Second Language and Cognition: Conceptual Categorization of Count/Mass Nouns in English with Japanese University Students

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Abstract

This paper reports on a study designed to explore the conceptual basis of count/mass noun distinction with Japanese students. It focuses on the perceptual cues used to match pictures with count or mass noun phrases, when there is the effect of distance, size, and clarity between pairs of pictures. The study tests the cognitive individuation hypothesis in which count nouns are conceptualized as individuated things whereas mass nouns are conceptualized as non-individuated things in the mind of speakers. Participants in this study

were 103 students from a university in Japan. They completed picture tasks consisting of 22 pairs of novel pictures with a phrase indicating a novel count or mass noun. The results indicate that participants relied primarily on the perceptual cue of distance and clarity to match pictures with count or mass noun phrases. They made the majority of choices consistent with the cognitive individuation hypothesis, when there were two effects (size and distance, or distance and clarity). The study provides insights into effective ways to enhance Japanese speakers' application of conceptual knowledge when making count/mass noun distinction in English and potentially informs future studies in second language and cognition and EFL pedagogy.

Keywords: Count/Mass Noun Categorization, Japanese EFL Users, Aggregates, Cognitive Individuation Hypothesis, Perceptibility

Introduction

"Teacher, why can't we categorize rice as a count noun in English? We can count rice in Japanese." This is a common question of Japanese students who eat rice three times a day and are able to count rice within the Japanese grammatical system. Common forms of noun categorization are the count/mass noun distinction system used in English and Arabic and the classifier system used in Chinese and Japanese. German and French encode both number and gender as part of the inherent properties of nouns. In the early twentieth century, Sapir and Whorf proposed that human cognition, the way people see the world, is affected by language and culture (see Whorf, 1956). In the last decade, the Sapir-Whorf hypothesis has been revived and there is ongoing research investigating how language and culture influence cognition (e.g., Jarvis & Odlin, 2000; Levinson, 2003; Nisbett, 2003; Pavlenko, 2002). The current study focuses on the conceptual basis of count/mass noun distinctions with Japanese speakers and explores whether

their conceptual categorization of count and mass nouns in English differs from that of native English speakers as indicated in previous research (e.g., Bloom, 1994; Bloom & Kelemen, 1995; Wisniewski, Imai & Casey, 1996).

1.1 Language and cognition: Count/mass noun distinction and the concept of individuation

The relationship between language and cognition has been of great interest for second language acquisition researchers. According to Whorf (1956), language plays an important role in shaping cognition of concepts. In this view, human concepts can be influenced by the acquisition of grammatical categories in different languages. In the last decade, the extent to which a learners' L1 conceptual structure influences their second language has received growing attention in the field of cognitive psychology. Studies have explored different perspectives such as the concept of space (e.g., Levinson, 1996, 2003), the concept of time (Boroditsky, 2001; von Stutterheim, 2003), the concept of color (Roberson, Davies, & Davidoff, 2000) and the concept of emotion (Pavlenko, 2002).

The current study explores the relationship between language and cognition, focusing on count/mass noun distinction and the concept of individuation. The concept of individuation is illustrated in the process of people drawing a mental boundary around an apple and viewing the apple as an individuated object, distinct from other apples. Through the process of individuation, people can count an apple with apple-sized units. Langacker (1987) suggests that people focus on the boundary of entities in order to construe count nouns and do not see the boundary of entities in the case of mass nouns.

Psychologists have long discussed how people conceptually distinguish count and mass nouns in their mind beyond grammatical categorization. In the domain of psycholinguistics, a cognitive individuation hypothesis predicts that count nouns are conceptualized as distinct, countable, and individuated things whereas mass nouns are conceptualized as non-distinct, uncountable, and non-individuated things in the minds of speakers (Bloom, 1990, 1996; Langacker, 1987, 2008; Link, 1983, 1998; Wierzbicka, 1998). Previous studies evaluated the cognitive individuation hypothesis with native English speakers in different domains (Bloom, 1994; Bloom & Kelemen, 1995; Middleton et al., 2004; Wisniewski et al., 1996). Bloom (1994) found that native English children interpreted a count noun describing a series of sounds as individual sounds, whereas they interpreted a mass noun describing a series of sounds as non-individuated sounds. In the domain of superordinates, Wisniewski et al. (1996) investigated native English speaking university students and found that mass superordinates (e.g., furniture, clothing) refer to non-individuated groups of objects whereas count superordinates (e.g., vehicles) refer to individuated groups of objects. Further, Middleton et al. (2004) explored the domain of aggregates which refers to relatively small, homogeneous things which tend to occur together (e.g., sugar, rice, beans) with English university students and found that count aggregate such as sugar refers to individuated groups whereas mass aggregate refers to non-individuated groups. These studies support the cognitive individuation hypothesis in the context of native English speakers.

1.2 Numerical classifier language and the concept of individuation

The numerical classifier system is one type of classifier system. In numerical

classifier languages, classifiers for nouns occur as morphemes in order to indicate the quantity of the entity. Numerical classifier languages are found in the region of South-East and East Asia, i.e. Thai, Japanese and Chinese. In Japanese, there are approximately 70 numerical classifiers which Japanese speakers use widely in the daily life (Denny, 1979). When Japanese speakers think it is important to quantify an entity, they attach a numerical classifier to a noun, as in the case of '*ringo* - 2 *ko no ringo'* (apple - 2 portions of apple). The Japanese numerical classifier is attached to a noun based on mixed semantic properties of the object, including biological taxonomy, size, shape, and function (Uchida & Imai, 1999).

Studies examining patterns in two or more languages have explored whether language influences the construal of individuation. Studies generally support the view that humans possess innate knowledge of individuation. For example, Lucy (1992) compared individuation in non-linguistic tasks for speakers of English and speakers of Yucatec Maya who live a traditional life in the Yucatec peninsula. The Yucatec Maya language possesses the numerical classifier system and does not distinguish individual/non-individual entities. Lucy found that English speakers relied primarily on the perceptual cue of shape to conceptualize individuation of objects, whereas Yucatec Maya speakers relied primarily on the perceptual cue of material composition in order to construe individuation in non-linguistic tasks. Lucy reasoned that English speakers rely more on the perceptual cue of shape to conceptualize individuation of objects, whereas Yucatec speakers rely more on perceptual cue of material to categorize objects with the numerical classifier system. Thus, conceptual categorization shaped by English or the Yucatec language

influenced the perceptual cues to signal individuation in non-linguistic tasks. Further, a series of studies by Japanese researcher Imai and her co-researchers (see Imai, 1999; Imai & Gentner, 1997; Imai & Mazuka, 2007) investigated Japanese speakers who also use a numerical classifier system. Imai and Mazuka (2007), for example, investigated how Japanese speakers and English speakers classify entities as individual things and as non-individuated things. The results indicate that both English speakers and Japanese speakers distinguish between individuated objects and non-individuated substance. The results further indicate that English speakers relied on the perceptual cues of solidity and boundedness to construe entities as individuated objects, even when the visual perceptual cues were weak or ambiguous. Japanese speakers, on the other hand, did not rely on these perceptual cues to construe entities as individual or non-individuated things. The researchers suggest that Japanese speakers do not usually rely on the perceptual cues of solidity and boundedness to categorize objects within the numerical classifier system. This finding suggests that conceptual categorization as shaped by the Japanese language influences the perceptual cues used to categorize entities, in particular when the visual perceptual cues are weak.

Published studies with Japanese participants to date have focused on the perceptual cues of shape and materials in order to distinguish individuated objects and non-individuated substances. The current study investigates three perceptual cues using picture tasks: the effect of size (large, middle, or small), of distance (close versus distant), and of clarity (clear versus blurred) in order to build on the findings of previous studies. The study aims to investigate which of these three cues, size, distance and clarity, Japanese participants rely

on in order to match pictures with a phrase indicating either a count noun or a mass noun.

1.3 The domain of aggregates

Count and mass nouns in English are distinguished through a variety of domains, such as objects/substance, mental events, sounds, and aggregates. The current study focuses on the domain of aggregates, the domain most widely investigated to date, which refers to relatively small, homogeneous things which tend to occur together (e.g., rice, salt, beans, and popcorn).

Count/mass noun distinction in the domain of aggregates

In the domain of aggregates, Wierzbicka (1988) suggests that the key factors to conceptually distinguish count and mass nouns are the perceptibility of each element and human interaction with each element in daily life. Table 1 shows the description of count/mass aggregates based on perceptibility and human interaction.

Table 1 Description of aggregates based on perceptibility and human interaction

	Perceptibility	**Human interaction**	**Examples**
Mass nouns	Size: small Distance: close to each other	People do not usually interact with separate elements	rice sand sugar
Count nouns	Size: relatively small Distance: each element could be separated from the other	People sometimes interact with separate elements	noodles peas beans

Wierzbicka, (1998, p.555-559)

Wierzbicka (1988) developed a hypothesis which predicts that perceptibility leads speakers to conceptualize things as individuated things or non-individuated things and, as a result, they match individuated things with count

nouns whereas they match non-individuated things with mass nouns.

Let us take an example of rice and beans. With regard to the size of each element, each single bean is bigger than a single grain of rice. In daily life, people normally eat rice when it is cooked and see each element sticks together. People normally see each element of beans separately, whether it is raw or cooked. Wierzbicka (1988) suggests that size and distance increase perceptibility of each element of the aggregate. Each element of beans is more perceptible and thus people construe it as an individual group, whereas each element of rice is less perceptible and thus people construe it as a non-individual group. The current study builds on Wierzbicka (1988) to include the perceptual cues of distance and size in the pairs of aggregate pictures in the research design.

Japanese numerical classifier system in the domain of aggregates

In the domain of aggregates, several kinds of Japanese numerical classifiers are attached to nouns. Table 2 shows the categorization of aggregates based on the Japanese numerical classifier system. Shape, function and size are considered to be the basic semantic properties to categorize aggregates with the Japanese numerical classifier system. As shown in Table 2, *tsubu* is used for relatively small roundish objects (e.g., rice, grapes), whereas *ko* is used for large roundish objects (e.g., candies, stones) which are larger than the entities with classifier *tsubu*. Downing (1996) investigated the usage of 154 classifier forms with Japanese-speaking adults. Tanihara, Yen and Lee (1990) found that the prototypical features of *ko* are small and concrete with a definite shape (e.g., eggs, clams).

Table 2 Categorization of aggregate based on Japanese numerical classifiers

Numerical classifier	Description	Example
ko (個)	relatively small objects solid objects (general classifier)	candies, stones, coins, dice, chocolate balls
tsu (つ)	small, inanimate, concrete or abstract (general classifier)	stones
tsubu (粒)	small, round objects smaller than the objects with classifier "ko"	rice, grapes, gems, coffee beans
joo (錠)	medicine	pills
tama (玉)	global masses small, round objects	pearls, noodles,
saya (莢)	beans in the pod	beans, peas

(Downing, 1996)

One area of investigation is the conceptual basis of count/mass noun distinction between individuated objects and non-individuated substances in both studies of children's conceptual development and cross-linguistic studies (e.g., Imai & Gentner, 1997; Lucy, 1992; Soja, Carey, & Spelke, 1991). Middleton et al.'s (2004) study explored the conceptual basis of count/mass noun distinctions in the domain of aggregates with native English speakers beyond the prototypical distinction between objects and substances. Middleton et al. (2004) evaluated the cognitive individuation hypothesis with a series of experiments by testing Wierzbicka's (1988) prediction in which perceptibility and human interaction direct native English speakers to conceptualize things as individuals or non-individuated things and result in them matching individual things with count noun phrases, and matching non-individuated things with mass noun phrases. The test instrument for the current study adopts Middleton et al.'s (2004) picture tasks consisting of novel aggregate pictures with a phrase indicating a novel count or mass noun. Use of picture tasks enables a direct examination of whether perceptual cues, such as size, distance, or clarity of each element, which are considered to predispose the

conceptual basis of count/mass noun distinction, affect participant choice for count or mass noun phrase (Wierzbicka, 1988). As Imai (1999) pointed out, perceptual cues are powerful indicators for categorization, as people can categorize entities by just looking at them. Studies which explored different concepts, such as the concept of time (Boroditsky, 2000), spatial representation (Munnich, Landau, & Dosher, 2001), and the representation of emotion (Papagragou, Massey, & Gleitman, 2002), used picture tasks as the research instrument to show that speakers of different languages often perceive the same visual stimuli in a different way. By using picture tasks, the current study evaluates the cognitive individuation hypothesis by testing Wierzbicka's (1988) hypothesis and examines the extent of consistency in the use of perceptual cues (e.g., distance, size, and clarity). Thus, the research questions are as follows:

1. What are the perceptual cues Japanese university students rely on to match pictures with mass noun phrases or count noun phrases, when there is the effect of distance, size, or clarity between pairs of pictures?
2. To what extent do Japanese university students make choices which are consistent with Wierzbicka's (1988) hypothesis in which participants choose less perceptible elements to match with mass noun phrases, whereas they choose more perceptible elements to match with count noun phrases?

2. Method

2.1 Participants

Participants were 103 Japanese university students from the Department of English Language, in a private university in Japan which has a good reputation for language education and international exchange programs. The English language entry requirement into the program of English is set at a higher level than for other areas of study. Participants were aged 19 - 25 years old. Japanese students usually start to learn English in junior high school and have thus been learning English for around six years before entering university. However, they generally have few opportunities to use English for communication outside the classroom as English is a foreign language in Japan. This situation would apply broadly to this participant group. Participants are considered to have similar educational backgrounds and their English proficiency is at upper-intermediate level. They were informed that the results of the task would not be shared with their teachers or affect the overall assessment of their studies. They took part in this study outside of class time, at the beginning of the semester.

2.2 Design and materials

Novel pictures with a phrase indicating a novel count or mass noun

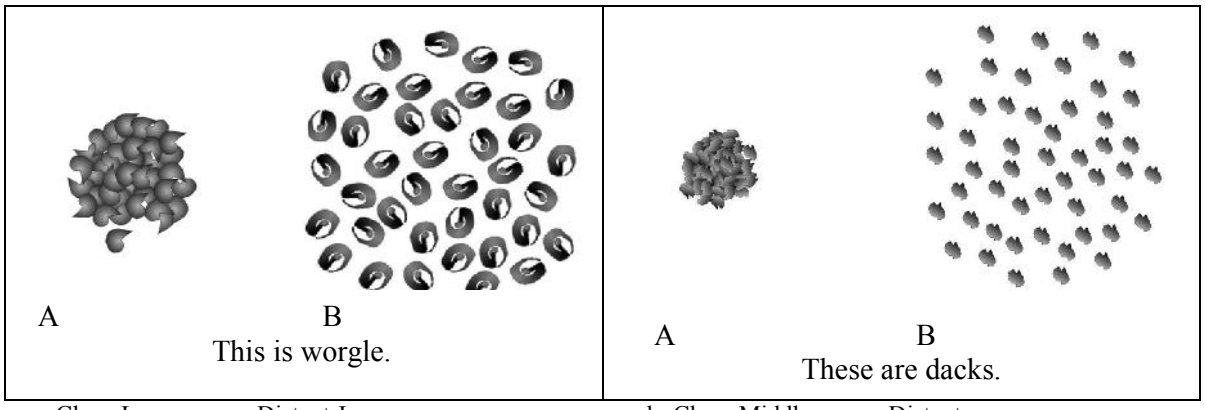
Pairs of pictures were adapted from Middleton et al.'s (2004) study and modified for the current study. The pairs of novel aggregates show relatively small, homogeneous things close together. Each novel aggregate was composed of 40 elements (e.g., 40 grains of rice in an aggregate) and each element was a simple black and white shape. The existing instrument of Middleton et al.'s (2004) study had only two effects: distance and size. The

middle size of elements and the effect of clarity (e.g., clear, blurred) were added into the instrument in the current study. As shown in Table 3, each element of the aggregates in the current study varied with regard to distance, size and clarity, in order to influence perceptibility of each element. Distance has two stages of degree: distant and close; size has three stages of degree: large, middle, and small, and clarity has two stages of degree: clear and blurred.

Table 3 Three variables in pairs of pictures

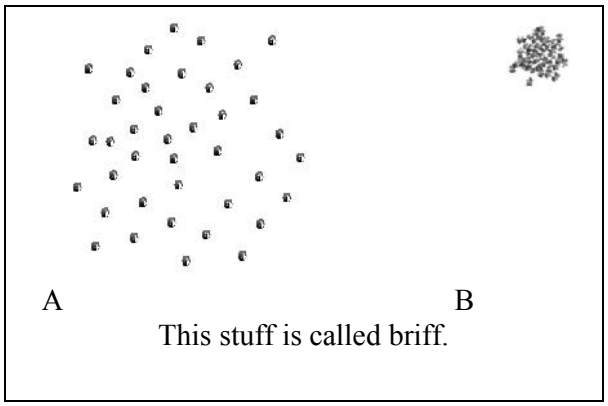
Variables	**Perceptibility**		
	More perceptible		**Less perceptible**
Distance	Distant		Close
Size	Large	Middle	Small
Clarity	Clear		Blurred

Figure 1 shows the examples of pairs of pictures in which distance is varied between pairs of aggregates. For example, picture A shows an aggregate with large-close elements on the left and an aggregate with large-distant elements on the right.



a. Close-Large versus Distant-Large

b. Close-Middle versus Distant-Middle



c. Distant-Small versus Close-Small

Figure 1 Pairs of pictures in which distance varied between pairs of aggregates

Phrases indicating novel count/mass nouns

Table 4 shows examples of phrases indicating novel count or mass nouns, which appear below the pairs of picture. Novel nouns which are not true words (e.g., worgle, furgle) were used so that the learners have no prior knowledge of the word and it removes any variability of prior word familiarity. Phrases indicating novel nouns were adapted from the study of Middleton et al. (2004).

Table 4 Examples of phrases indicating novel count/mass nouns

Mass forms	**Count forms**
This is worgle.	We call these hurgs.
We call this stuff furgle.	These things are shubs.
This stuff is called grundel.	These things are called pammels.
This stuff is shub.	We call these norps.

22 pairs of pictures with phrase indicating count/mass nouns

This study paired the pictures to form 11 contrast pictures with mass noun phrases and 11 contrasting pictures with count noun phrases. As shown in Table 5, the contrasting pictures were divided into four categories to manipulate the three conditions, size, distance, clarity, or two manipulating conditions. 22 contrasts of the pictures were randomly matched with mass noun phrases or count noun phrases, which appeared below the pairs of the

pictures in the test instrument.

Table 5 Pairs of novel aggregate pictures

Manipulating conditions	Pairs of imaginary pictures
Distance	
	Distant-Large versus Close-Large
	Distant-Middle versus Close-Middle
	Distant-Small versus Close-Small
Size	
	Large-Distant versus Middle-Distant
	Large-Distant versus Small-Distant
	Large-Close versus Middle-Close
	Large-Close versus Small-Close
Clarity	
	Clear-Close versus Blurred-Close
	Clear-Distant versus Blurred-Distant
Strong effect	
	Large-Distant versus Small-Close-Clear
	Distant-Clear versus Close-Blurred

Retrospective interview

5 out of 103 participants were selected for retrospective interviews. Table 6 shows information of the five participants in the retrospective interviews. The selection of the participants targeted those who made a majority of choices consistent with Wierzbicka's hypothesis. Each participant was presented with their own answers for the picture tasks and the researcher asked each participant the reason for their choices.

Table 6 Information of the five participants in the retrospective interviews

Name	Age	Gender	Consistency of choice (%)
Student A	24	Female	63%
Student B	24	Female	68%
Student C	23	Male	59%
Student D	25	Female	73%
Student E	22	Female	90%

Interview data was analyzed by the authors according to the responses

provided by each student. Participants' explanations in response to their choice of pictures were classified into three categories of students identified: (1) Perceptibility; (2) Pronunciation sound and (3) Language. In the first category, perceptibility is divided into three sub categories, according to three effects on perceptibility: size, distance and clarity. In the second category, pronunciation sound focuses on the explanation of the sound of novel words (e.g., dack, worgles) affecting their choices. In the third category, language effect focuses on the explanation of English language use such as "this" or "these" affecting their choices. Examples of these three categories are displayed in Table 7.

Table 7 Classification scheme and examples of qualitative data

Category	Sub-category	Examples
1.Perceptibility	Distance	There is distance between each element.
		Each element is close together.
		Each element is close together, and thus it looks like a single body.
	Size	Each element is small. Each element is larger in this picture.
	Clarity	There is the boundary around each element. There is no boundary around each element, and thus each element is not perceptible.
2.Pronunciation sound		"dack" is similar to "duck", and thus it makes me choose this picture.
		The sound of "worgle" makes me choose this picture.
3.Language		"This" would refer to a single element of an aggregate. Each element is perceptible, and "this" can be used to point out a single element of an aggregate.

2.3 Procedure

This study was carried out during April 2008. The participants were instructed

in Japanese by a senior student in order to ensure that they understood what they were to do. They were each given an envelope including a practice task, a picture task instrument, and an answer sheet numbered 1-22. The practice task was conducted in order for participants to familiarize themselves with the task format of matching pictures with a phrase indicating count or mass nouns. Participants were instructed that they would see a pair of imaginary aggregate pictures with a phrase indicating imaginary count or mass nouns. It was explained that aggregates are small, homogeneous things that tend to occur together and they were given examples of aggregates (e.g. sugar, rice, beans, buttons, and leaves). They were instructed to read the phrase and consider which of the two pictures the phrase best describes. They were to mark "A" if they thought the phrase best describes the picture A on the left or mark "B" if the phrase best describes the picture B on the right. After the practice task was checked and any questions were answered, the experimental task was conducted. The participants were not allowed to go back and change their answer so that they did not have time to think about the imaginary pictures in detail. In order to elicit their conceptual categorizations, they were informed that they should choose A or B quickly without a great deal of thinking. They were to put the experimental task back into envelopes after they answered all the questions so that they did not go back and change their answers. The senior student who assisted this study walked round the classroom and checked that participants answered all the questions. The task took approximately 15 minutes to complete. 103 completed answer sheets were collected.

3. Results

Choice of pairs of the pictures for count/ mass noun phrases by overall participants

Participants' choice of pairs of pictures for count or mass noun phrases was explored by descriptive statistics. Appendix 1 shows the percentage of overall participants' (n=103) choice of pairs of pictures in order to match with count/ mass noun phrases. When there is the effect of distance, a majority of participants (75.7% for large elements, 84.5% for middle elements, and 74.8% for small elements) chose close elements to match with mass noun phrases whereas a majority of participants (71.8% for large elements, 87.4% for middle elements, and 75.7% for small elements) chose distant elements to match count noun phrases with regardless of size difference of each element in the pairs of pictures. When there is the effect of clarity, a majority of participants (71.8% for distant elements, 70.9% for close elements) chose clear elements to match with count noun phrases regardless of distant difference of each element in the pairs of pictures. Further, when there is the effect of distance and size, 80 participants (77.7%) chose distant-large elements to match with count noun phrases whereas 81 participants (78.6%) chose close-small elements to match with mass noun phrases. When there is the effect of clarity and distance, 89 participants (86.4%) chose clear-distant elements to match with count noun phrases whereas 76 participants (73.8%) chose blurred-close elements to match with mass noun phrases.

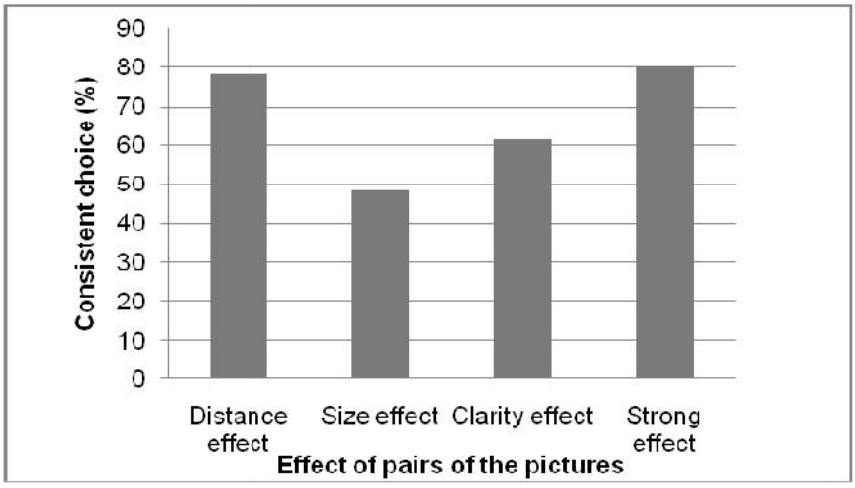
Choice consistent with Wierzbicka's (1988) hypothesis

This study further investigates to what extent the findings were consistent with

Wierzbicka's (1988) hypothesis in which speakers match less perceptible elements with mass noun phrases, and more perceptible elements with count noun phrases. The current study scored participants' choice as 1 for a consistent choice, and 0 for an inconsistent choice. When a participant made consistent choices for both count and mass nouns, the score was 2; when a participant made consistent and inconsistent choices, the score was 1; when a participant made inconsistent choices for both count and mass nouns, the score was 0.

As shown in Table 8, Japanese participants made 78.0% of choices consistent with Wierzbicka's hypothesis, when there is the effect of distance between pairs of aggregate pictures. The portion of consistent choice was significantly higher than chance responding, $t(204)=11.21$, $p<.05$. They made 48.2 % of choices consistent with Wierzbicka's hypothesis, when there is the effect of size between pairs of aggregate pictures, which was not higher than chance responding, $t(204)=-0.92$, $p>.05$. They made 61.2 % of choices consistent with Wierzbicka's hypothesis, when there is the effect of

Table 8 Proportion of choice (%) consistent with Wierzbicka's (1988) hypothesis



clarity between pairs of aggregate pictures, which was significantly higher than chance responding, t(204) =4.59, p <.05. They made 80.0% of choices consistent with Wierzbicka's hypothesis, when there is strong effect between pairs of aggregate pictures: the effect of clarity and distance or size and distance, which was significantly higher than chance responding, t(204) = 12.69, p <.01. Overall, participants made a majority of choices consistent with Wierzbicka's hypothesis when there is the effect of distance, clarity, and strong effect.

Supplemental data from retrospective interview

Qualitative data from the retrospective interview reveals the five participants' thinking processes to match pairs of pictures with count/mass noun phrases. Table 9 shows the reasons why they matched each picture with count/mass noun phrases. When there is the effect of distance between pairs of each picture, all five participants frequently chose pictures based on the perceptibility, distance effect, 27 out of 31 times mentioned (87%). When there is the effect of size, all five participants frequently depended on the perceptibility, size effect, 13 out of 29 times mentioned (45%). Here it needs to be indicated that they did not make a distinction between count or mass noun phrases, according to the size difference. For example, student B commented that an aggregate with smaller elements can be categorized into both count and mass noun. They also depended on the perceptibility, distance effect (4 out of 29 times mentioned). Two participants depended on the pronunciation sound of novel word (e.g., worgle, furgle). For instance, student A mentioned that the pronunciation sound of "weg" affected the choice of the

pictures. Three participants depended on the phrase included in the pictures. In the interview, three students mentioned that "this" in the phrase below the picture could refer to a single element of an aggregate. When there is the effect of clarity, all five participants frequently depended on perceptibility, clarity effect, 14 out of 21 times mentioned (67%). When there is the strong effect: size and distance or distance and clarity, they frequently depended on perceptibility, distance effect. No one mentioned that they depended on the size effect. In summary, in response to the research question 1, supplemental retrospective data from interviews suggested that participants frequently depended on the perceptual cues of distance and clarity when matching pictures with count/mass noun phrases. When there is the effect of size, they did not frequently depend on the effect of size. The pronunciation sound or English language itself also affected their choice of pictures.

Table 9 Qualitative data from retrospective interview

Perceptibility effect between pairs of pictures	Reasons for choosing pictures	Number of participants mentioned	Number of times mentioned
Distance effect	1.Perceptibility: Text justification		
	Distance	5	27
	2.The pronunciation sounds	2	2
	3.Language	1	2
Size effect	1.Perceptibility: Text justification		
	Size	5	13
	Distance	3	6
	2.The pronunciation sounds	2	7
	3.Language	3	3
Clarity effect	1.Perceptibility: Text justification		
	Clarity	5	14
	Distance	2	4
	2.The pronunciation sounds	2	3
Strong effect	1.Perceptibility: Text justification		
	Distance	5	9
	Clarity	2	2
	2.The pronunciation sounds	1	2
	3.Language	1	1

4. Discussion

The current study analyzed the data in terms of the proportion of choices (%) consistent with Wierzbicka's (1988) hypothesis in which participants match less perceptible elements with mass noun phrases, whereas they match more perceptible elements with count noun phrases. Middleton et al.'s (2004) study analyzed data in a similar manner. It is possible to compare the findings in both studies. Table 10 shows the findings of the current study and Middleton et al.'s (2004) study.

Table 10 Findings of the current study and Middleton et al.'s (2004) study

Perceptual cues	**English speakers (Middleton et al. 2004)**	**Japanese speakers (current study)**
Distance		
Less perceptible (close)	mass nouns	mass nouns
More perceptible (distant)	count nouns	count nouns
Size		
Less perceptible (smaller)	count or mass nouns	count or mass nouns
More perceptible (larger)	count or mass nouns	count or mass nouns
Clarity		
Less perceptible (blurred)	not examined	mass nouns
More perceptible (clear)	not examined	count nouns
Distance and size		
Less perceptible (close &small)	mass nouns	mass nouns
More perceptible (distant & large)	count nouns	count nouns
Distance and clarity		
Less perceptible (close & blurred)	not examined	mass nouns
More perceptible (distant & clear)	not examined	count nouns

As shown in Table 10, when there is strong effect, by manipulating two conditions, size and distance, Japanese university students in the current study and native English university students in Middleton et al.'s (2004) study made

a majority of choices consistent with Wierzbicka's hypothesis. When there is only one effect, distance or size, both Japanese university students and English university students in Middleton et al.'s (2004) study relied on the perceptual cue of distance and did not rely on the perceptual cue of size.

There could be two possible explanations for these findings. Firstly, Japanese speakers conceptualise entities the same way as English native speakers, that is, they have general knowledge that individual/non-individual distinction correspond to count/mass noun distinction, thus offering support of Wierzbicka's hypothesis. Saalback and Imai (2005) investigated Japanese speakers (Japanese has a numerical classifier system) and German speakers (German does not have a numerical classifier system), and found a similar performance between these groups. They suggest that the Japanese numerical classifier system might not have a strong effect on Japanese conceptual structure, as Japanese use numerical classifier mainly when they need to enumerate objects. How frequently Japanese speakers use their grammatical categorization might be important in influencing their conceptual categorization in English. Thus, the findings of the current study might suggest that the conceptual categorization of Japanese university students might not be shaped by the Japanese numerical classifier system and might be similar to that of English speakers. These findings are in accord with results in other studies with native English speakers, where Wisniewski et al. (1996) evaluated the cognitive individuation hypothesis in the domain of superordinates, and Bloom and Kelemen (1995) investigated the process of acquiring new words. There would be value in further studies to apply the cognitive individuation hypothesis to other non-native English speaker groups

in the domain of aggregates to further test Wierzbicka's hypothesis.

Another possible explanation for the findings in the current study is that Japanese students might have learned a new way of categorizing mass or count nouns and they might apply their knowledge when they match pictures with count or mass noun phrases. English language learning might force them to categorize in this way, since all the sentences are in English. Jarvis (2007) cautions that researchers need to investigate whether or not language itself influences categorization by using verbal tasks that involve picture categorization with English phrases. A study of this type could examine groups of learners at different proficiency levels to isolate language knowledge as a variable (Athanasopoulos, 2006). Other variables which future studies could take into account include length of residence in an English-speaking country, and age of first L2 learning (Athanasopoulos & Kasai, 2008; Cook, Bassetti, Kasai, Sasaki, & Takahashi, 2006). Future studies could also utilize additional non-linguistic measures, such as judgment tasks between pictures and rating similarity on a Likert-type scale.

The current study has important implications for future English language teaching in EFL contexts. Larsen-Freeman (2002) insists that grammar is not rule-governed but more flexible according to the context. This flexible feature is apparent in the case of 'noise' which can act as a count noun (e.g. *The coffee machine is making unusual noises*) and as a mass noun (e.g. *There was too much playground noise to hear the bell*), depending on context. The difficulty for EFL learners with a context-governed classification for count/mass nouns is that there may be limited opportunities in EFL settings for learners to encounter different contexts of count/mass noun use in daily life. The current

study could provide teachers and learners with a pedagogical tool for distinguishing between count and mass nouns through the use of pictures embedded into teaching materials. These pictures could be sensitive to context where appropriate, as in the case of 'noise'. For count noun pictures, the boundary of each element should be delineated so that elements appear separately. For mass noun pictures, the delineation between elements should be presented as less distinct. Use of such pictures as presented in this paper may provide learners with a meaningful conceptual framework for classifying count and mass nouns. Within a confined scope and with a clear focus, the current study thus provides important implications for future studies in second language and cognition and for future English language teaching in EFL contexts.

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Appendix 1 The percentage of overall participants' choice of pairs of pictures

Pairs of the pictures		**Mass nouns** Percent /Frequency	**Count nouns** Percent/Frequency
Effect of Distance	Close-Large	75.7% (78)	28.2% (29)
	Distant-Large	24.3% (25)	71.8% (74)
	Close-Middle	84.5% (87)	12.6% (13)
	Distant-Middle	15.5% (16)	87.4% (90)
	Close-Small	74.8% (77)	24.3% (25)
	Distant-Small	25.2% (26)	75.7% (78)
Effect of Size	Large-Close	60.2% (62)	41.7% (43)
	Small-Close	39.8% (41)	58.3% (60)
	Large-Distant	65.0% (67)	56.3% (58)
	Small-Distant	35.0% (36)	43.7% (45)
	Large-Close	30.1% (31)	46.6% (48)
	Middle-Close	69.9% (72)	53.4% (55)
	Large-Distant	71.8% (74)	67.0% (69)
	Middle-Distant	28.2% (29)	33.0% (34)
Effect of clarity	Clear-Distant	65.0% (67)	71.8% (74)
	Blurred-Distant	35.0% (36)	28.2% (29)
	Clear-Close	38.8% (40)	70.9% (73)
	Blurred-Close	61.2% (63)	29.1% (30)
Strong effect	Distant-Large	21.4% (22)	77.7% (80)
	Close-Small	78.6% (81)	22.3% (23)
	Clear-Distant	26.2% (27)	86.4% (89)
	Blurred-Close	73.8% (76)	13.6% (14)