness	$F(2,52) = 5.47$, $p < .05$*

A 2 × 3 repeated-measures ANOVA on the suppliance of *-tul* was conducted with countability (3 levels) and concreteness (2 levels) as the within-subjects variables. The results are reported in Table 4. There was a significant effect of countability; post-hoc Bonferroni comparisons indicated that there was no significant difference between the count category and the mass atomic category, but *-tul* was supplied significantly less with mass non-atomic nouns than with either mass atomic or count nouns. There was no effect of concreteness, but there was a significant interaction between the two factors: there was more suppliance of *-tul* with concrete than abstract nouns in the count category, but not in the other two categories (even though the difference between concrete and abstract nouns did not reach significance even for the count category).

4 Korean Grammaticality Judgment Task: materials and results

The purpose of the GJT was to supplement the GT. Since use of *-tul* in Korean is always optional with indefinites, there was a possibility that in the GT, participants would hardly ever supply *-tul* at all. We therefore created the GJT, which used exactly the same items as the GT: each test sentence from the GT was presented in two forms in the GJT, once with *-tul* and once without (each filler sentence from the GT was similarly presented in two distinct forms in the GJT). The 48 target sentences and 48 fillers were arranged into four blocks and randomized for order of presentation within each block. Participants were asked to judge each sentence in the GJT as either grammatical or ungrammatical, by circling either 'yes' or 'no'.

If *-tul* is possible with atomic but not non-atomic nouns in Korean, we predict that, in the presence of *-tul*, sentences in the count and mass atomic categories should receive higher ratings than sentences in the mass non-atomic categories. Sentences with bare singulars should be rated as grammatical in all three categories, since *-tul* is always optional.

The dependent measure in the GJT was the proportion of sentences rated as grammatical. The results are reported in Figure 3. In the four atomic categories, participants gave higher ratings, on average, to sentences which contained plural (*-tul* marked) nouns than to sentences with bare singular nouns. The reverse was the case in the two mass non-atomic categories.

A repeated-measures 3 × 2 × 2 ANOVA was conducted on the responses, with countability (3 levels), concreteness (2 levels) and number (2 levels: singular vs. plural) as the within-subjects variables. The results of the analysis are presented in Table 5. There was a significant effect of countability, but not of the other two factors. There were significant interactions between all three variables.

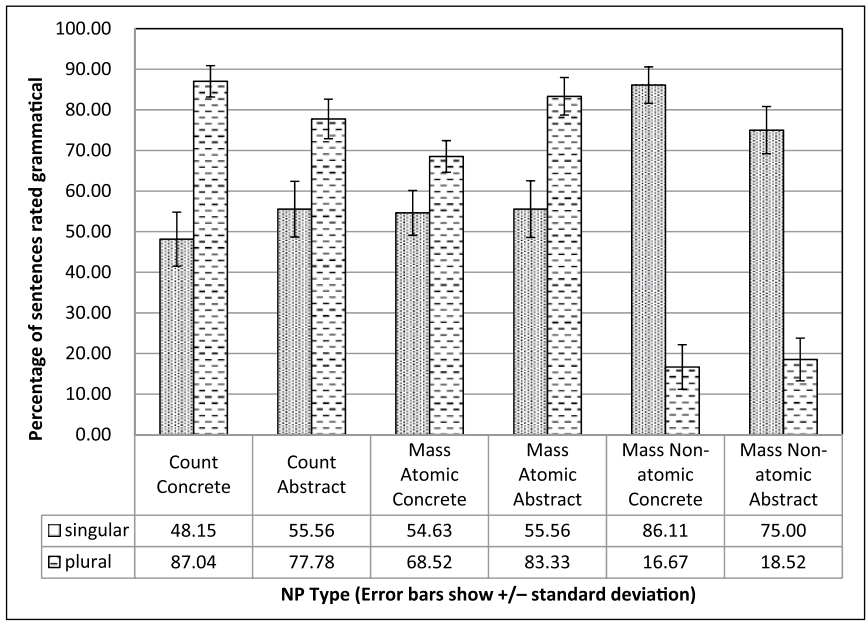


Figure 3. Korean Grammar Judgement Task (GT) results, Experiment 2: Percentage of sentences rated as grammatical.

Table 5. Korean Grammaticality Judgment Task (GJT) results, Experiment 2: ANOVA output on the percentage of sentences rated as grammatical.

Effect	*F*-statistic and *p*-value
countability	$F(2,52) = 23.42$, $p < .001$*
concreteness	$F(1,26) = .051$, $p = .823$
number	$F(1,26) = 2.31$, $p = .082$
countability × concreteness	$F(2,52) = 3.34$, $p = .043$*
countability × number	$F(2,52) = 50.02$, $p < .001$*
concreteness × number	$F(1,26) = .862$, $p = .362$
countability × concreteness × number	$F(2,52) = 6.83$, $p = .002$*

In order to find the source of the three-way interaction, two follow-up 2 × 3 ANOVAs were conducted, one on sentences with plural nouns and the other on sentences with singular nouns; the alpha level was set to .025 (.05/2, Bonferroni correction). For sentences with singular nouns, countability had a significant effect ($F(2,52) = 10.80$, $p < .001$), with significantly higher acceptance of singular nouns in the mass non-atomic than the count and mass atomic categories. Concreteness had no effect ($F(1,26) = .227$, $p = .638$), and there was no interaction ($F(2,52) = 3.02$, $p = .638$). For sentences with plural (*-tul* marked) nouns, countability once again had a significant effect ($F(2,52) = 100.79$, $p < .001$), with plural nouns accepted significantly less in the mass non-atomic

category than the other two categories (*-tul* was also accepted marginally less in the mass atomic than in the count category). There was no effect of concreteness ($F(1,26) = .837$, $p = .369$), but it interacted significantly with countability ($F(2, 52) = 9.03$, $p < .001$); the interaction plot revealed that participants accepted sentences with plural nouns more with concrete nouns than abstract nouns in the count category, while the opposite was the case in the mass atomic category (concreteness did not appear to matter in the mass non-atomic category).

5 Discussion

The Korean study results are consistent with the description of Korean in Kim (2005). In the GT, Korean NSs used the plural marker *-tul* optionally with count and mass atomic nouns, but hardly used it with non-atomic nouns. Similarly, in the GJT, Korean NSs found count and mass atomic nouns to be more acceptable in the presence of *-tul* and found mass non-atomic nouns to be more acceptable without *-tul*.[10] These findings provide empirical evidence for Kim's (2005) claim that Korean has a count/mass distinction which is based on atomicity. Even though *-tul* is always optional with indefinites, when a plural interpretation of an atomic NP was targeted, Korean NSs preferred to use *-tul*, and judged nouns without *-tul* to be less acceptable than those with *-tul*.

To sum up, the results from both Korean and Mandarin experiments show that the behavior of plural marking in these languages is just as we had assumed based on the literature: *-tul* is optionally used with atomic nouns, while *-men* is not used at all with [–human] nouns.

V General discussion and suggestions for further research

The findings presented in this article have a number of important implications. First, we have seen (in Experiment 2) that plural marking in Korean is much more productive than plural marking in Mandarin, and furthermore reflects atomicity. Second, we have seen (in Experiment 1) that, despite the differences between their L1s, both L1-Korean and L1-Mandarin L2-English learners correctly use *-s* with count nouns and optionally overuse *-s* with atomic mass nouns in English, but not with non-atomic ones. Thus, for atomicity to influence the L2-acquisition of plural marking, it is not necessary for atomicity to be encoded in the plural marking system of the learners' L1. Rather, we have argued that atomicity influences L2-learners because it is a semantic universal.

1 Indirect transfer or a semantic universal?

There are two ways of potentially accounting for why atomicity influences the L2-learner groups in our study. One possibility is that we are dealing with L1-transfer after all, but while transfer is direct in the case of Korean speakers (who map the semantics of *-tul* onto the semantics of English plural *-s*), it is quite indirect in the case of Mandarin speakers. Recall that in Mandarin, atomicity appears to be encoded in the classifier system; it is possible that, because of this, Mandarin learners of English transfer the mapping between atomicity and the nominal domain, and hence are influenced by atomicity in the

acquisition of plural marking. However, we find this explanation to be unlikely. Classifiers and plural marking are very different phenomena (morphologically, syntactically and semantically), and it is not at all clear why L1-Mandarin L2-English learners should map classifiers to plural marking. Furthermore, indirect transfer of this type is not readily attested in other domains. For example, many studies show that L2-English learners from article-less L1s have difficulty acquiring the semantics of definiteness that underlies English articles, even though definiteness is encoded elsewhere in the L1 (e.g. word order, demonstratives, etc.). The mere fact that a semantic universal receives expression somewhere in the learners' L1 is not by itself sufficient for learners to transfer this universal to the target category (such articles or plural marking) in their L2. In fact, semantic universals, by virtue of being universals, find expression somewhere in the linguistic system, albeit in different domains (e.g. specificity can be reflected on determiners, but also on adjectives – such as *certain, particular* – and in the mood system of the Spanish indicative/subjunctive contrast; see, for example, Rivero, 1975; Quer, 1998).

Another possibility, suggested by an anonymous reviewer, is that L1-Mandarin L2-English learners might after all be transferring the semantics of plural marking from their L1 to their L2: since *-men* is used only with [+human] nouns, and since [+human] nouns are by definition atomic, we could still be dealing with transfer of the semantics of atomicity. As we see it, the story would need to go something like this. In Mandarin, *-men* encodes the features [+human, +atomic]. Therefore, first, L1-Mandarin L2-English learners assume that the English plural marker also encodes the features [+human, +atomic]. Confronted with multiple instances of [–human] nouns with plural marking in the input, they change their hypothesis to the plural marker encoding only the [+atomic] feature, and as a result, overuse *the* with atomic mass nouns. While we cannot exclude this explanation entirely, it would seem to predict that Mandarin speakers should overall exhibit less use of the plural marker *-s* than Korean speakers: after all, Korean speakers start out from the beginning of acquisition assuming that *-s* is about atomicity, while Mandarin speakers go through two stages, first treating it as a marker of the [+human] feature and then switching to treating it as a marker of atomicity. The fact that Mandarin and Korean L2-English learners in our study exhibited nearly identical degree of plural *-s* use speaks against the L1-transfer explanation.

Rather than arguing for some form of indirect transfer, we argue that learners are influenced by atomicity because it is a semantic universal that underlies the count/mass distinction cross-linguistically. As discussed in Section II.5, Inagaki and Barner (2009) and Inagaki (2014) have found that atomicity influences judgments of quantity regardless of the language (English or Japanese) or status as a native speaker or a learner (while they do not use the term 'atomicity', they draw the same distinction that we do). The fact that even speakers of English, in which words like *furniture* have mass morphosyntax, nevertheless fall back on atomicity when making judgments of quantity, supports the view of atomicity as a semantic universal. When learners from a generalized classifier L1 are faced with the task of learning English count/mass morphosyntax, they initially hypothesize that English plural marking encodes atomicity – not because atomicity is encoded (in some way) in their L1, but because atomicity is a semantic universal. A similar proposal has been made in the L2-acquisition of the English article system by Ionin et al. (2004), who argued that L2-English learners from article-less L1s rely on the

semantic universals of definiteness and specificity when making hypotheses about the meaning of English articles.

In future research, it would be quite interesting to test L2-English learners from an L1 which, like English, has both obligatory plural marking and atomic mass nouns (e.g. Russian or French). If such learners perform exactly like the L1-Korean and L1-Mandarin L2-English learners in our study, i.e. if they rely on atomicity and overuse *-s* with nouns like *furniture, luggage*, etc. (but not with *water* or *gas*), this would provide compelling evidence for the effect of atomicity as a semantic universal. On the other hand, if these learners are not influenced by atomicity, this would indicate that direct L1-transfer overrides atomicity: if, e.g. L1-Russian L2-English learners correctly use *furniture* in the singular, this would likely be an effect of direct transfer from Russian. It is probable that such learners would treat as mass those English nouns that are mass in their L1, and as count – those that are count in their L1. We would then say that L1-Korean/Mandarin L2-English learners are influenced by atomicity as a semantic universal, while for learners from a language with obligatory plural marking (such as Russian or French), transfer from their L1 overrides access to the semantic universal of atomicity. This type of argument was made by Ionin et al. (2008), who showed that L2-English learners from an article-less L1 (Russian) were influenced by specificity, while those from an L1 with articles (Spanish) were not; Ionin et al. argued that transfer from the Spanish article system overrode access to the semantic universal of specificity.

To sum up, we conclude that the results of this study support the view of atomicity as a semantic universal which influences all languages. The effects of atomicity on L2-English plural marking are not restricted to learners whose L1 (Korean) encodes atomicity in its plural system.

2 *Learnability*

So far in this article, we have focused on the fact that the L2-learners overuse plural *-s* with atomic mass nouns significantly more than with non-atomic mass nouns, consistent with the influence of atomicity. However, it is important to note that the learners also exhibit significantly more (correct) use of *-s* with count nouns than (incorrect) use of *-s* with mass nouns. Indeed, the learners were at-ceiling in their correct suppliance of plural marking with count nouns. Given that the learners had intermediate-to-advanced proficiency, this is not surprising. Clearly, in addition to the influence of atomicity, the learners are also influenced by L2-input, which informs them that nouns like *chair* require plural marking when more than one entity is being referred to.

We note that the count/mass distinction of English is quite learnable, and does not suffer from poverty of the stimulus, as there is much unambiguous evidence in the input pointing to the status of a noun as count vs. mass. In particular, the use of *many* vs. *much* clearly points to a noun being count vs. mass; count nouns have a variety of other cues as well, including the indefinite article and the universal quantifiers *every* and *each*. Furthermore, when it comes to combination with numerals, count nouns combine with numerals directly, while mass nouns require measure phrases such as *a pound of* or *a piece of*. If learners start with the hypothesis that, e.g. *table* and *furniture* are count nouns but *water* is a mass noun, they will then face contradictory evidence: they will be exposed

to nouns like *furniture* consistently behaving like *water* rather than like *table* in terms of which quantifiers they can combine with, and how they combine with numerals. Eventually, this should lead learners to re-classify *furniture* as a mass rather than a count noun. We hypothesize that such learning happens on a piecemeal basis: just because *furniture* is mass, it does not follow that *evidence* or *luggage* should also be mass. This would explain why overuse of *-s* with mass atomic nouns persists for advanced learners, even when they are near-ceiling with count nouns and mass non-atomic nouns.

3 Suggestions for further research

There are a number of directions that can be pursued with this research. First, as discussed above, there is reason to test L2-English learners who come from a plural-marking L1, in order to attempt to examine whether L1-transfer overrides semantic universals in this domain. Second, given our hypothesis, discussed above, that the acquisition of the count/mass distinction is driven by cues such as *many* vs. *much*, it may be interesting to conduct a classroom intervention study, to see if attracting learners' attention to such cues would improve their performance with mass atomic nouns.

Acknowledgements

The third author's research is supported by the Humanities and Social Sciences Foundation of the Ministry of Education of China for Young Scholars (Project No. 11YJC740165).

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Notes

1. At the theoretical level, the concepts 'atomicity' and 'boundedness', as well as the closely related one of 'individuation' receive slightly different definitions (see, for example, Bunt, 1985; Chierchia, 2010; Landman, 1989, 1991). However, for the purposes of this study, the differences among them are irrelevant: all nouns tested denote either atomic/bounded/individuated entities, or else non-atomic/unbounded/non-individuated ones. We use the term 'atomicity' in this study, following the terminology in Chierchia (1998a, 1998b, 2010). However, nothing in our analysis hinges on this choice of terminology.
2. An anonymous reviewer points out that the concrete nouns that we are classifying as mass atomic have an additional property of denoting superordinate categories: i.e. there are no fixed predetermined atoms for nouns such as *furniture* or *jewelry*, unlike nouns such as *table* or *necklace*. As pointed out by Chierchia (2010), such superordinate nouns vary both across languages and within a language in terms of whether they have mass or count syntax: e.g. Italian has both *mobile*/*mobile* (count) and *mobilia* (mass), both of which mean 'furniture', while the Italian *calzatura*/*calzature* 'footwear' is count (Chierchia 2010: 110). Chierchia

(2010: 139) notes that 'nouns like *furniture* do retain their atomic structure. Such structure can be extracted from their denotation … And such structure will be indistinguishable from that of plurals.' A detailed discussion of superordinate nouns is beyond the scope of the present article. We hold to the view that such nouns are atomic, and we furthermore note that the abstract atomic nouns discussed in our study, such as *evidence* or *advice*, do not denote superordinate categories. The fact that we obtain very similar results for concrete nouns like *furniture* and abstract nouns like *evidence* suggests that our findings are not specific to nouns which denote superordinate categories.

3. The following abbreviations are used in this article: Acc = Accusative, Asp = Aspect, Cl = Classifier, Decl = Declarative, Gen = Genitive, Nom = Nominative, Pl = Plural, Top = Topic.
4. While *-tul* marking is always optional in indefinite contexts, as shown above, it is obligatory with definites (both in the presence of a demonstrative, and in anaphoric contexts). For more discussion and examples, see, amongst others, Kim, 2005; Kwon and Zribi-Hertz, 2004; Nemoto, 2005. As only indefinite contexts are tested in our studies, this is not directly relevant for us.
5. There were some differences between native English speakers and native Japanese speakers in Inagaki and Barner (2009), as well as with the learners in Inagaki (2014), with regard to flexible nouns such as *string*, which can be both count and mass in English. These differences are not directly relevant to our study, which does not test such nouns. Another study that used the quantity judgment task was Cheung, Li and Barner (2010), with native Mandarin Chinese speakers; however, this study did not test the category of atomic mass nouns that is of interest to us in the present article.
6. An anonymous reviewer notes that four tokens per condition is very few. We acknowledge this as a limitation, but we also note that, if the concrete and abstract items are combined, we have eight tokens per each countability level. Given that our focus is on the effects of countability, and given that performance was very similar with concrete and abstract nouns, as described below, eight items per countability level are sufficient to allow us to generalize about mass vs. count nouns.
7. There were no noticeable differences in performance on nouns with vs. without adjectival modification; adjectival modification was not included as a factor in this study. All nouns tested were inanimate, with the single exception of one item with the noun *boy* in the count concrete category; performance on this item was no different from that on the other items in the count concrete category.
8. The Korean speakers were selected from a larger sample of 61 participants, as we had initially tested L1-Korean L2-English learners of differing proficiency levels. Since the goal of the present study is on the Korean/Mandarin comparison, we selected the subset of Korean speakers who L2-English proficiency most closely matched that of the Mandarin speakers tested in the study.
9. One of the test item in our Grammar Task did contain a [+human] noun, *boy*, which is in principle compatible with *-men* in Mandarin. However, the 10 native Mandarin speakers whom we tested never opted to use *-men* even with this item. While we did not conduct a formal experiment on the use of classifiers in Mandarin, we did examine which classifiers the nouns tested in the GT would be compatible with (the Mandarin version of the GT did not use any classifiers with the target nouns). All nouns used in our mass non-atomic category take mass classifiers in Mandarin, whereas all nouns used in our count category, and all but one of the nouns used in our mass atomic category take count classifiers in Mandarin. The single exception is the noun *xianjin* 'cash', from the mass atomic category, whose classifier behavior is inconclusive. Thus, with respect to our test items, Mandarin classifiers draw the distinction between atomic and non-atomic nouns.

10. As pointed out by an anonymous reviewer, the GT and the GJT did give somewhat different results: whereas use of *-tul* was completely optional for atomic nouns in the GT (i.e. participants produced *-tul* about 50% of the time, and produced the singular form about 50% of the time); in the GJT, the participants exhibited a strong preference for *-tul* over a singular form, with atomic nouns. This result most likely stemmed from the differences in test format: the GJT was a more metalinguistic task, which explicitly gave participants both singular and plural forms that could then be compared. Crucially, the overall effect of atomicity was the same in the GT as in the GJT.

References

An Y (2007) Korean *tul* and English *all*. In: Shields R (ed.) *LSO Working Papers in Linguistics 7: Proceedings of WIGL* (pp. 1–16). Madison, WI: University of Wisconsin-Madison.

Amuzie GL and Spinner P (2013) Korean EFL learners' indefinite article use with four types of abstract nouns. *Applied Linguistics* 34: 415–34.

Athanasopoulos P (2006) Effects of the grammatical representation of number on cognition in bilinguals. *Bilingualism: Language And Cognition* 9: 89–96.

Baek M (2002) A study on Korean plural senses. *Discourse and cognition* 9: 59–78.

Barner D and Snedeker J (2005) Quantity judgments and individuation: Evidence that mass nouns count. *Cognition* 97: 41–66.

Bloom P (1994) Possible names: The role of syntax–semantics mappings in the acquisition of nominals. *Lingua* 92: 297–329.

Borer H (2005) *In Name Only: Structuring Sense: Volume 1*. Oxford: Oxford University Press.

Bunt HC (1985) *Mass terms and model-theoretic semantics*. Cambridge: Cambridge University Press.

Cheng L (2000) Moving just the feature. In: Lutz U, Müller G, and von Stechow A (eds) *Wh-scope marking*. Amsterdam: John Benjamins, pp. 77–99.

Cheung P, Li P, and Barner D (2010) Individuation and quantification: Do bare nouns in Mandarin Chinese individuate? In: Clemens LE and Liu C-M (eds) *Proceedings of the 22nd North American Conference on Chinese Linguistics* (pp. 395–412). Cambridge, MA: Harvard University.

Cheng L and Sybesma R (1998) Yi-wang Tang, yi-ge Tang: Classifiers and massifiers. *Tsing Hua Journal of Chinese Studies* 3: 385–412.

Cheng L and Sybesma R (1999) Bare and not-so-bare nouns and the structure of NP. *Linguistic Inquiry* 30: 509–42.

Chien YC, Lust B, and Chiang C (2003) Chinese children's comprehension of count-classifiers and mass-classifiers. *Journal of East Asian Linguistics* 12: 91–120.

Chierchia G (1998a) Reference to kinds across languages. *Natural Language Semantics* 6: 339–405.

Chierchia G (1998b) Plurality of mass nouns and the notion of 'semantic parameter'. In: Rothstein K (ed) *Events in Grammar*. New York: Springer, pp. 53–103.

Chierchia G (2010) Mass nouns, vagueness and semantic variation. *Synthese* 174: 99–149.

Choi S, Ionin T, and Zhu Y (under review) Interpretation of count and mass NPs by L2-English learners from generalized classifier L1s. In: Rispoli M and Ionin T (eds) *Proceedings of the 7th Conference on Generative Approaches to Language Acquisition North America (GALANA 7).* Amsterdam: John Benjamins.

Cowart W (1997) *Experimental syntax*. Thousand Oaks, CA: Sage.

Ellis R (2005) Measuring implicit and explicit knowledge of a second language: A psychometric study. *Studies In Second Language Acquisition* 27: 141–72.

Gebhardt L (2009) Numeral classifiers and the structure of DP. Unpublished PhD Thesis, Northwestern University, Evanston, IL, USA.

Gordon P (1985) Evaluating the semantic categories hypothesis: The case of the count/mass distinction. *Cognition* 20: 209–42.

Hiki M (1990) The judgment of noun countability by Japanese college students: Where is the difficulty? *JACET Bulletin* 21: 19–38.

Hiki M (1991) A study of learners' judgment on noun countability. Unpublished PhD Thesis, Indiana University, Bloomington, IN, USA.

Hua D and Lee THT (2005) Chinese ESL learners' understanding of the English count–mass distinction. In: Dekydtspotter L, Sprouse R, and Lijestrand A (eds) *Proceedings of the 7th Generative Approaches to Second Language Acquisition Conference*. Somerville, MA: Cascadilla Proceedings Project, pp. 138–49.

Hwang S and Lardiere D (2013) Plural-marking in L2 Korean: A feature-based approach. *Second Language Research* 29: 57–86.

Iljic R (1994) Quantification in Mandarin Chinese: two markers of plurality. *Linguistics* 32: 91–116.

Imai M and Mazuka R (2003) Reevaluating linguistic relativity: Language-specific categories and the role of universal ontological knowledge in the construal of individuation. In: Gentner D and Goldin-Meadow S (eds) *Language in mind: Advances in the study of language and thought*. Cambridge, MA: MIT Press, pp. 429–64.

Inagaki S (2014) Syntax–semantics mappings as a source of difficulty in Japanese speakers' acquisition of the mass–count distinction in English. *Bilingualism: Language and cognition* 17: 464–77.

Inagaki S and Barner D (2009) Countability in absence of count syntax: Evidence from Japanese quantity judgments. In: Inagaki S, Hirakawa M, Hirakawa Y, et al. (eds) *Papers from the Eighth Annual Conference of the Japanese Society for Language Sciences (Studies in Language Sciences 8)*. Tokyo: Kurosio, pp. 111–25.

Ionin T, Ko H, and Wexler K (2004) Article semantics in L2 acquisition: The role of specificity. *Language Acquisition* 12: 2–69.

Ionin T, Zubizarreta ML, and Bautista Maldonado S (2008) Sources of linguistic knowledge in the second language acquisition of English articles. *Lingua* 118: 554–76.

Iwasaki N, Vinson DP, and Vigliocco G (2010) Does the grammatical count/mass distinction affect semantic representations? Evidence from experiments in English and Japanese. *Language And Cognitive Processes* 25: 189–223.

Jackendoff R (1991) Parts and boundaries. *Cognition* 41: 9–45.

Ko H, Ionin T, and Wexler K (2010) The role of presuppositionality in the second language acquisition of English articles. *Linguistic Inquiry* 41: 213–54.

Kim C (2005) The Korean plural marker *tul* and its implications. Unpublished PhD Thesis, University of Delaware, Newark, DE, USA.

Kong S (2012) Adult English speakers' acquisition of Chinese count–mass classifiers. *Journal of Chinese Linguistics* 40: 442–77.

Kwon S and Zribi-Hertz A (2004) Number from a syntactic perspective: Why plural marking looks 'truer' in French than in Korean. In: Bonami O and Cabredo Hofherr P (eds) *The 5th Colloque de Syntaxe et Sémantique à Paris* (pp. 133–58). Paris: Thesus.

Langacker RW (1999) *Grammar and Conceptualization*. Berlin: Mouton de Gruyter.

Landman F (1989) Groups, I. *Linguistics and Philosophy* 12: 559–605.

Landman F (1991) *Structures for Semantics*. SLAP 45. Dordrecht: Kluwer.

Lardiere D (2009) Some thoughts on a contrastive analysis of features in second language acquisition. *Second Language Research* 25: 173–227.

Li YA (1999) Plurality in a Classifier Language. *Journal of East Asian Linguistics* 8: 75– 99.
Montrul S (2001) Agentive verbs of manner of motion in Spanish and English as second languages. *Studies in Second Language Acquisition* 23: 171–206.
Nemoto N (2005) On mass denotations of bare nouns in Japanese and Korean. *Linguistics* 43: 383–413.
Nicolas D (1997) Count nouns, mass nouns and their acquisition. Mémoire de troisième année de doctorat [special comprehensive examination], McGill University, Montreal, Canada.
Odlin T (1989) *Language transfer: Cross-linguistic influence in language learning*. Cambridge: Cambridge University Press.
O'Neill R, Cornelius ET, and Washburn GN (1991) *American Kernel Lessons: Advanced Students' Book*. New York: Longman.
Papafragou A (2005) Relations between language and thought: Individuation and the count/mass distinction. In: Lefebvre C and Cohen H (eds) *Handbook of Categorization in Cognitive Science*. New York: Elsevier, pp. 256–71.
Paradis C (2001) Adjectives and boundedness. *Cognitive Linguistics* 12: 47–65.
Paradis C (2005) Ontologies and construals in lexical semantics. *Axiomathes* 15: 541–73.
Quer J (1998) *Mood at the Interface*. Amsterdam: Holland Academic Graphics.
Rivero ML (1975) Referential properties of Spanish noun phrases. *Language* 51: 32–48.
Schwartz B and Sprouse R (1994) Word order and nominative case in nonnative language acquisition: A longitudinal study of (L1 Turkish) German Interlanguage. In: Hoekstra T and Schwartz BD (eds) *Language Acquisition Studies in Generative Grammar: Papers in Honor of Kenneth Wexler from the 1991 GLOW Workshops*. Philadelphia, PA: John Benjamins, pp. 317–68.
Schwartz B and Sprouse R (1996) L2 cognitive states and the Full Transfer/Full Access model. *Second Language Research* 12: 40–72.
Slabakova R (2008) *Meaning in the Second Language*. Berlin: Mouton de Gruyter.
Snape N (2008) Resetting the nominal mapping parameter in L2 English: Definite article use and the count–mass distinction. *Bilingualism: Language and Cognition* 11: 63–79.
Soja N (1992) Inferences about the meanings of nouns: The relationship between perception and syntax. *Cognitive Development* 7: 29–46.
White L (2003) On the nature of interlanguage representation: Universal Grammar in the second language. In: Doughty C and Long M (eds) *Handbook of Second Language Acquisition*. London: Blackwell, pp. 19–42.
Wierzbicka A (1985) Oats and wheat: The fallacy of arbitrariness. In: Haiman J (ed) *Iconicity in Syntax*. Amsterdam: John Benjamins (also in A Wierzbicka (1988) *The semantics of grammar*. Amsterdam: John Benjamins).
Yi B (2010) Numeral classifiers and the mass/count distinction. Unpublished manuscript, University of Toronto, Canada.
Yoon KY (1993) Challenging prototype descriptions: Perception of noun countability and indefinite vs. zero article use. *International Review of Applied Linguistics* 31: 269–89.
Zheng H (2011) About the plural marker *tul* in Korean. *Studies in Linguistics* 19: 281–302.

Appendix 1.

List of items.

English nouns for each category (Experiment 1)

Category	Nouns used
Count concrete	computer, pencil, chair, boy
Count abstract	method, idea, message, topic
Mass atomic concrete	furniture, luggage, equipment, cash
Mass atomic abstract	evidence, advice, information, literature
Mass non-atomic concrete	water, gas, oil, air
Mass non-atomic abstract	happiness, courage, fun, beauty

English GT items (for Experiment 1)

A. Count concrete

1. Paul donated a lot of (new computer) for homeless children last year.
2. Ann picked up a lot of (pencil) in the classroom after class.
3. Jason saw more (young boy) than expected on the playground of the preschool.
4. Michael decided to stack more (chair) in the storage closet, just in case.

B. Count abstract

1. Kyle developed a lot of (new method) with his colleagues in the biochemical industry.
2. Amy brought more (good idea) than others to develop a new financial system.
3. Yesterday, Maria received a lot of (message) from Jamie Parker, her former boss.
4. Jake brought up more (topic) than any of the other members of the city council.

C. Mass atomic concrete

1. Lauren bought a lot of (new furniture) from Kronheim's for her new house.
2. Mary traveled to Europe last summer, and brought a lot of (luggage) with her.
3. Recently, police purchased more (new equipment) to suppress the riots.
4. Alicia thinks that she needs more (cash) whenever she opens her purse.

D. Mass atomic abstract

1. This study provides more (good evidence) for the claim than any other research.
2. Mark gave me a lot of (advice) about that issue, and I was very grateful to him.
3. This website provides a lot of (useful information) about the phenomena.
4. I think I have read more (literature) about love than any other person.

E. Mass non-atomic concrete

1. California farmers found more (underground water) in the southern area.
2. Early models of cars needed much more (gas) than recent models.
3. The soldiers needed a lot of (fresh air) after using toxic chemicals in training.
4. A damaged ship leaked a lot of (oil) into the Mississippi River last night.

F. Mass non-atomic abstract

1. The beautiful baby brought a lot of (happiness) to him and his family.
2. John showed a lot of (physical courage) in many battles of World War II.
3. Mary and I had more (fun) together than any other girls in high school.
4. She may not be pretty but she has more (inner beauty) than any other girl.

Korean nouns for each category (Experiment 2)

Category	Nouns used
Count concrete	컴퓨터 (computer), 연필 (pencil), 의자 (chair), 소년 (boy)
Count abstract	방법 (method), 아이디어 (idea), 메시지 (message), 안건 (topic)
Mass atomic concrete	가구 (furniture), 짐 (luggage), 장비 (equipment), 현금 (cash)
Mass atomic abstract	증거 (evidence), 조언 (advice), 정보 (information), 참고문헌 (literature)
Mass non-atomic concrete	물 (water), 가스 (gas), 기름 (oil), 공기 (air)
Mass non-atomic abstract	행복 (happiness), 용기 (courage), 즐거움 (fun), 아름다움 (beauty)

Chinese nouns for each category (Experiment 2)

Category	Nouns used
Count concrete	电脑 (computer), 铅笔 (pencil), 椅子 (chair), 男孩 (boy)
Count abstract	方法 (method), 想法 (idea), 消息 (message), 话题 (topic)
Mass atomic concrete	家具(furniture), 行李(luggage), 设备(equipment), 现金 (cash)
Mass atomic abstract	证据 (evidence), 建议 (advice), 信息 (information), 文 (literature)
Mass non-atomic concrete	水 (water), 汽油 (gas), 石油 (oil), 空气 (air)
Mass non-atomic abstract	欢乐 (happiness), 勇气 (courage), 乐趣 (fun), 美 (beauty)