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Linguistic Clues: The Foreign Language Learner's Use of Sortal Classifiers and Morphological Cues in Mandarin Chinese

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Linguistic Clues: The Foreign Language Learner's Use of Sortal Classifiers and Morphological Cues in Mandarin Chinese

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1.1 Introduction

Second language acquisition is an important topic of study. With globalization and the Internet, it is quite common to interact with speakers of other languages on a day to day basis. As a consequence of this increase in interaction a demand has come for more people with the ability to speak foreign languages to facilitate communication. However, as anyone who has tried to learn a foreign language can attest, acquiring a new language is a difficult and seemingly never-ending process.

I am interested in the ways that learners can use what they have already successfully acquired to further acquire more of the language. In other words, once a learner has managed to successfully learn some aspect of the language, is it possible for them to use that as a stepping stone to speed up what can be a lifelong process: that of vocabulary acquisition?

In order to do this, I chose to concentrate on native English speakers learning Mandarin Chinese. Since my thesis is focused on using previously acquired material to learn new words, I wanted to identify a grammatical category that would be completely new to English speakers, such as a classifier (a grammatical system used to count nouns in Mandarin Chinese). Since English does not use classifiers and English speakers are unfamiliar with this concept, I decided to study whether English speakers could take advantage of previously-acquired classifiers as a way to guess the meaning of an unknown word. In Mandarin, classifiers highlight a particular characteristic of an object. If English speakers in their acquisition of classifiers can become aware of the characteristic a specific classifier highlights, then it should be logically possible for them to use this newly acquired information as a way to acquire new words.

In addition to this, I wanted to see if this process could work in the opposite direction. In other words, I was curious about whether foreign language learners could take advantage of previously-learned material to influence selection in a grammatical category that is absent in their own language. For example, can native English speakers who have acquired enough vocabulary to become aware of common morphological cues (clues to a word's meaning) use these cues to determine which classifier to select when faced with an unknown word? With the difficulty as well as importance of foreign language acquisition, determining what factors can influence a learner's ability to use acquired language to further their own acquisition can have valuable implications for future language study.

1.2 Second Language Acquisition Issues

The field of second language acquisition involves a number of important issues. However, in my study I decided to focus on one in particular. Second language learners are constantly engaged in a variety of explicit learning. I chose to concentrate on whether second language learners, after having acquired previous knowledge of linguistic cues, could use those linguistic cues to engage in implicit learning. Specifically, I wanted to determine whether learners could guess the meaning of unknown words from these cues. If second language learners can infer the meaning of an unfamiliar word from linguistic cues available to them, then this opens a door to their ability to further their acquisition on their own.

1.3 Classifiers

In order to test my research questions, an understanding of the grammatical category in Mandarin that is being tested is necessary. CLASSIFIERS can be defined as

morphemes which occur “in surface structures under specifiable conditions” and denote “some salient perceived or imputed characteristics of an entity to which an associated noun refers” (Aikhenvald, 13). By their very definition, classifiers can be used to point out specific characteristics of an object as determined by the speaker, offering researchers a link to the conceptual categories behind language.

Classifiers come in the form of independent morphemes, as in Thai (1) or in the form of affixes as in Yagua (2):

(1)	Prathêet	sâam	prathêet		(2)	Ek-tâ	bai
	Land	three	CL^{land}			One-CL $1^{nonhuman}$	book
	‘three countries’					‘one book’	

When classifiers are independent morphemes, the inventory often differs from speaker to speaker, allowing for more freedom in the selection of an independent classifier on the part of the individual speaker (Aikhenvald, 114). Additionally, independent morphemes tend to refer to the shape and form of the object. Unlike independent morphemes, classifiers in the form of affixes often have a fixed inventory and refer to animacy (114).

The structures that classifiers are restricted to are called CLASSIFIER CONSTRUCTIONS. According to Aikhenvald, these structures are “morphosyntactic units (which may be noun phrases of different kinds, verb phrases, or clauses) which require the presence of a particular kind of morpheme, the choice of which is dictated by the semantic characteristics of the referent of the head of a noun phrase” (13). Classifier constructions come in many forms, and it is important to consider these forms in terms of a scale of gradient properties. The ‘types’ of classifiers are not dichotomies, but often tend to blend with others over time; many languages not only have more than one ‘type’, but may use the same classifiers in more than one classifier construction (Aikhenvald, 13).

It is possible to categorize classifiers into smaller groupings based on what classifier constructions they occur in. For example, a classifier that appears in a numeral construction and one that appears in a deictic construction would be classified as a numeral classifier or a deictic classifier accordingly. Aikhenvald says that numeral classifiers are "morphemes which appear only next to a numeral or quantifier" (6).

Numeral classifiers are the second most frequent type of classifier, second only to noun classes, and tend to categorize a referent according to animacy, shape, or other innate properties, such as in the following Uzbek numeral classifiers *nafar* and *bâs* which refer to the animacy (3) and shape (4) of the noun accordingly (102):

(3) Bir nafar âdam
One CL^{human} person
'one person'

(4) Bir bâs karâm
One CL$^{head\ shaped}$ cabbage
'one (head of) cabbage'

Numeral classifiers can be further divided into two varieties: sortal classifiers and mensural classifiers. A SORTAL CLASSIFIER categorizes "whatever it refers to in terms of the kind of entity that it is", whereas a MENSURAL CLASSIFIER categorizes "in terms of quantity" (Aikhenvald, 115). In other words, sortal classifiers refer to the quality of the object, while mensural classifiers describe the quantity of the object. The sortal classifier *má?*^{L} in Comaltepec Chinantec refers to the quality of the paper, while the mensural classifier *han* in Korean refers to the amount of rice wine (115):

(5) Tú^{M} má?^{L} ma ^{L} hi ^{L}
Two CL^{leaf} paper
'Two sheets of paper'

(6) Makkeli han mal
Rice.wine one CL$^{rice\ wine}$
'one measure of makkeli'

In other words, sortal classifiers categorize nouns according to animacy, shape, and consistency, while mensural classifiers are used as measuring units for countable and

mass nouns. For this reason, a mensural classifier has more freedom in being applied since its use is often based on the temporary state of the referent, such as the amount of the object or the arrangement of the object (Aikhenvald, 115).

Languages in which every noun must be classified often have a generic classifier. This classifier can have a default function, a residue function, an unspecified referent function, or a combination of the three (Aikhenvald, 335). A classifier is in DEFAULT function "if it can be substituted for other classifiers under specialized pragmatic conditions" (335). If it is in RESIDUE function then it is being used as "a remainder category for referents outside the domains covered by other classifiers" (335). Finally, the generic classifier is in an UNSPECIFIED REFERENT function if "it is used to refer to an unknown entity" (335). While each of these is a separate function, a classifier can be performing multiple functions at one time.

Mandarin

Classifier Distribution

Since classifier 'types' are placed on a continua, it is often possible for a language to have more than one variety of classifier, with one 'type' being the primary environment. In Mandarin, this is the case. In addition to numeral classifiers which are considered the primary environment, Mandarin also has deictic classifiers.

(7)	四	本	书	(8)	这	本	书
	si4	ben3	shu1		zhe4	ben3	shu1
	four	CL^{volume}	book		this	CL^{volume}	book

As demonstrated by the example, the same classifiers can occur in both numeral constructions and deictic constructions. Since I chose to restrict my study to numeral

classifier constructions, additional information about deictic constructions is not relevant for our purposes.

Description of Mandarin Classifiers

Mandarin also has both sortal and mensural classifiers. For example, 本 *ben3* and 瓶 *ping2* are both classifiers found in Mandarin. However, 本 *ben3* is used to refer to the book's property or quality of being bound as a volume, while 瓶 *ping2* describes the amount or quantity of the water being contained in a bottle:

(9) Sortal

这	本	书
Zhe4	ben3	shu1
this	CL^{volume}	book

(10) Mensural

这	瓶	水
Zhe4	ping2	shui3
this	CL^{bottle}	water

In Mandarin, properties denoted by sortal classifiers fall into four main groups:

(1) animacy: human (ordinary versus honorific) versus inhuman (ordinary versus valued)

(2) shape: round (large versus small), long (flexible versus rigid), and flat (thick versus thin)

(3) function: clothing, tools, vehicles, machines

(4) arrangement: paired versus single (Hu, 16)

These classifiers all categorize the noun in terms of some quality of the object, and I tested classifiers within the first three groups.

Table 1 Properties of Sortal Classifiers

	Number	Classifier	Noun
Animacy	三 San1	只 *Zhi1*	猫 Mao1
Gloss	3	CL$^{\text{Animate non-human}}$	Cat
Shape	三 San1	张 Zhang1	纸 Zhi3
Gloss	3	CL$^{\text{flat thin objects}}$	Paper
Function	三 San1	把 *Ba3*	雨伞 Yu3san3
Gloss	3	CL$^{\text{things you hold}}$	Umbrella
Arrangement	三 San1	双 Shuang1	筷子 Kua4zi
Gloss	3	CL$^{\text{pair}}$	chopsticks

Since I tested only sortal classifiers, additional information on mensural classifiers is unnecessary.

Generic Classifier

In Mandarin, classifiers are obligatory (all nouns must be classified). Due to this, a generic classifier 个 *ge4* exists, originally derived from a noun meaning 'bamboo stalk'. It is used to classify nouns that may be semantically incompatible with categories used for regular classifier assignment. Since 个 *ge4* is a generic classifier, it can potentially have a default function, a residue function, an unspecified referent function or a combination of all three. In Mandarin, the generic classifier 个 *ge4* can be used for all three functions. (Aikhenvald, 335) Since it is acceptable with most nouns, it is used quite frequently by native speakers. Due to its default function, I expected many learners to use 个 *ge4* for objects they were uncertain about.

Common Classifiers

Although Mandarin has a large system of classifiers, in speech the common adult only uses about 20-30 regularly. In part, this is because some classifiers are only used with very specific nominals. When these nominals do not occur often in common speech,

then these classifiers do not occur often as well. Furthermore, the use of classifiers can vary depending on the region. For example, in Beijing the classifier 辆 *liang4* is used with words for vehicles, while in Taiwan the machine classifiers 台 *tai2* or 部 *bu4*, may be used instead.

(11) Beijing

一	辆	汽车
yi1	liang4	qi4che1
one	CL^{vehicle}	car

(12) Taiwan

一	台/部	汽车
yi1	tai2/bu4	qi4che1
one	CL^{machine}	car

In addition to this, sortal classifiers in Mandarin can be used by fewer nouns than commonly assumed. As many as 40% of all nouns may only be able to take the general classifier 个 *ge4*. Some of these consist of everyday objects like leaves, wheels, and balls. Objects like the 'sun' or the 'city' that are large and distant, as well as abstract concepts like 'idea' and 'plan' can also only take the general classifier (Erbaugh, "Chinese Classifiers" 42).

Morphological Cues

While Mandarin Chinese is an isolating language, there are morphological cues that can be used to guess the semantic meaning of the word. For example, words that end in 车 *che1* commonly refer to vehicles in Mandarin(13), words that end in 机 *ji1* refer to machines (14), and words that end in 鱼 *yu2* usually refer to fish(15):

(13)

校	车
xiao4	che1
school	vehicle/car
'school bus'	

(14)

烘干	机
hong1 gan1	ji1
dry over a fire	machine
'dryer'	

(15)

飞	鱼
fei1	yu2
to fly	fish
'flying fish'	

Just as classifiers describe a semantic characteristic of the object they refer to, these morphological cues in Mandarin also provide a clue to some aspect of the referent's identity.

1.4 Acquisition

Although my study is focused on foreign language learners, a vast amount of research has been done on the acquisition of classifiers by native speakers. Research done into how first language learners acquire classifiers can provide valuable insight into a lesser-studied area, that of classifier acquisition by foreign language learners.

Research shows that children are aware of differences between mass and count nouns, as well as the classifiers or measure words that are associated with them. However, children were found to use classifiers less than needed and to overuse the generic classifier 个 *ge4*, especially in early acquisition (Aikhenvald, 420).

Since classifiers are obligatory in numeral constructions, the omission of a classifier is deemed an omission error. In a study by Hu, age was determined to be a factor in omission errors. Specifically, the three-year old and four-year old children tested in the study made omission errors, but none of the five-year olds or six-year olds omitted a classifier. Hu also determined that the generic classifier is present in children as young as three, and that specific classifiers do not enter into speech until approximately the age of three. Additionally, around the age of five to six, there is a spurt in classifier growth (66).

According to Erbaugh, between the ages of 1.10 and 3.10, specific classifiers are still being developed and rarely used by children. Erbaugh argues that these classifiers begin by being used lexically and are only used with one referent before they are then

extended to prototypical members of the class. Following this extension, the classifier is further extended to non-prototypical members which are learned on a case by case basis. The feature generalized most frequently for semantic expansion was shape, most often vertical extension and small size (Erbaugh, "Development" 415).

Erbaugh determined a general order of classifier acquisition for first language learners (listed in order of acquisition):

Order of Acquisition
Classifiers for discrete, countable, portable, concrete objects
Classifiers for large immovable objects
Classifiers for actions
Classifiers for abstractions and honorifics ("Development" 431)

Children tend to acquire shape-based classifiers relatively early, but conflicting opinions arise over which shape classifiers are acquired before others. Erbaugh argues that those which refer to non-extended round objects are acquired before those that refer to extended objects (Aikhenvald, 420). More evidence for this can be found in Loke's study on children's classifier use in Singapore. He found that classifiers associated with three-dimensional objects (个 *ge4*, 粒 *li4*) were acquired before those associated with one-dimensional objects (只 *zhi1*, 条 *tiao2*) which were in turn acquired before classifiers associated with two-dimensional objects (张 *zhang1*, 片 *pian4*, 块 *kuai4*) (Loke, 144). He believes this is because three-dimensional objects are unmarked, while one-dimensional objects are marked by one extension, and two-dimensional objects are marked by two extensions.

Unlike Erbaugh and Loke, Hu found that the order of classifier acquisition did not necessarily parallel perceptual saliency. Instead, it was found that a better understood classifier such as 张 *zhang1* would be used more than a less understood classifier such as

颗 *ke1*, even when the children demonstrated higher scores in the perception of the three dimensional object than the two dimensional one. In other words, if a child understood the semantic basis for a classifier, such as 张 *zhang1* (used for thin, flat objects), but the child did not completely understand the semantic basis for 颗 *ke1* (used for 3D round objects), then the child would use 张 *zhang1* more often than 颗 *ke1*, even when the child demonstrated more perceptual awareness of 3D round objects than flat thin objects.

Order of Shape Classifier Acquisition (Hu)
2D
1D
3D

It is possible that secondary features expressed in one-dimensional classifiers such as flexibility and rigidity may be the reason for later acquisition, as well as the fact that there are fewer two-dimensional classifiers than one-dimensional classifiers (Hu, 127).

In addition to his controversial findings on acquisition order based on perceptual salience, Loke also determined that functional classifiers were acquired after shape classifiers, due perhaps to the idea that humans first interact with objects before finding a function for them (Loke, 144). Finally, Erbaugh discovered that measures were acquired before specific classifiers ("Development" 431). This is probably due to the semantic complexity of specific classifiers.

Another study completed in 1993 by Hu found that acquisition depended in part on the frequency of the classifier as well as whether the classifier related to the child's life directly. For example, 只 *zhi1* (animacy) which has a high frequency was acquired much earlier than classifiers such as 台 *tai2* (used for machines) or 位 *wei4* (honorific) which do not relate as directly to the child's life and were not found in child speech until

around age six (Hu, 125). It was also determined that numeral classifiers were acquired before deictic classifiers, with near-demonstratives being acquired before far-demonstratives (Hu, 125). In sum, even with the controversy concerning which shape classifiers are acquired first, there is agreement that perceptual saliency, the frequency of classifier use, understanding the semantic basis for the classifier, and the relation of the classifier to the child's life all affect classifier acquisition. It is likely that these factors also affect the acquisition of classifiers by foreign language learners.

Second Language Acquisition of Classifiers

Due to the classifier's unique ability to provide direct insight into a learner's thought process, some research has been previously conducted on the second language acquisition of Mandarin classifiers. However, due to the semantic complexity of the Mandarin classifier conceptual categories compared to the more easily identifiable categories of classifiers found in Japanese or Cantonese, this is still a relatively open field for research. While the research I have conducted is able to provide further evidence to some of the claims made by previous researchers, many claims I make must remain tentative claims due to the limited, though quickly expanding, research in this area.

Since my thesis focuses on what clues a learner can use to further their own acquisition of a language, and I chose to focus on Mandarin classifiers, a brief description of the 'fuzziness' of the conceptual categories is necessary. While each classifier is associated with specific objects that can take the classifier, these conceptual categories are not clear or obvious sometimes. For example, the classifier 台 *tai2* is used for electronic machines, and the classifier 把 *ba3* is used for things that can be held or picked up in the hand. However, while a telephone may be held in one hand, it takes the

machine classifier 台 *tai2* instead of the functional classifier 把 *ba3*. As Charter says in her dissertation thesis *The Second Language Acquisition of Mandarin Nominal Syntax*, "So, allocation of a noun to one class or another is arbitrary, within certain limits, and therefore must be lexically specified" (7). In other words, while each classifier may have a shape, function, or characteristic associated with it, the choice of what classifier to use for an unknown word, especially for learners acquiring Mandarin as a foreign language, can be a difficult and hesitant choice.

Since I was testing learners on which classifiers they would be able to use to guess the meaning of a novel word, it is important to understand what the research to date claims about the order of classifier acquisition for second language learners. Like the first language learners previously discussed, second language learners are also believed to follow a specific order of acquisition called the Numeral Classifier Accessibility Hierarchy. This hierarchy can be described as: Animate human> Animate non human> Shape> Function, with the most accessible (and therefore usually first acquired) being the animate human classifier and the least accessible (and therefore last to be acquired) being a function classifier (Lowie, 112).

Besides the acquisition order of classifiers, it is also necessary to understand what resources foreign language learners may utilize to guess about classifiers. Kuo discovered that foreign language learners rely on a number of different strategies. In a study about how native English speakers learning Mandarin guessed shape classifiers for unknown objects, Kuo determined that these learners relied on their first language, took advantage of experience, or followed the shape principle (433). It is logical to assume that the

learners I tested also employed these strategies in their determination of the semantic basis of a learned classifier.

In addition to testing learners on whether they could use a known classifier to guess an unknown word, I also wanted to test if there was anyway to do the reverse. To use something known about an unknown word to guess which classifier to use. This is where information about Mandarin morphology is essential. In Mandarin, certain morphemes can provide clues to an unknown word's meaning. For example, the character 机 *ji1* occurs on a number of words denoting machines. Once a learner is aware of this distributional pattern, a learner can use this known morphological cue to guess the meaning of an unknown word, therefore using this information to influence their classifier selection.

Research on this type of clue is quite limited. The only study I located concerning classifier selection based on these morphological cues involved native Mandarin speakers. Hu found that Mandarin-speaking children were able to use these cues to guess classifiers (91). My research question tested foreign language learners to determine if they could take advantage of these cues as well.

2 Project

In this study I considered two main research questions:

Question One: Do foreign language learners of Mandarin Chinese make use of morphological cues such as 车 *che1* 'car' and 机 *ji1* 'machine-like object' to select the correct sortal classifier?

Question Two: Do foreign language learners of Mandarin Chinese use classifiers as a way to determine the correct referent of a novel word?

In order to test these two research questions, I gained the cooperation of the Chinese department at the College of William and Mary. I tested college students (age 18-22) studying Mandarin Chinese in four different levels of study at the college:

Table 2 Chinese Classes Tested

Course Number	Chinese Level	Length of Study (when tested)	Studied in China?
402	Advanced	7.5 semesters	The majority: Yes
302	Upper-Intermediate	5.5 semesters	
202	Intermediate	3.5 semesters	The majority: No
102	Beginning	1.5 semesters	

I tested one class at each level of study possible at the College of William and Mary, with the exception of 302 (where I tested two classes to ensure enough participants). By testing each level available at an undergraduate university, I was able to determine when an average learner is able to take advantage of available linguistic cues, and analyze some of the reasons behind why the learner is able to take advantage of these characteristics of Mandarin at this point.

Since both the situational context (objects in the vicinity and the characteristics of those objects) and the linguistic context (speaker's words) influence how a learner assigns a potential meaning to an unknown word, it is important to note exactly what cues I tested. Based on my research questions, I chose to limit the linguistic cues to known classifiers and known morphological cues. Then, in my first research question, I tested only linguistic cues, while in my second research question, both situational cues and linguistic cues must be utilized to assign meaning to an unknown word. For my second research question, learners used familiar classifiers as a linguistic cue and the shapes/animacy/function of the objects in a picture as the situational context.

I decided to test this for a number of important reasons. First, it is important to know whether learners can utilize a structure that is absent in their own language, in this

case classifiers in Mandarin Chinese, as a way to further acquire the language being studied. Second, with the complexity of languages, it is widely believed among linguists that there must be ways in which the learner can use what they have already acquired in the language to further acquire the language. This is seen in such terminology as syntactic bootstrapping or semantic bootstrapping among others. While this is often applied to first language acquisition, I believe it is important to also consider foreign language acquisition in this light. I investigated whether native English speakers studying Mandarin Chinese can use previously acquired classifiers or morphological cues to determine the general meaning of unfamiliar words, potentially opening the way to further noun acquisition and increasing their proficiency on their own.

2.1 Research Plan

Question One: Do foreign language learners of Mandarin Chinese make use of morphological cues such as 车 *che1* 'car' and 机 *ji1* 'machine-like object' to select the correct sortal classifier?

The first question focused on the use of morphological cues in the selection of classifiers by native English speakers. After studying Mandarin for a short while, learners become aware of some morphological cues that can often provide a clue to the meaning of a new word, and potentially help to predict the correct classifier. For example, the word 车 *che1* 'car' often occurs on the end of words that refer to a type of vehicle. Once students become aware of this affix, it is possible to use a morphological cue such as *che1* to guess which classifier to use in conjunction with an unknown word. A student who hears the unknown word 公共汽车 *gong1 gong4 qi4 che1* 'bus' and is aware of 车 *che1* can correctly guess the correct classifier 辆 *liang4* 'CL$^{\text{vehicle}}$' even without the knowledge that this word refers to a bus.

Interestingly, while most of the words that contain 车 *che1* at the end are types of vehicles, there are some exceptions. These exceptions do not take 辆 *liang4* as their classifier. I used this knowledge to determine if foreign language learners with English as their native language can and do take advantage of these morphological cues in Mandarin when determining their classifier choice. If they do make use of these cues, then their classifier choices for unknown words ending in 车 *che1* will reflect this bias towards the classifier 辆 *liang4,* even when the word refers to an object that is not a vehicle.

Acquiring a foreign language is a difficult process, and whether learners can take advantage of these morphological cues to further acquire the language has important implications. It is widely known that when a learner encounters an unfamiliar word, it is possible to use the situational context to determine its meaning. This is similar to how English speakers use 'a' and 'some'. When English speakers hear 'a' used with an unfamiliar noun, they pay attention to the object's shape, while they pay attention to the texture of an object when they hear 'some'. These two words encode a difference between mass and count nouns in English. MASS NOUNS are nouns that identify objects which are an unbounded mass, while COUNT NOUNS are nouns that have singular and plural forms, and can be modified by a numeral. For example, 'book' is a count noun (books/book, 5 books), and 'sand' is a mass noun. In English, 'a' correlates with count nouns, and 'some' correlates with mass nouns. Therefore by using the situational context, a learner can infer the meaning of an unknown English noun in this way. From this example alone, it is obvious that situational context can play a large role in how the learner guesses an unknown word's meaning, and should be carefully examined in the study I conducted.

In addition to the situational context, it is also possible to use the linguistic output of the speaker to sometimes decipher the meaning, or general meaning, of the new word. In my study, the morphological cues constitute part of the linguistic context. By presenting learners with these linguistic cues, I tested whether foreign language learners of Mandarin can utilize these morphological cues in the word itself to not only guess the general meaning of the word, but to further select the correct classifier.

To find the answers to my first research question, I tested native English speakers studying Mandarin at the College of William and Mary. I did this by saying an unknown word in Chinese and having them write the classifier they would guess to use with the word. I tested 16 Chinese words in this way, with 14 random distracter words containing no morphological cues. I then tested 16 English words by following the same process.

The central factor in testing the first research question are the words chosen to be tested. I specifically decided to work with 车 *che1* 'car' and 机 *ji1* 'machine' since these are often encountered very early in the study of Mandarin. I selected words that would be unfamiliar to students, but ended in one of these two morphological cues. I then selected a number of words in which these cues correctly helped to identify the type of noun. 公共汽车 g*ong1 gong4 qi4 che1* in which 车 *che1* 'car' does correctly imply that the unknown word should take 辆 *liang4* 'CL^{vehicle}' is an example of these nouns. I also selected a number of words in which 车 *che1* 'car', if used to guess the meaning, would incorrectly imply that the word should use the classifier for a vehicle. 风力水车 *feng1 li4 shui3 che1* 'windmill' is an example of these nouns. Although this word ends in 车 *che1* it should not take a vehicle classifier. I then chose to test 8 车 *che1* words and 8 机 *ji1*

words in both English and Chinese in order to ascertain if students are using these cues to guess the classifier.

If students are using these morphological cues, then they should choose 辆 *liang4* for any words ending in 车 *che1,* even words such as 风力水车 *feng1 li4 shui3 che1* 'windmill'. However, when presented with these words in English, they should only choose 辆 *liang4* for words that denote vehicles. In this case, 'windmill' should not receive the classifier 辆 *liang4.* The same principle should hold for the words ending in 机 *ji1*. Learners should select the machine classifier only for the English words that actually denote machines, choosing another classifier for English words that denote other objects (even though their Chinese translation ends in 机 *ji1*).

Question Two: Do foreign language learners of Mandarin Chinese use classifiers as a way to determine the correct referent of a novel word?

In addition to studying classifier selection by native English speakers, I studied whether foreign language learners could take advantage of classifiers heard in speech to determine what was being referenced. In other words, I tested English-speaking students learning Mandarin to determine if they were able to use familiar classifiers as a way to determine the referents of novel nouns. For example, if a student who is familiar with the classifier 辆 *liang4* 'vehicle' hears this classifier followed by an unknown word, can and will the student use the classifier to guess that the speaker is discussing the only object in the vicinity that has wheels and could be considered a type of vehicle, such as a bicycle or a bus?

To test the second question, I selected six commonly used and taught classifiers to examine:

1. 只 *Zhi1*
2 条. *Tiao2*
3. 块 *Kuai4*
4. 把 *Ba3*
5. 辆 *Liang4*
6. 台 *Tai2*

I then selected ten different objects that use each of these classifiers for a total of 60 objects. These objects were specifically chosen to be unknown to the students, and to vary from prototypical objects for a classifier to less obvious items. For example, the classifier 只 *zhi1* is used for animals. The objects 'cat' and 'dog' would be an example of prototypical items that take the classifier 只 *zhi1,* while the objects 'butterfly' and 'lizard' would be less prototypical objects that take the classifier 只 *zhi1.* After selecting objects that were unfamiliar to the students and ranged in the obviousness of what classifier to use, I then created 10 different pictures, each containing one object using each of the six classifiers and four extra objects. For example, picture one looked like this:

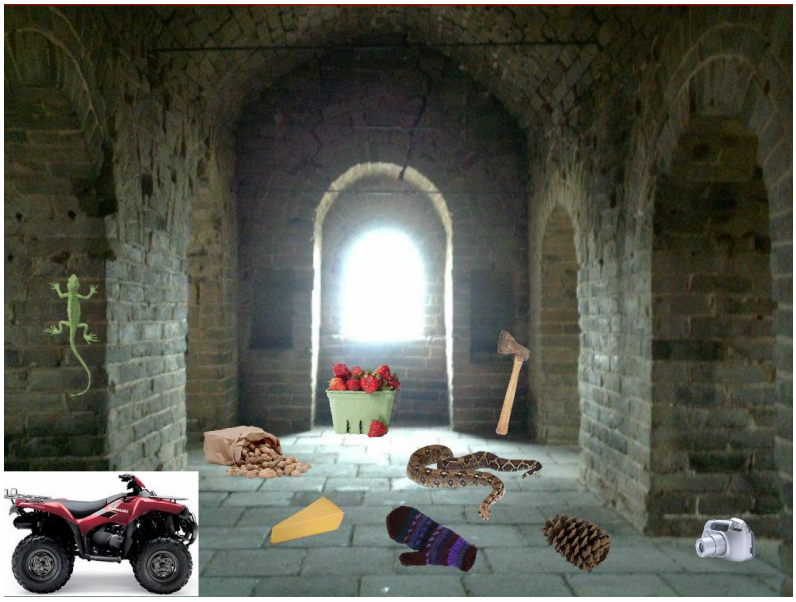

Table 3 shows the objects in picture one and the classifiers they would take:

Table 3 Objects in Picture One

Object	**Classifier**
Lizard	只 *Zhi1*
Axe	把 *Ba3*
Snake	条 *Tiao2*
Slice of cheesecake	块 *Kuai4*
Four wheeler	辆 *Liang4*
Camera	台 *Tai2*
Bag of peanuts	Extra objects
Apple	
Stamp	
Mitten	

3. Results/Discussion of Question 1

After collecting and analyzing the results, some patterns in responses were immediately apparent. I began by determining whether learners were able to correctly guess 辆 *liang4* (the vehicle classifier) for nouns ending in 车 *che1*. If learners could do this, then it would prove that the learner's previous knowledge of 车 *che1*'s meaning had enabled them to correctly choose 辆 *liang4* for an unknown word. In other words, the linguistic context, specifically the morphological cue 车 *che1*, influenced the learner's selection of the classifier.

To begin with, I chose eight words ending in 车 *che1* to test, four of which actually name a vehicle and four of which misleadingly name other objects (Table 4).

Table 4 Words Tested Ending in 车 *che1*

Chinese	**Pinyin**	**English meaning**	
救护车	jiu4 hu4 che1	Ambulance	Take the vehicle classifier 辆 liang4
碰碰车	peng4 peng4 che1	Bumper Car	
消防车	xiao1 fang2 che1	Fire Engine	
购物车	gou4 wu4 che1	Shopping Cart	
过山车	guo4 shan1 che1	Roller Coaster	Do not take the vehicle classifier 辆 liang4
纺车	fang3 che1	Spinning Wheel	
风力水车	feng1 li4 shui3 che1	Windmill	
转车	zhuan4 che1	Carousel	

If the learner is using only 车 *che1* to guess the correct classifier, then the learner should guess 辆 *liang4* for any unknown nouns ending in 车 *che1*, whether the noun denotes a vehicle or not.

Each learner was asked to write the classifier they would use with each unknown word, as well as whether they knew the meaning of the noun. In this way, I was able to examine whether learners used the morphological cue in their classifier selection.

Table 5 Unknown Chinese Words Ending in 车 *che1*

	Ambulance	**Bumper Car**	**Fire Engine**	**Shopping Cart**	**Roller Coaster**	**Spinning Wheel**	**Windmill**	**Carousel**	**Total Participants**
4	4/6	4/6	7/8	4/7	4/6	6/8	5/9	6/8	9
3	11/16	10/16	12/18	10/16	11/17	12/19	14/18	10/16	19
2	1/13	1/11	1/10	0/12	1/12	1/13	1/13	0/12	13
1	No Data	*	5/11	5/9	*	5/11	6/12	5/9	13

* Unable to include data due to misinterpreted input

Generalization 1 – 车 *che1* is a very easily-used linguistic cue

Based on the data in Table 5, I can conclude that each level excluding 202 was not only aware of this cue, but also consistently using it when faced with the task of selecting a classifier for an unfamiliar word. This is obvious from the fact that on average at least 2/3 or more of the advanced 402 learners chose 辆 *liang4* for almost every

unknown word ending in 车 *che1*, as well as 3/4 of the 302 learners. Even half of the 102 learners consistently demonstrated that their previous knowledge of the linguistic cue could influence their classifier choice.

Unlike the other three levels, only one of the intermediate level learners (202) was able to select 辆 *liang4* as the classifier for the unknown words ending in 车 *che1*. Unsurprisingly, this the only learner from 202 who listed 车 *che1* as a reason for how he chose classifiers for unknown words.

Table 6 202 Learner Who Knew 辆 Liang4

	Ambulance	**Bumper Car**	**Fire Engine**	**Shopping Cart**	**Roller Coaster**	**Spinning Wheel**	**Windmill**	**Carousel**	**Total Participants**
2	1/13	1/11	1/10	0/12	1/12	1/13	1/13	0/12	13

This is most likely due to a lack of emphasis on or large amount of exposure to the vehicle classifier by the class as a whole.

With the exception of the 202 level, I can conclude from the learner responses, that the majority of second language learners, even those who have just become aware of this morphological cue (as in the 102 learners), are utilizing the morphological cue 车 *che1* to guess the classifier.

Generalization 2 – 车 *che1* is more easily used than 机 *ji1* as a linguistic cue

While the vast majority of learners, especially upper-level learners, were able to take advantage of 车 *che1* as a linguistic cue, I had predicted that 机 *ji1* would be much more difficult to use in this way. Unlike 车 *che1* which literally means “vehicle/ car”, 机 *ji1* is simply a sound or character that is added to the end of a large variety of electronic machines. It does not literally mean “machine”, but if the learner is aware of its normal distribution on the end of machine words, then a learner can logically guess the machine classifier 台 *tai2* or another slightly less studied classifier for machines 部 *bu4*. I

considered either 台 *tai2* or 部 *bu4* to demonstrate the successful recognition of 机 *ji1* to name machines. Due to the extra step in recognizing 机 *ji1* as a linguistic cue (knowing that it is the final sound for many words denoting machines) and its later introduction into the learner's Chinese education, I expected only upper-level learners to be able to correctly guess the classifier from this cue, and for less of these learners to be able to.

To test this question, I again selected eight words ending in 机 *ji1* to test, four accurately naming machines and four naming other objects.

Table 7 Words Tested Ending in 机 *ji1*

Chinese	**Pinyin**	**English meaning**	
传真机	chuan2 zhen1 ji1	Fax machine	Take the machine classifier 台 tai2
发动机	fa1 dong4 ji1	Engine	
烘干机	hong1 gan1 ji1	Dryer	
饮水机	yin3 shui3 ji1	Water Fountain	
直升机	zhi2 sheng1 ji1	Helicopter	Do not take the machine classifier 台 tai2
动机	dong4 ji1	Motive / Motivation / Intention	
司机	si1 ji1	Chauffeur / Driver	
拖拉机	tuo1 la1 ji1	Tractor	

Learners who correctly associated 机 *ji1* with machines should have selected the machine classifier for all of the unknown Chinese words ending in 机 *ji1*, even those words that identified an object other than a machine.

Table 8 Unknown Chinese Words Ending in 机 *ji1*

	Fax Machine	**Engine**	**Dryer**	**Water Fountain**	**Helicopter**	**Motive**	**Chauffeur**	**Tractor**	**Total Participants**
4	3/6	3/7	3/7	2/5	3/9	3/9	0/4	2/8	9
3	2/15	3/18	2/15	3/14	3/18	3/18	1/19	3/17	19
2	1/9	2/13	0/7	2/13	2/12	1/12	0/6	0/11	13
1	0/13	1/12	0/11	0/12	0/12	0/12	0/10	0/10	13

By looking at the learner responses for the unknown Chinese words ending in 机 *ji1* (Table 8), I can conclude that my predictions were proven true. While it is apparent that some learners at the upper level are aware of the distribution of 机 *ji1* and therefore able to correctly select 台 *tai2* when faced with an unknown word ending in 机 *ji1*, this linguistic cue is not as well known as 车 *che1*. For instance, while at least 2/3 of the advanced learners were able to use 车 *che1* as a cue, only about 1/3 to 1/2 of the same learners were able to utilize the linguistic cue 机 *ji1*. This drop in the number of learners able to use this cue is even more pronounced in the 302 level. While almost 3/4 of the 302 learners successfully used 车 *che1* to guess the classifier, only around 1/6 of the 302 learners could consistently demonstrate this ability.

Generalization 3- Learners selected classifiers based solely on the linguistic cues

Based on the first two generalizations, we are now aware that the majority of learners are aware of the morphological cue 车 *che1*, and that a small number of the upper-level learners are aware of the morphological cue 机 *ji1*. However, if we consider the responses provided by the foreign language learners when presented with the English equivalents of the already tested unknown Chinese words, we can see that these learners were not only aware of these cues, but made their choices on which classifier to use based solely on the morphological cue.

Since these learners were unaware that the English words they were tested on were translations of the Chinese words that had already been tested, the learners treated each word as being a completely new word. Therefore, there were no morphological cues associated with any English words. If we assume that learners chose 辆 *liang4* or 台 *tai2*

based solely on the morphological cues at the end of the Chinese word, then these learners, when given the equivalent word in English, should behave according to the following predictions:

1. If the English equivalent of these Chinese words is actually a vehicle or a machine, then these learners should choose the same classifier.

2. If the English equivalent does not identify a vehicle or a machine, then these learners should select a different classifier.

If learners behave according to my predictions, then these learners have demonstrated that they made their classifier choices due solely to the morphological cue found in the Chinese word.

Table 9 English 车 *che1* Words (vehicles)

	Ambulance	**Bumper Car**	**Fire Engine**	**Shopping Cart**	**Total Participants**
4	4/4	4/4	7/7	4/4	9
3	11/11	11/11	10/12	4/10	19
2	1/1	1/1	1/1	0/0	13
1	No Data	No Data	5/5	2/5	13

As expected, the learners who had demonstrated using the morphological cue 车 *che1* when faced with unknown Chinese words, also chose 辆 *liang4* for the English words denoting vehicles. This can be seen by the fact that every student who used 辆 *liang4* for 救护车 *jiu4 hu4 che1* 'ambulance' and 碰碰车 *peng4peng4che1* 'bumper car', also chose 辆 *liang4* for their English equivalents. Furthermore, with the exception of two 302 students, the same results were found for fire engine. In summary, the learners who demonstrated using the morphological cue 车 *che1* behaved exactly as predicted when presented with the English equivalents that referred to vehicles.

Unlike the English words that named vehicles, learners responded differently to the English equivalents of the misleading Chinese words (those words that do not denote vehicles but still end with 车 *che1* in Chinese).

Table 10 English 车 *che1* Words (not vehicles)

	Spinning Wheel	Windmill	Total Participants
4	0/6	0/5	9
3	0/12	0/14	19
2	0/1	0/1	13
1	0/5	0/6	13

Every student who demonstrated the use of 车 *che1* to guess the classifier 辆 *liang4*, chose a different classifier for the English words 'spinning wheel' and 'windmill'. Just as predicted, these unanimous results prove that it must be the linguistic cue 车 *che1* that compelled the learners to guess 辆 *liang4* before when the word was unknown to them Instead of the vehicle classifier, these learners overwhelmingly chose the general classifier. To summarize, when these learners were faced with English words that were not vehicles and contained no morphological cue they had no reason to select 辆 *liang4* as a classifier, even though the meaning remained the same both times.

Since only a small number of upper-level learners demonstrated a use of 机 *ji1* as a clue to classifier selection, I examined a much smaller number of learners than with 车 *che1*. However, if learners demonstrate the same predicted behavior with 机 *ji1* as they demonstrated with 车 *che1*, then it is possible to conclude that these learners made their classifier selections solely on the morphological cue 机 *ji1* as well.

Table 11 English 机 *ji1* (machines)

	Fax Machine	Engine	Dryer
4	3/3	2/3	2/3
3	2/2	2/3	2/2

When tested on words that were prototypical machines, ‘fax machine’, ‘engine’, and ‘dryer’, at least 2/3 (if not all) of the upper level learners consistently chose the machine classifier. This is a display of the behavior I had predicted, and provides evidence that these learners when choosing the machine classifier for unknown Chinese words did so only based on the morphological cue 机 *ji1*.

When the results for the English equivalents of the misleading 机 *ji1* words (words that do not denote machines even though they end in 机 *ji1*) are analyzed, we can see that the upper-level learners also displayed the predicted behavior.

Table 12 English 机 *ji1* (not machines)

	Helicopter	**Motive**	**Chauffeur**	**Tractor**
4	0/3	0/3	No Data	0/2
3	0/3	0/3	0/1	0/3

Not one learner selected the machine classifier for ‘helicopter’, ‘motive’, ‘chauffeur’, or ‘tractor’, even though each learner selected it for the Chinese equivalents. However, this is not surprising since without 机 *ji1* as a morphological cue, nothing would compel the learners to select the machine classifier for these objects which do not name prototypical machines.

Furthermore, those students who selected the machine classifier 台 *tai2* for the unknown Chinese words ending in 机 *ji1* did not guess 台 *tai2* for any other unknown Chinese words. This would provide further evidence that the learners who were aware of this distribution chose solely based on 机 *ji1* as a morphological cue. When this cue was absent, they had no motivation for guessing 台 *tai2* and therefore did not.

Generalization 4 – Semantic Fit plays an important role

As mentioned previously, semantic fit can have a large effect on learner judgments. By looking at the learner selections, we can see how more learners choose 个 *ge4* instead of 辆 *liang4* for the less prototypical vehicle 'shopping cart'. Although Chinese speakers consider 'shopping cart' to be 'vehicle-enough' to take the classifier 辆, only five of the eleven students at the 302 level chose 辆 *liang4*, and only two of the five 102 level students chose the vehicle classifier.

Table 13 Semantic Fit - 'Shopping Cart'

	Shopping Cart
4	4/4
3	4/10
2	0/0
1	2/5

The key to understanding why so many students chose not to select 辆 *liang4* when given the English word 'shopping cart' may be found in some of the specific responses given by those students. For example, one student wrote 辆 *liang4* as the classifier they would use, then crossed it out and wrote 个 *ge4*, the general classifier. It is likely that 'shopping cart', as a less prototypical vehicle, was simply not considered 'vehicle enough' to take the classifier 辆 *liang4*, therefore explaining why some students chose to use the general classifier 个 *ge4* since in its default function, it is acceptable to use with most words.

Another example of semantic fit can be seen by the learners' responses to 过山车 *guo4 shan1 che1* 'roller coaster'. Chinese speakers do not use the vehicle classifier for 'roller coaster', but five of the English speakers believed it to be similar enough to a vehicle to warrant the vehicle classifier. While there weren't many of these learners,

these few learners demonstrated that semantic fit, how well they believe an object to fit their concept of 辆 *liang4*, can affect a learner's decision on what classifier to use.

Table 14 Semantic Fit- 'Roller Coaster'

	Roller Coaster
4	1/4
3	3/11
2	1/1
1	No Data

The final evidence for the important role semantic fit plays can be seen in the English translations for 机 *ji1*. For example, 饮水机 *yin3 shui3 ji1* 'water fountain' takes the machine classifier. However, all of the learners who selected 台 *tai2* when faced with the Chinese translation of 'water fountain' chose not to use 台 *tai2* for the English translation of 'water fountain'. These learners chose to use the general classifier instead, indicating that English speakers may see a water fountain as being a less prototypical electric machine than 'fax machine', 'dryer', or 'engine' where they chose the machine classifier. How well the object tested fit the learner's idea of what an object taking 台 *tai2* should be like (semantic fit) played an important role in how the learners responded.

Table 15 Semantic Fit - 'Water Fountain'

	Water Fountain
4	0/2
3	0/3

Generalization 5 – Awareness of linguistic cues is the most important factor

After learners completed filling in the classifiers for the words I chose to test, they were then asked to list the most important reason they used to select their answers.

Table 16 Reasons for Guessing

	车 *che1*	机 *ji1*	个 *ge4*
4	4	4	0
3	11	7	2
2	1	1	5
1	8	5	5

In accordance with what the data has shown already, many learners listed 车 *che1* as one of the most important ways they decided to guess. In fact, although only four of the advanced learners specifically listed "che1/ji" as the reason why they guessed as they did, the rest of the learners listed 'part of the word' as their primary reason for guessing in certain ways. I chose not to list them in the table since this could technically refer to any characters in the word. However, it is likely that they were referring to the endings of many of the words, *che1/ji1* which would explain their ability to guess the right classifier, even when the word was completely unknown to them. This trend continues with the 302 learners. While only eleven specifically listed 车 *che1* and only seven specifically stated 机 *ji1* as reasons, the majority of the rest of the learners listed 'part of the word' as their reasoning.

When we look at the lower level learners we reach a slightly different conclusion. For the intermediate learners (202), nine of the thirteen listed gut instinct/luck as their reasoning or using the general classifier 个 *ge4*. This is vastly different from the upper level learners, where 个 *ge4* as their priority for how to guess was only mentioned twice out of the 28 participants. This could explain why in many of the earlier charts, we found the 102s guessing correctly in instances where the 202s were not.

Unlike the 202 learners, the beginner learners (102) were definitely aware of the 车 *che1* cue, and many listed exactly this as their main strategy for guessing. There were

also a surprising number of 102 learners who listed 机 *ji1* as something they used to guess. However, although five of the thirteen learners listed this as a clue, none of the learners used it to guess the machine classifier. I believe the answer to this can be found in one of the 102's responses to their most important reason for guessing as they did. The learner wrote: "che-liang, ji-ge, animal-zhi". This would explain why many indicated an awareness of 机 *ji1* in the last question, but listed 个 *ge4* as the classifier when I asked to provide one for the unknown Chinese word ending 机 *ji1*. The 102s, according to their Chinese teacher, had not been introduced to 台 *tai2* at the time of testing.

As expected, the reasons provided by the learners for how they guessed correlate with how well they were able to perform the task I requested of them: selecting a classifier when given an unknown word in Chinese. The upper level learners listed more reasons involving the morphological cues 车 *che1* and 机 *ji1*, while the lower-level learners listed more reasons involving luck, guessing, or using the general classifier 个 *ge4*. Furthermore, the awareness of these cues enabled the 102s to often outperform the 202s in this task, even though the 202s were an entire year ahead of them in study.

From the results of this test, we can conclude that foreign language learners are able to take advantage of previously-learned morphological cues to inform their guesses at which classifier to use with an unknown word. Morphological cues that have a literal meaning such as 车 *che1* 'vehicle/car' are more easily utilized in this way, while evidence suggests that foreign language learners have a more difficult time taking advantage of morphological cues based only on distributional patterns, such as 机 *ji1*. Due to the extra step necessary to use cues such as 机 *ji1*, a learner must first realize what

kind of words have this morphological cue, and these distributional pattern cues are normally utilized only by the more advanced learners who have had more exposure to the language.

Besides proving that foreign language learners can use morphological cues and demonstrating the extra time necessary to be able to utilize the distributional morphological cues, we can also conclude that semantic fit correlated with the learner's classifier selections. How well the object fit the learner's concept of a classifier directly affected the classifier they selected. Objects closer to the prototype received the classifier the most often, while objects that learners considered to be too different from the prototype received the general classifier just as Erbaugh described earlier. In summary, learners used linguistic cues to guess when given an unknown Chinese word, and used semantic fit when given an English word.

3.2 Results/Discussion of Question 2

I discovered a variety of interesting information from the results of my second test. Since my research question involved determining whether students, without any suggestions or prompting, could use these classifiers to guess referents, I was unable to guarantee that each word would be unknown to every student I tested. If I had selected to provide only the classifier, learners would have been forced to focus on it for lack of other information. Instead, I tried to select words that would be unknown to the average learner, and focused my analysis on those learners who indicated that the word was unknown to them. Although this limited some of my data (when a word was known by the entire class), I was still able to collect a large amount of data in which learners who demonstrated use of the classifiers to select the referent did so without any prompting to

focus on this grammatical category. In other words, a learner who successfully completed my task by noticing the classifiers did so on their own, therefore proving that learners can and do make use of classifiers in the real world.

Since 只 *zhi1* is one of the first classifiers learned by children and classifies nouns as being a non-human animate object (a more quickly acquired category normally), I chose to test how well second language learners could use this classifier to identify an unknown animal from a list of pictures. Since there was only one object that took the animal classifier 只 *zhi1* in each picture, any learner who was aware that 只 *zhi1* was used for animals should be able to correctly select the word from the classifier alone.

Although I tried to choose words that would be unknown to most of the learners, after extensive study in China, many 402 level learners were still familiar with some of the words I tested. Since my research question focused on whether learners can use classifiers when faced with an *unknown* word, I did not count learner responses if they indicated previous knowledge of a tested word. This would explain why, for many words, more data from 102 learners is analyzed than data from 402 learners. To further account for this possibility, I chose to test ten examples of each classifier, therefore guaranteeing some words that were unknown to all levels.

Generalization 1- Any level learner can perform this task successfully

Since I only analyzed the data for learners who indicated that the word was unknown to them, only two pieces of knowledge are required to correctly guess the referent: 1) exposure to the classifier and 2) knowledge of what items take the classifier. In other words, a 102 level learner can perform just as well as a 402 level learner if both

have been exposed to the classifier being tested and are aware of what items take the tested classifier.

Since learners at any level can perform this task equally well given the same knowledge of classifiers, it is no surprise that the data provides evidence for this when we analyze a classifier commonly known to both upper-level learners and lower-level learners, such as 只 *zhi1* for animals. The 102 level learners consistently perform as well as the 402 learners:

Table 17 只 *zhi1* 402/102 Comparison

	4	**1**
Lizard	5/13	7/14
Spider	5/7	7/13
Flamingo	6/10	10/14
Mouse	5/8	7/14
Turtle	5/7	9/13
Toad	9/10	11/14
Butterfly	4/5	8/14
Terrier	6/11	6/14

If we look at the 402 and 102 performance on the classifier 辆 *liang4*, another classifier commonly known to both upper-level and lower-level learners, we see this trend continue. In fact, since one of the 402 learners listed lack of classifier knowledge as the reason for guessing randomly, we see that the 102s actually guessed correctly 100% of the time, while the 402s did not.

Table 18 辆 *liang4* 402/102 Comparison

	4	**1**
Four Wheeler	4/5	13/13
Baby Carriage	8/9	14/14
Wheelbarrow	9/10	11/11

Generalization 2- Results parallel the Numeral Classifier Accessibility Hierarchy

In addition to the fact that students at any level with the necessary knowledge can correctly guess the referent, a general pattern emerges concerning which classifiers were more easily used as a resource for guessing the referent by the learners. In other words, by analyzing the data to determine which classifiers were used more successfully, as well as which classifiers were only successfully used by the upper-level learners, we can come to a conclusion about what kinds of classifiers are most easily used in a task such as this. Since I chose to test an animate classifier, two shape classifiers, and a functional classifier, we can find a general pattern concerning which of these classifiers was the most successfully used by learners and which classifiers were more difficult.

To begin with, it is immediately noticeable that the majority of learners were able to use the animate classifier the most successfully of all the classifiers tested (excluding the vehicle classifier 辆 *liang4* and the machine classifier 台 *tai2* since these both had multiple clues to the referent's identity). This is not surprising if we consider the Numeral Classifier Accessibility Hierarchy discussed earlier:

(16) Animate human> Animate non human> Shape> Function

To use a basic animate classifier, a learner need only make a binary distinction: is this object animate or inanimate? Although the classifier I tested, 只 *zhi1* has one extra dimension to this: It is only used for non-human animate objects, it is still the most semantically transparent classifier I tested. In other words, a learner need only determine if an object is non-human and animate to use the classifier for it.

While the majority of the learners used 只 *zhi1* successfully most of the time, the 202 learners were the exception to this (perhaps due to a limited amount of exposure to

the animal classifier 只 *zhi1*). Of the other three levels though, over 50% of the learners selected the correct referent the majority of the time. Drops in performance were usually the result of having to select a less prototypical animal, such as a 'toad', or having to choose between two animals. For example, in the picture containing 'lizard' there was also a picture of a 'snake'. Although 'snake' was included because it takes the classifier 条 *tiao2* (long thin flexible object), many students selected snake when given the animal classifier 只 *zhi1* and an unknown word. In other words, even though these learners chose the wrong referent, they were nonetheless using the animal classifier to make their choice.

Table 19 只 *zhi1* Data

	4	**3**	**1**
Tabby Cat	1/1	6/7	10/11
Lizard	5/13	3/11	7/14
Spider	5/7	4/9	7/13
Flamingo	6/10	6/10	10/14
Mouse	5/8	5/10	7/14
Turtle	5/7	7/10	9/13
Toad	9/10	3/10	11/14
Butterfly	4/5	5/10	8/14
Terrier	6/11	7/11	6/14

条 *tiao2* was the second most successfully used classifier. Unlike 只 *zhi1* which was an animate classifier, 条 *tiao2* is a shape classifier. It is used to classify objects which are long, thin, and flexible. Although determining if an object is long, thin, and flexible may sound like a simple enough task, slight differences in shape actually make this a slightly more difficult task than deciding if an object is non-human and animate. With this in mind, it is logical that learners would have slightly more trouble using this classifier to guess an object, than 只 *zhi1* which requires they only determine if an object is an animal. In addition to this, English speakers are used to the category of animals,

while ‘long, thin, and flexible objects’ is not a familiar category to them. Finally, it is important to note that many of these classifiers are not described as being used with a specific shapes. In fact, many textbooks simply list objects that take the classifier. For example, a learner might ‘learn’ 条 *tiao2* by reading that it is used with ‘rope, paths, necklaces, etc.’ This requires that a learner extrapolate the commonalities among the objects before allowing the learner to use it to guess an unknown referent.

By taking note of these three fundamental differences between 只 *zhi1* and 条 *tiao2*, it is understandable why most learners were able to use 只 more successfully than 条 *tiao2*.

Table 20 条 *tiao2* Data

	Pearl Necklace	**Necktie**	**Extension Cord**
4	1/5	4/8	6/9
3	4/6	6/10	8/10
2	5/12	3/12	6/12
1	8/13	6/14	4/14

It is important to note that when I discuss how successful learners were in using a particular classifier, I am speaking generally of all levels. While many learners were able to use 条 *tiao2* quite well, more learners were able to use 只 *zhi1*.

Remembering the reasons why 条 *tiao2* was more difficult to use than 只 *zhi1*, it comes as no surprise that the second shape classifier I tested was shown to be the third most successfully used (still excluding the vehicle classifier 辆 *liang4* and the machine classifier 台 *tai2*). Similar to 条 *tiao2*, the second shape classifier 块 *kuai4* requires that a learner first determine the shape of the objects it is normally used with. It then requires

that they be able to determine if an object is similar enough to that prototypical shape to take 块 *kuai4* as its classifier.

However, there is one difference between 条 *tiao2* and 块 *kuai4*. This can be seen in my original difficulty in even selecting 块 *kuai4* shaped objects for my test. Even knowing that 块 *kuai4* was used for objects that were 'clumps' or for objects that were 'flat but not thin', I was unable to successfully select objects that took 块 *kuai4* on my own. In fact, many of the objects I deemed to be perfect matches to the shape I associated with 块 *kuai4* did not use 块 *kuai4* at all. After a large number of unsuccessful objects, I finally had to simply request a Chinese professor tell me some objects that took 块 *kuai4* so as to complete my images.

What this situation demonstrates so successfully I believe, is that English speakers have a hard time determining exactly what shaped objects take the shape classifier 块 *kuai4*. This semantic fuzziness causes learners to have a more difficult time successfully using 块 *kuai4* as a clue to referent meaning. If we consider the data, while some learners were able to use this classifier, fewer than half of the learners per academic level were able to consistently select the referent solely on the classifier 块 *kuai4*.

Table 21 块 *kuai4* Data

	Soap	**Blocks**	**Dice**	**Poker Chips**
4	4/9	5/11	6/11	4/11
3	4/9	6/11	3/9	5/12
2	2/12	0/12	1/12	2/11
1	4/11	3/14	7/14	4/13

Unsurprisingly, the functional classifier 把 *ba3* was the least successful classifier used. In addition to being learned much later in a learner's Mandarin education than the

other three, it is not an animate classifier or a shape classifier. Instead, a learner must know that 把 *ba3* is used to classify 'tools that are held'. If a learner exposed to 把 *ba3* receives only some examples of objects that use 把 *ba3*, it can be incredibly difficult to determine when to use 把 *ba3*. For example, a learner seeing only a list including 'violin, shovel, scissors, paint brush, umbrella' has a difficult task ahead of them to infer that 把 *ba3* is used for 'tools that you hold'. Furthermore, a learner must know what an unknown object's purpose is to determine if an object would take 把 *ba3*. Unlike shape, an object's purpose is not as easily perceivable from looks alone. Based on its late introduction to foreign language learners, the fact that English speakers are not used to dividing the world up into this kind of category, and the importance of the less easily perceived purpose of an object, it is understandable why most of the foreign language learners I tested were not able to use 把 *ba3* successfully.

Table 22 把 *ba3* Data

	Violin	**Scissors**	**Tambourine**
4	2/8	2/7	2/10
3	3/10	1/11	4/11
2	2/12	3/12	2/11
1	6/13	1/12	5/14

The results from the foreign language learners I tested provide further evidence for the Numeral Classifier Accessibility Hierarchy described by previous research in second language acquisition.

Generalization 3 – Semantic Fit accounts for performance drops

As demonstrated in my first research question, semantic fit accounts for a large amount of the data as well. Learners performed more accurately whenever the object was a prototypical object for a classifier. For less prototypical objects, learners consistently

demonstrated worse performance overall. For example, nearly every learner tested (with the exception of 202) successfully chose the prototypical 'cat' when given the animal classifier 只 *zhi1*. However when given the same classifier, less than half of the learners were able to pick 'lizard'.

Table 23 Prototypical/ Non-Prototypical Distinction

	Prototypical	**Non-Prototypical**
	Cat	**Lizard**
4	1/1	5/13
3	6/7	3/11
1	10/11	7/14

Even the 202s who overall demonstrated less awareness of classifiers, showed this drop in performance (though on a less pronounced scale).

Table 24 202 Prototypical/ Non-Prototypical Distinction

	Prototypical	**Non-Prototypical**
	Cat	**Lizard**
2	5/11	0/12

This distinction between prototypical objects and less prototypical objects is consistently demonstrated in all of the classifiers. Semantic fit accounts for many performance drops based on a particular item.

Generalization 4- Better performance results from additional linguistic cues

While determining which classifiers were most successfully used, I very quickly noticed that the learners achieved almost perfect results on 辆 *liang4*, and much better results than I expected on 台 *tai2*. Since 辆 *liang4* is one of the first classifiers introduced to second language learners, I would expect learners to perform better on this classifier for that reason alone, but 台 *tai2* is introduced much later in their education. However if we consider my earlier research question, another potential reason for good performance on these two classifiers is apparent.

If we focus on 辆 *liang4* first, we see that there are two reasons why a learner would perform well on this classifier task. Foreign language learners could: 1) use the classifier 辆 *liang4* to guess the referent, or 2) use the morphological cue 车 *che1* discussed in my last research question. Most likely, it differed based on the learner, with some focusing on the classifier, some focusing on the morphological cue, and some using both. With access to both of these cues, the performance level increased dramatically as can be seen by the near-perfect performance by the 402 learners.

Table 25 辆 *liang4* 402 Level

	Four Wheeler	Tricycle	Scooter	Wheelbarrow	Baby Carriage	Total Participants
4	4/5	4/4	10/11	9/10	8/9	14

	School Bus	Unicycle	Tractor	Tank	Motorcycle	Total Participants
4	6/7	6/7	6/10	7/7	1/1	13

This is made even more obvious once we consider the results on an individual level. The one learner who guessed incorrectly for each vehicle (except 'tricycle', 'tank' and 'motorcycle') explains their incorrect guesses when describing how they selected a referent. The person wrote, "I should use [classifiers] to recognize the words but I don't use them very often", explaining the lack of perfect performance by the 402s. While this learner specified a focus on the classifiers while guessing, we cannot know about the other learners. Since every vehicle I tested ended in the morphological cue 车 *che1*, there is no way based on this classifier's results to determine whether more learners were using the classifier or the morphological cue.

In addition to the 402 learners, the other three levels demonstrated this near-perfect performance level as well (even the 202 level learners who demonstrated less exposure to the 辆 *liang4* classifier in my earlier research question).

Table 26 辆 *liang4* Data

	Four Wheeler	Tricycle	Scooter	Wheelbarrow	Baby Carriage	Total Participants
3	6/6	8/8	9/9	8/9	7/8	12
2	7/8	7/9	9/12	8/11	7/11	12
1	13/13	8/9	11/12	11/11	14/14	14

	School Bus	Unicycle	Tractor	Tank	Motorcycle	Total Participants
3	10/10	8/10	6/9	9/10	5/5	12
2	8/10	9/12	2/12	8/9	9/9	12
1	11/11	12/12	10/13	13/13	11/11	14

Generalization 5- The morphological cue is more easily used than the classifier as a linguistic cue

When we study the machine classifier 台 *tai2*, we see almost the same results for the 402s. Similar to 辆 *liang4*, there are two potential reasons for correctly guessing the referent of 台 *tai2* as well. If we look at Table 27, the table which displayed the most popular ways learners selected a classifier in my last research question, we notice that the 402, 302, and 102 level learners all listed 机 *ji1* as a reason.

Table 27 Reasons for guessing

	车 *che1*	机 *ji1*	个 *ge4*
4	4	4	0
3	11	7	2
2	1	1	5
1	8	5	5

A larger percentage of upper-level learners were aware of the 台- 机 *tai2-ji1* connection, but the 102 level learners who listed 机 *ji1* still associated it with machines (though not the machine classifier 台 *tai2*). With this knowledge, some of these learners could also choose the correct machine referent based on the morphological cue 机 *ji1*. Since these learners did not demonstrate knowledge of the machine classifier 台 *tai2* in my earlier question (only one learner of all 102 learners tested listed the classifier 台 *tai2*

as a guess), it is very unlikely that they have knowledge of this classifier usually introduced in more advanced classes. If we consider all of this information we see that, it is possible for the 402, and 302 learners to choose a machine as their guessed referent for two reasons: 1) the machine classifier 台 *tai2* or 2) the morphological cue 机 *ji1*. It is likely that any 102 learners who select a machine in this task do so because of the morphological cue 机 *ji1* that they have demonstrated knowledge of, and not because of the machine classifier 台 *tai2* which they have not demonstrated any previous knowledge of.

When we look at the results for the classifier 台 *tai2*, we see the same trend among 402 learners we found with the other classifiers. Learners at this level are aware of classifiers and morphological cues and their use as a potential resource to guess an unknown word's referent. We again notice the one learner who listed lack of classifier knowledge as the reason for consistently guessing incorrectly. With the exception of 'vacuum cleaner' and 'microscope' (and to a lesser extent 'typewriter') the 402 level learners consistently demonstrated their ability to select the correct referent.

As expected, learners who demonstrated awareness of both clues performed better than learners who were only able to make use of one clue. For instance, seven out of nine 402 learners guessed the word for blender, while only six out of the thirteen 102 learners guessed blender.

Table 28 台 *tai2* Data

	Stereo	**Blender**	**Total Participants**
4	7/9	7/9	13
3	3/9	4/11	12
2	7/12	5/12	12
1	7/13	6/13	14

	Sewing Machine	Printer	Total Participants
4	8/11	8/10	13
3	4/10	4/10	12
2	5/12	7/12	12
1	9/14	9/13	14

While we were unable to determine with 辆 *liang4* which clue learners were using to guess the referent when both the classifier and the morphological cue were present in a task, 台 *tai2* provides us with an opportunity to answer this question. When we look at the results for 'microscope' and 'vacuum cleaner' we find evidence that learners were certainly making heavy use of the morphological cue 机 *ji1* in this task. Although 'microscope' and 'vacuum cleaner' could be considered prototypical machines (both were selected as the most machine-like by the 102 class I tested separately), the majority of learners were unable to select these items as the correct referents.

Table 29 台 *tai2* Poor Results

	Vacuum Cleaner	Microscope
4	5/10	4/10
3	2/11	2/11
2	4/12	4/12
1	5/14	3/14

Since the classifier 台 *tai2* was used, learners should have been able to select the referent based solely on the classifier. However, 'microscope' and 'vacuum cleaner' were unique among the test subjects in that they were unknown by most learners and did not end in the morphological cue 机 *ji1*. As prototypical machines that were paired with the machine classifier 台 *tai2*, the only explanation for this drop in performance is the lack of morphological cue provided with the other machine test objects.

Due to the fact that some of the learners were still able to correctly guess the machine with only the machine classifier, especially the 402s, we can see that these upper-level learners are using the machine classifier to guess the referent. However, since the performance level on these words dropped so significantly, especially among the lower-levels, we can see that lower-level learners are especially making use of morphological cues to select a referents. This observation can be further reinforced since the lower-level learners demonstrated a lack of awareness of the classifier 台 *tai2* in the earlier research question. Based on the data concerning 台 *tai2*, we can see that many upper-level learners are making use of both clues, while most lower-level learners are only making use of the morphological cue. Although every level's performance dropped when selecting a referent for 'microscope' and 'vacuum cleaner', some upper-level learners still selected correctly.

The last piece of evidence for the importance of the morphological cue comes from one word which contains a morphological cue that does not match with its classifier 只 *zhi1*. In the picture the learners saw, there was a picture of a turtle as well as a picture of a fish. The word for turtle is unique in that it contains a morphological cue 鱼 *yu2* which occurs at the end of all words denoting a species of fish. If we look at the 202 level results, more of these learners selected the incorrect 'salmon' than those that selected the correct 'turtle'. More importantly, those that selected 'salmon' indicated recognizing part of the word 鱼 *yu2*.

Just as important are the 302 learners who selected 'salmon'. While the 202 learners may not have been aware that fish do not take the classifier 只 *zhi1*, these learners are aware of this mismatch in classifier and morphological cue. When the

classifier and morphological cue came into conflict, the majority of 402 and 302 learners decided to choose the referent that the classifier pointed to. In other words, while the morphological cue seems to be more easily used by lower-level learners, the upper-level learners chose the classifier clue over the morphological cue when the two clues did not match.

Table 30 Morphological Cue/Classifier Clash

	Turtle	Salmon
4	5/7	1/7
3	7/10	2/10
2	3/12	4/12
1	9/13	1/13

To summarize, I believe that the morphological cue is more easily perceived as a useful way to guess what a noun means than the classifier. Since the morphological cue is actually a part of the word the learner is attempting to identify and it occurs in a particularly salient part of the word (the end), this makes logical sense. On the other hand, the classifier is not a part of the word, is only spoken when the noun occurs in a numeral or demonstrative phrase, and is less semantically transparent. Considering all of these reasons, it is no surprise that the data shows that upper-level learners are the ones making use of classifiers the most, while everyone is using the morphological cues.

3 Summary

In conclusion, we can conclude from the data previously analyzed that learners can and do make use of linguistic cues, both morphological cues and classifiers, as well as situational cues (such as which object in a picture could be considered a vehicle) to guess the meaning of an unknown word. In instances where the learners demonstrated previous knowledge of these linguistic cues, they were then able to demonstrate their ability to further their own acquisition through the utilization of those clues. Although

there are examples in which these clues can sometimes mislead a learner into selecting an incorrect classifier or referent, nonetheless these clues remain helpful in the majority of situations, usually allowing learners to make an informed guess at an unknown word's meaning or referent. Furthermore, we saw how important a role semantic fit has in a learner's choice. The more prototypical the object was, the more likely the learner chose a sortal classifier, whereas the less prototypical, the more likely the learner chose a general classifier. In other words, learners performing this task systematically used any linguistic or situational clues available to them, took semantic fit into account, and only then made their best guess.

There are a large number of questions still available for research in this area. For example, people who moved to China and acquired Mandarin through immersion could be tested for comparisons. Learners who did not explicitly study Mandarin Chinese might demonstrate a unique knowledge of classifiers since they would truly have to determine the characteristic highlighted by each classifier on their own through hearing it in conjunction with different nouns. In others words, they would have to hear enough instances of the classifier with different nouns, and remember those nouns in order to become aware of the characteristic. Without an awareness of what nouns take the classifier, then the classifier as a linguistic cue is meaningless. Additionally, these learners might prove to pick up the morphological cues faster than learners who explicitly study the language since they would have the opportunity to hear more Mandarin, increasing the likelihood that they would become aware of what these cues can signify.

Besides testing people learning Mandarin through immersion, variations of similar tests could pinpoint more specific information. For example, a researcher could

again select a picture with 10 objects in it, but allow two 条 *tiao2* objects in the picture (one prototypical object, one less prototypical object) to test the degree of importance semantic fit plays. Another important question might be whether learners can use the morphological cues when given the same test in writing. Knowing whether learners perform better on the oral or written test might help identify how these learners were being introduced to these morphological cues.

From just the few examples of possible future research questions in this quickly-expanding field, we can see what we stand to learn by more research. Research in second language acquisition in the expanding global world, especially in a language that is becoming increasingly taught in the United States such as Mandarin Chinese, can not only enable teachers to provide a better education to second language learners, but also provide insight into how learners acquire a second language.

By analyzing how learners made semantic guesses when given limited information, we discovered that it is not the level of the learner, or how long the learner studied, that enabled them to guess correctly more often. Instead, we found that previous knowledge was the only necessary requirement to a learner discovering and utilizing these cues to help in future situations. This suggests that by simply pointing out these linguistic clues, teachers could provide learners with the necessary information to more accurately guess the meaning of unknown words, potentially enabling them to operate more successfully in the real world or acquire unknown words on their own.

In addition to the pedagogical implications, the data points to a number of important conclusions for the process of second language acquisition. First we found that learners need not know an unknown word's meaning to guess the correct referent or

classifier. They are indeed able to use previous knowledge to acquire language on their own, even when that previous knowledge involves a grammatical category only found in the new language. In fact, even the very beginning learners who have studied the language for less than 6 months demonstrated this ability to utilize the cues they had already discovered.

Finally, we can conclude that learners are themselves aware of the concept of semantic fit, and are continually measuring new objects to the prototype to determine when to use a classifier. Given semantic fit and a learner's previous knowledge of these, a researcher can predict how a learner will guess in a task such as this. In conclusion, the majority of foreign language learners, once introduced to a cue, are aware of the semantic information encoded in them, and are continually making use of these clues in their everyday use of the language. With this awareness, learners can make the most of their previous knowledge of the language, therefore enabling them to further their own acquisition.

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