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Date:
2018

Citation:
Zhao, H. & MacWhinney, B. (2018). The instructed learning of form-function mappings in the English article system. Modern Language Journal, 102 (1), pp.99-119. https://doi.org/10.1111/modl.12449.

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The Instructed Learning of Form–Function Mappings in the English Article System

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<A>ABSTRACT

This article analyzes the instructed learning of the English article system by second language (L2) learners. The Competition Model (MacWhinney, 1987, 2012) was adopted as the theoretical framework for analyzing the cues to article usage and for designing effective computer-based article instruction. Study 1 found that article cues followed a Zipfian distribution for availability or frequency and that the cues had overall high reliabilities. Study 2 assessed the initial level of cue reliance in a group of intermediate–advanced L2 learners. As expected, the input variables of *cue availability* and *cue reliability* clearly influenced both the accuracy of learners' choices in a cloze test format and the subjects' response times. Study 3 demonstrated that the form–function mappings relevant for native-like article choice can be taught in 2 1-hour sessions using the strategy of *cue focusing*. The type of explicit instruction (analogical, i.e., by giving analogous examples without metalinguistic comments, vs. metalinguistic feedback) had an additional effect on response time, while both instruction types led to a similar increase in accuracy. These findings are novel and are highly relevant to both theory and pedagogy. <END OF ABSTRACT>

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This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/modl.12449.

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Keywords: Competition Model; cue validity; cue focusing; explicit feedback; computer–based instruction; English articles

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Researchers in second language acquisition (SLA) are paying increasing attention to the relationship between the statistics of language input and learning outcomes (e.g., Ellis, 2002, 2006; Ellis & Collins, 2009; Ellis & Ferreira–Junior, 2009; Ellis, O'Donnell, & Römer, 2013; Gries & Wulff, 2005). In their articulation of this new trend, Ellis and Collins (2009) call for more research that generates corpus-based and experimentally validated data examining how the L2 learning of linguistic constructions is affected by frequency, frequency distribution, perceptual saliency, meaning prototypicality, and the reliability of form–function mapping in the input. A series of studies have been published that advance our understanding regarding this issue, most of which are about acquisition (Ellis & Ferreira–Junior, 2009; Ellis & O'Donnell, 2012; Year & Gordon, 2009) and instruction (Ellis & Sagarra, 2010a, 2010b, 2011), centered on the English verb system.

The current study extends this line of research into the grammatical domain of the English article system. It has frequently been noted (e.g., Celce–Murcia & Larsen–Freeman, 1999; Master, 1987, 1997) that English articles (*the*, *a/an*, and zero article represented as '*Ø*') are one of the most difficult grammatical categories in L2 learning, particularly for learners whose first languages (L1s) do not have article systems (e.g., Mandarin, Cantonese, Japanese, Korean, Slavic languages, etc.). What makes the learning of this system particularly difficult is the complex, interlocking nature of the many different cues to article selection. As we will see, the four forms in the system (*the*, *a*, *an*, and *Ø*) are mapped onto scores of functions and usages (Huddleston & Pullum, 2002; MacWhinney, 1984; Quirk et al., 1985). Understanding all these form–function mappings and their complex interrelations places a heavy burden on the language learner.

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Many article form–function mappings are idiosyncratic. For example, buildings sometimes take the definite article, as in *the Monroeville Mall* and sometimes a zero article, as in *Porter Hall*. There are cues to differentiate such uses, but learners often cannot detect these cues, and they are seldom taught explicitly. Idiosyncratic mappings of this type are often low in frequency, leaving learners insufficient opportunities for exposure. On the other hand, some nonidiosyncratic form–function mappings have high frequency but relatively lower reliability. Learners are exposed to many cases of these high frequency mappings, but still cannot acquire their usages due to the lower reliability and fuzzier nature of the cues. The divergent nature of frequency and reliability within the article system makes it particularly interesting from the viewpoint of linguistic and psycholinguistic theory.

Previous literature that adopted a functional approach to L2 article acquisition has focused on the role of the L1 and the stages of interlanguage development. Some studies relied on naturalistic spoken data (e.g., Huebner, 1983; Master, 1987), whereas others adopted spoken or written elicitation tasks (e.g., Butler, 2002; Liu & Gleason, 2002) of which the fill-in-the-article cloze test was a typical example. L1 effects have been found to play an important role in article acquisition. As Master (1987, 1997) summarized, beginning learners whose L1 contains an article system overuse *the* from the onset, and even later they use zero article less than learners whose L1 does not contain articles. For learners whose L1 has no articles, the zero article is initially used as the default. Once these learners realize that zero article is not always appropriate, the definite article becomes the default. Even advanced learners continue to have such problems. Despite the strong need to address article learning difficulty, there is a very limited body of literature on article instruction. Some initial attempts have been proposed (e.g., Master, 1990). Yet pedagogical treatments of article instruction have not articulated an effective method for teaching the article system. Most Chinese and Japanese advanced learners of English continue to produce errors in article usage in both speaking and writing.

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The current study investigates how L2 learners acquire the form–function mappings of the article system and examines how to design instruction to promote effective learning. We adopt the Competition Model (MacWhinney, 1987, 1997, 2012) as the theoretical and methodological framework for measuring the frequency and reliability of the article form–function mappings (Studies 1 and 2) and for designing an instructional intervention to teach these mappings (Study 3). The results we obtain from Study 1 help to generate hypotheses for Studies 2 and 3. The linguistic phenomenon under study has rarely been researched within the Competition Model; the current study is among the first to report research on details of the acquisition process and on explicit instruction of article choice, drawing on previous descriptive linguistic work on the English article system.

<A>BACKGROUND

>B>*Cue Validity Factors*

The basic theoretical construct of the Competition Model (MacWhinney, 2012, in press) is the notion of a form–function mapping. In comprehension, forms compete for mapping onto functions. During this competition, forms serve as *cues* for the activation of functions. For example, in German, the presence of the diminutive suffix *–chen* is a cue for assignment of neuter gender to the noun. In English, agreement in number between a nominal and the main verb can sometimes function as a useful cue to selection of that noun as Subject. In production, cues serve to license the use of specific forms. For example, selection of the article *das* in *das Mädchen* (‘the girl’) in German is cued by the presence of *–chen* on *Mädchen*. Similarly, the use of plural marking on the verb is cued by the presence of plural marking on the Subject in English.

Ellis (2006) has described language acquisition as “contingency learning, that is the gathering of information about the relative frequencies of form–function mappings” (p. 1). This view regards language acquisition as a type of statistical learning, through which learners determine the cues for the

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mapping of forms to functions. The Competition Model breaks this concept down further by distinguishing a series of cue validity factors impacting cue learning. These include: *function frequency, cue availability*, *cue reliability*, *conflict reliability*, *cue cost* (salience, segmentability), and *contrast availability*.

We can illustrate the first four of these six factors in the context of the English article. If we imagine that each day a speaker produces an average of 800 nouns using the definite article to express the function of *uniqueness* (as opposed to other functions such as *prior mention*), then the *function frequency* of uniqueness marking would be 800/day. This number can then be compared with the daily frequency of other linguistic functions, such as *possession, plurality, quantifier scope*, and so on. All things being equal, cues related to a frequent function will be acquired earlier than cues related to infrequent functions. Within these 800 cases of uniqueness marking, we can then look at the *availability* of various cues. For example, one cue to uniqueness could be actual physical uniqueness as in *the sun* or *the White House*. Although this cue would be highly *reliable* (correct for the cases in which it is available), it is relatively low in *availability* for marking of this function. When a cue is low in availability, it means that it is not there when you need it to make a given grammatical assignment. The cue "*lake* → *Ø*", for example, is low in *availability*, because it is seldom the case that the form of the article can be determined by the fact that the noun refers to a lake. However, when this cue is present, it always correctly predicts the use of zero article. Therefore, it is high in *reliability*.

For the English article, the factors of *cue cost* and *contrast availability* are minimally relevant, because the actual forms of the article are easy to identify and there is no problem with contrast availability for the article. On the other hand, the factor of *conflict reliability* is quite important and often challenging for learners. For example, in the default case, noncount nouns use zero article marking. However, noncount nouns can take either definite or indefinite articles, if they are modified by a relative clause or prepositional phrase, as in *the sugar in the bowl* or *the coffee they*

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gave us. In such cases, the cue that supports choice of the definite article dominates over the cueing of zero by noncountability. There is also a third cue that supports choice of the indefinite, as in *a man who came late to dinner*, but this cue is not as high in conflict reliability as the one for the definite, given that we cannot say *a sugar in the bowl*. The English article system is rich in cue competitions of this type, often allowing alternative forms to exist, such as either '*Friction on the pulley caused failure of the flywheel*' or '*The friction on the pulley caused the failure of the flywheel.*' Further cueing from overall discourse patterns can then support the choice of one of these options over the other.

Empirical findings from experimental and corpus studies have supported the relevance of these cue validity factors in L2 acquisition (Collins et al., 2009; Ellis & Ferreira–Junior, 2009; Ellis & Sagarra, 2010a, 2010b, 2011; Wulff et al., 2009). (A bibliography of 143 Competition Model studies in 16 languages testing out the empirical predictions of the model can be found at http://psyling.talkbank.org/CM-bib.pdf.)

Descriptive linguists (Cole, 2000; Huddleston & Pullum, 2002; Quirk et al., 1985) provided functional linguistic analyses of the article system showing that the four article forms participate in approximately 90 different form–function mappings. Some of these functions specify syntactic and semantic properties (e.g., countability, singularity, plurality); some functions include discourse-based properties (e.g., immediate situation, first mention, second mention, partonymy); many functions are idiosyncratic surface features whose usage is highly conventional (e.g., names of rivers, lakes, malls, parks, bridges, theaters); and some functions are primarily idiosyncratic but incorporate some syntactic properties (e.g., names of mountains in singular or plural forms).

Based on this analysis, we can distinguish two categories of cues in the article system: *general* cues and *idiosyncratic* cues. General cues can be expressed by a transparent, general mapping from a general category (e.g., '*noncount* → Ø' as in '*Ø water*'), whereas idiosyncratic cues (e.g.,

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'*river* → *the*', '*lake* → *Ø*') are based on smaller lexical fields and their usages can best be explained by aspects of phrasal structure and historical conventions. There are also some idiomatic usages of articles such as '*by Ø hand*' and '*in Ø person*' that do not belong to the two categories and are beyond the scope of the current study. An important goal of the current study is to examine the properties of general and idiosyncratic cues and how these properties affect L2 acquisition.

The basic theoretical claim of the Competition Model is that *cue strength* is a function of *cue validity*. Cue strength is measured through experiments placing cues into competition. Cue validity is measured through corpus studies, which can calculate cue reliability, cue availability, and conflict reliability. During the acquisitional process, availability is the major determinant at first. Subsequently, reliability and finally conflict reliability take over as the determinants in later stages of acquisition (McDonald & MacWhinney, 1991).

The bulk of research in the Competition Model has examined the learning and use of cues for assignment of the case role of Actor or Agent. Studies of this type of decision can use an orthogonalized experimental design to set contrasting cues into competition, thereby measuring their relative cue strength. However, for article usage, it is usually impossible to create sentences with multiple orthogonalized cues pointing in opposite directions. For example, it would be strange to create a sentence in which the word *lake* becomes uncountable. This means that, to explore the role of availability, reliability, and other cue-based measures on acquisition of the article system, we must rely on other methods. In the studies presented here, we will rely instead on data from corpus studies to determine the availability and reliability of cues to article selection in English (McDonald & MacWhinney, 1989). We will then use these findings as a guide to account for patterns of L2 acquisition.

<B>Cue Competition in Language Acquisition and Instruction

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The Competition Model (Bates & MacWhinney, 1989; MacWhinney, 2012) views language processing as a competition between alternate form–function mappings on the levels of lexicon, syntax, phonology, and meaning. When the learner is faced with competition between two forms, he must either set up a way of blocking one of the forms or try to find a use for it. For example, when learners first hear the definite article *the* used with river names such as *the Colorado River*, they initially associate river names with the definite article. Learners will also hear the definite article used with names of other geographical features such as *the Pacific Ocean*, *the Mediterranean Sea*, *the Sahara Desert*, *the Tibetan Plateau*, and so forth. Based on these various encounters, the learner may begin to associate the use of the definite article with geographical features. However, when exposed to geographical features that take zero article, such as *Ø Lake Michigan*, *Ø Mount Whitney*, and *Ø Long Island*, the learner will note that both *the* and *Ø* are being used with the names of geographical features. Competition Model studies have shown that this conflict leads initially to a period of free variation. During this period, the learner is receptive to any data that can distinguish the two forms. Eventually, the learner will learn that, when the name of the geographical feature comes first, as in *Lake Michigan,* the definite article is dropped. At that point, this highly reliable, but less fully available positional cue will determine the choice in cases when it applies and the more general cue will apply to the other cases in this domain. However, there are still other cases of zero article for geographical features to which the positional cue does not apply, such as *Apple Valley* or *Borrego Canyon*. Understanding why we have *Apple Valley*, but *the Shenandoah Valley* will require understanding of the fact that the latter construction is based on the name of the river flowing through the valley. Finally, learners will need to acquire exceptional and archaic forms such as *the River Thames* or forms such as *the Slough of Despond* in which use of the definite article is licensed by the postposed modification of the geographical feature. The process of cue acquisition for the article can often involve such repeated parcellations of a cue domain.

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Competition can also be influenced by feedback and other instructional methods. MacWhinney (1991) notes that, when a child uses the wrong word to refer to an object, the parent may still be able to pick out the correct referent. In that case, the parent will name the referent with the correct word. This feedback strengthens the link of the word to the correct reference, thereby increasing its strength in competition with the incorrect word.

In more formal instruction, providing overt contrasts between competing form–function mappings can promote *cue focusing* (Presson, MacWhinney, & Tokowicz, 2014), which is also often called visual input enhancement or VIE (Tomlin & Villa, 1994; Wong, 2005). Focusing directs learner attention to the relevant features of the input and enhances learner awareness of the accurate distinctions between cues. Cue focusing can take different forms in instruction, such as presenting cues in contrast or providing the alternative form as feedback. For example, if learners are presented with minimal pairs of contrasting cues such as "*noncountable → Ø*" and "*noncountable with post-modifiers → the*" in sentences (a) and (b), their attention will be oriented to the features in the input that differentiate the two cues. In the sentence examples, the noncountable noun "*wealth*" is identified by material that follows it, that is, by the phrase "*of her parents.*" Learners will not acquire the cue unless they understand that the additional following information serves to more precisely identify the noncountable noun. Contrasting cue presentation facilitates this process of cue focusing. We can think of cue focusing as an instantiation of the general role of noticing (Mackey, 2006; Robinson, 1995; Schmidt, 1990) in second language acquisition.

a) *Alice is interested in Ø wealth.* [*Ø – noncountable*]

b) *Alice is interested in the wealth of her parents*. [*the – noncountable with post-modifiers*]

<B>Studies of the Competition Model and L2 Instruction

So far, only a few studies have applied the Competition Model to instructed L2 learning.

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However, these studies (Presson, Davy, & MacWhinney, 2013; Presson et al., 2014; Presson, Sagarra et al., 2013; Zhang, 2009; Zhao, Wong, & MacWhinney, under review) have all used cue focusing as the mechanism that supports cue learning. For example, Zhang (2009) taught the Chinese Pinyin system in the form of an online dictation task. Learners heard the sound of a Chinese word recorded on the computer and were asked to enter the correct phonetic form (with letters and tone) for the target sound. Cue focusing was manipulated in terms of explicit immediate feedback that contrasted the target sound with the sound for the phonetic form entered by the learner.

Presson, MacWhinney, and Tokowicz (2014) studied the learning of French gender cues also in an online tutorial system. Their training presented cues in a simple, declarative form (i.e., *–ance* indicates feminine). Cue focusing was operationalized through explicit feedback with two types of variations: correctness feedback (correct or incorrect) and metalinguistic feedback with richer explanations. When the learner made a wrong choice, correctness feedback provided learners with the correct target form that contrasted with the incorrect form picked by the learner. When the learner was correct, correctness feedback provided confirmation that strengthened the positive learning of the cue. Metalinguistic feedback was found to be more effective than correctness feedback. Presson, Sagarra, et al., (2013) applied a similar computer-based instructional paradigm to Spanish verb conjugations but compared metalinguistic feedback with analogical feedback. Analogical feedback was a type of explicit feedback that provided high-frequency exemplars of a cue to boost category learning (Ellis, 2012) and analogy learning (Goldberg, 2006; Herron & Tomasello, 1992). Their study found no difference between metalinguistic and analogical feedback.

Zhao et al. (under review) trained English prepositions in an online sentence–picture matching task. Cue focusing was manipulated by contrasting the presentation of a target preposition (e.g., *at*) with a distractor preposition (e.g., *to*), in a sentence frame such as *John shouts __ Mary*. Learners relied on schematic pictures to determine the selection of the correct preposition. Explicit

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feedback was provided as correctness feedback, metalinguistic feedback, and schema feedback (designed based on the cognitive linguistics concept of schematic diagrams). This study did not find a difference between correctness feedback and metalinguistic feedback. However, schema feedback outperformed the other two types of feedback.

<A>RESEARCH QUESTIONS

The current study uses the Competition Model to account for the learning of form–function mappings in the English article system. This is the first study that has examined cue-based instruction for this system. We use the text count methods of McDonald & MacWhinney (1989) to compute the availability and reliability of general and idiosyncratic article cues. Study 1 reports the methodology and results of the text count. Study 2 examines the extent to which learners use these cues accurately at pretest. Study 3 reports the results of an L2 article instructional intervention that relies on cue focusing with contrasting cue presentation and either metalinguistic or analogical feedback. The following questions are addressed in these studies: RQ1. What are the availability and reliability of the various article cues in naturally occurring English sentences?

RQ2. Are there differences between general cues and idiosyncratic cues in terms of cue availability and reliability? How do their cue properties affect instructed L2 learning?

RQ3. What is the level of correct usage of these cues in a population of intermediate–advanced Chinese learners of English?

RQ4. Does cue focusing promote effective learning of English articles among L2 learners?

RQ5. Do metalinguistic feedback and analogical feedback promote equally effective learning of article cues?

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<A>STUDY 1: AVAILABILITY AND RELIABILITY OF ARTICLE CUES

<B>Methodology

To evaluate cue availability and reliability, we constructed a mini-corpus of written English, comprised of 38 texts covering 10 common genres of English written texts (academic, encyclopedia, magazine, newspaper, novel, drama, children's story, etc.). The total word count of the corpus was 26,468. All texts were selected from well-known publications to ensure that they represented native speaker written English. The references for all the source texts are listed in Appendix A. Topics included politics, economy and finance, education, history, geography, technology, entertainment, sports, travel, food, and so forth. A total of 3,718 noun phrases were extracted from the corpus. Demonstratives, possessives, and quantifiers were excluded from analysis.

Our coding scheme was composed of 86 article cues. The cues were initially extracted from three well recognized English grammar books (Celce–Murcia & Larsen–Freeman, 1999; Huddleston & Pullum, 2002; Quirk et al., 1985) and an English as a second language (ESL) textbook that focused on articles (Cole, 2000). The grouping or segmentation of article cues largely aligned with the entries of article usages in these sources. Then the authors of the current study spent 3 months on a validation procedure which involved several rounds of applying the coding scheme on randomly sampled texts and revising the coding scheme and reapplying it to newly sampled texts. The time was spent largely on refining descriptions for the article cues, so that coders could code smoothly. At the end, the authors agreed that the coding scheme was reliable and comprehensive enough to cover all the common article usages in English written texts (excluding usages specific to special genres such as poems or legal documents).

The first author and a trained research assistant coded the 3,718 noun phrases with the validated coding scheme (coding reliability > .90). Every noun phrase was assigned one code of an

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article cue. For example, the sentence "*The quality*$_1$ *of a mother's*$_2$ *relationship*$_3$ *with her toddler could affect that child's weight*$_4$ *in adolescence*$_5$" contained five noun phrases that involve article use. The five nouns were assigned the following codes respectively: (1) *The quality*: "*singular countable with post-modifiers → the,*" (2) *a mother*: "*singular countable → a/an,*" (3 & 4) *relationship* and *weight*: "*possessive → Ø,*" and (5) *adolescence*: "*noncountable → Ø.*"

We also tagged noun phrases that contained usages that violated cue descriptions. For example, the head noun in the phrase "*Ø supporters of President Obama*" violated our description for the cue "*plural with post-modifiers → the*" (Use the definite article when plural nouns are followed by a post-modifier). In such a case, the cue would get a positive mark for availability but a negative mark for reliability. We also coded noun phrases containing usages that were not included in the coding scheme. 4.2% of the tokens in our text counts could not be assigned to a cue in the coding scheme and hence were not included in the availability and reliability analyses.

For availability, we followed Ellis, O'Donnell, & Römer (2013) and used token frequency instead of type frequency to calculate cue frequency in the input. Availability was calculated as the token frequency of a cue divided by the total number of noun phrases (N = 3,718). This assumes that every noun phrase must receive one of the four forms of article marking. Reliability was calculated as the token frequency of correct applications of a cue divided by the total number of occurrences of the cue.

We coded general cues and idiosyncratic cues based on the operational definitions previously discussed: General cues apply across a wide variety of nouns and phrases; idiosyncratic cues apply to a more limited set of nouns, and their usages can best be viewed as deriving from historical and community conventions. For example, cues such as "*noncountable → Ø*" (use zero article when noncountable nouns are used alone)", and "*second mention → the*" (use *the* when the noun has been

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mentioned explicitly) were coded as general cues. Cues such as "*river* → *the,*" "*lake* → *Ø,*" and "*disease* → *Ø*" were coded as idiosyncratic cues.

<B>*Results*

<C>*Availabilities in the Text Count*. Figure 1 plots the frequency distributions of all the 86 cues in the text count as log cue frequency against log cue rank. Because this log–log plot shows a linear trend, the frequency distribution in Figure 1 can be described by Zipf's law (Zipf, 1935): The frequency is inversely proportional to its rank in the frequency table; that is, the most frequent article cues account for the majority of occurrences of any given article usage. This result extends the finding that Zipf's law applies to verb argument constructions (Ellis & Ferreira–Junior, 2009; Goldberg, Casenhiser, & Sethuraman, 2004) to the domain of article usage. Table 1 presents the ten article cues with the highest availabilities. Cues are listed in descending order of availability. These ten cues accounted for 76.3% of all the coded tokens. Among them, the top four most frequent cues added up to account for 50.8% of all the tokens.

<C>*Reliabilities in the Text Count*. Figure 2 plots the reliability distributions of the 86 cues in the text count as log cue reliability against log reliability rank. Unlike Figure 1, this distribution is clearly nonZipfian. The full value of reliability is 1.00; that is, whenever a cue applies, it does so correctly. The 86 cues had a mean reliability of 0.93 (*SD* = 0.12). It means that article cues are all highly reliable with only a few exceptions. The two cues with the lowest reliabilities are in fact very frequent cues listed in Table 1: "*plural with post-modifiers* → *the*" [reliability = 0.392] and "*singular countable with post-modifiers* → *the*" [reliability = 0.435]. We found that, when plurals or singular countable nouns are followed by a post-modifier, such as a prepositional phrase or a *that*–clause, they did not use the definite article. Thus, the presence of a post-modifier is not reliably associated with use of the definite article. The Competition Model predicts that such unreliability should cause difficulty in language acquisition.

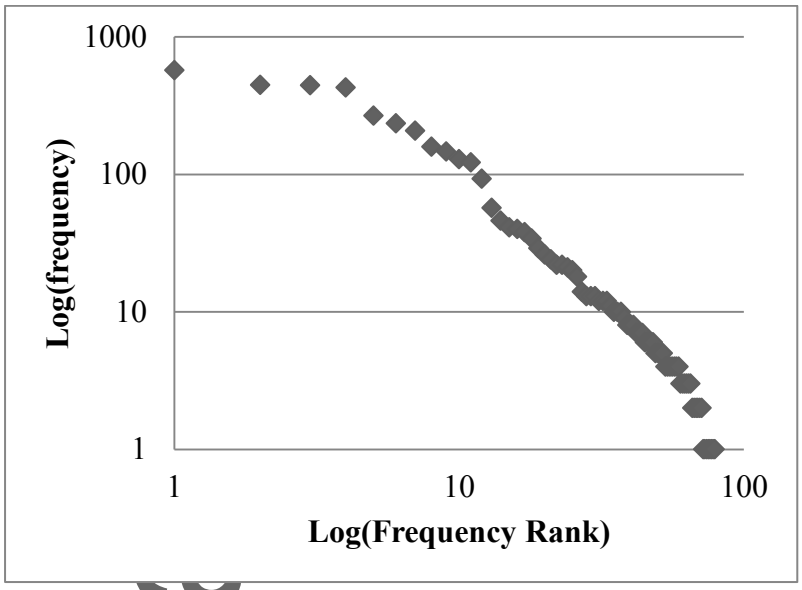
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<INSERT FIGURE 1 ABOUT HERE>

FIGURE 1

Frequency Distributions of 86 Article Cues



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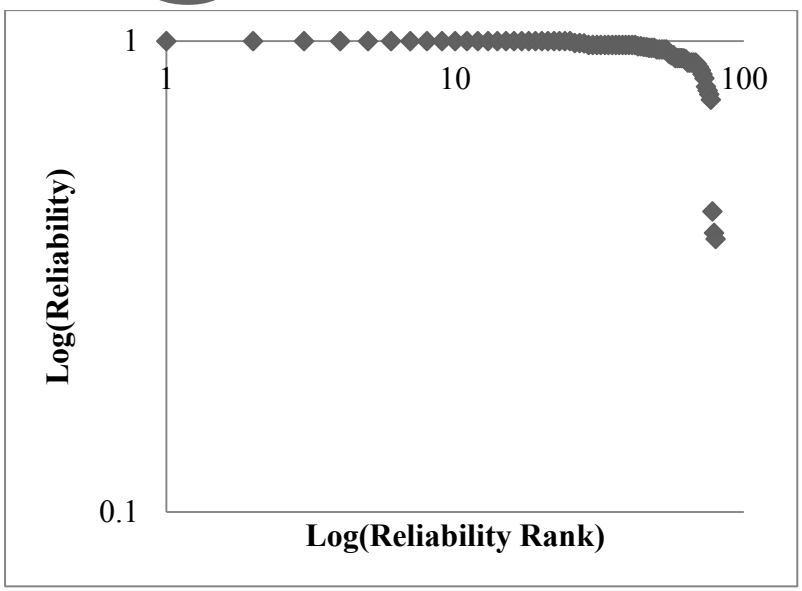
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<INSERT FIGURE 2 ABOUT HERE>

FIGURE 2

Reliability Distributions of 86 Article Cues



<INSERT TABLE 1 ABOUT HERE>

TABLE 1

Properties of the Ten Article Cues With the Highest Availability

Article Cue	Example	Availability	Reliability

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1	*plural → Ø*	*Ø books*	0.154	1.000
2	*non–countable → Ø*	*Ø water*	0.120	1.000
3	*singular countable with post-modifiers → the*	*the man she is dating*	0.119	0.435
4	*singular countable → a/an*	*a Shakespearean drama*	0.115	0.988
5	*plural with post-modifiers → the*	*the letters I received today*	0.063	0.392
6	*part of → the*	*I'm returning this coat for a refund. The zipper broke.*	0.056	1.000
7	*second mention with variation → the*	*I saw a peacock at the zoo. The bird was beautiful.*	0.043	1.000
8	*second mention → the*	*I saw a peacock. The peacock was beautiful.*	0.035	1.000
9	*names of countries, cities or states → Ø*	*Ø Hong Kong*	0.033	0.892
10	*noncountable with post-modifiers → the*	*the wealth of her parents*	0.025	0.785

<C>General Cues Versus Idiosyncratic Cues. Figure 3 presents the availability and reliability distributions for general cues and idiosyncratic cues. We observed a sharp contrast between their

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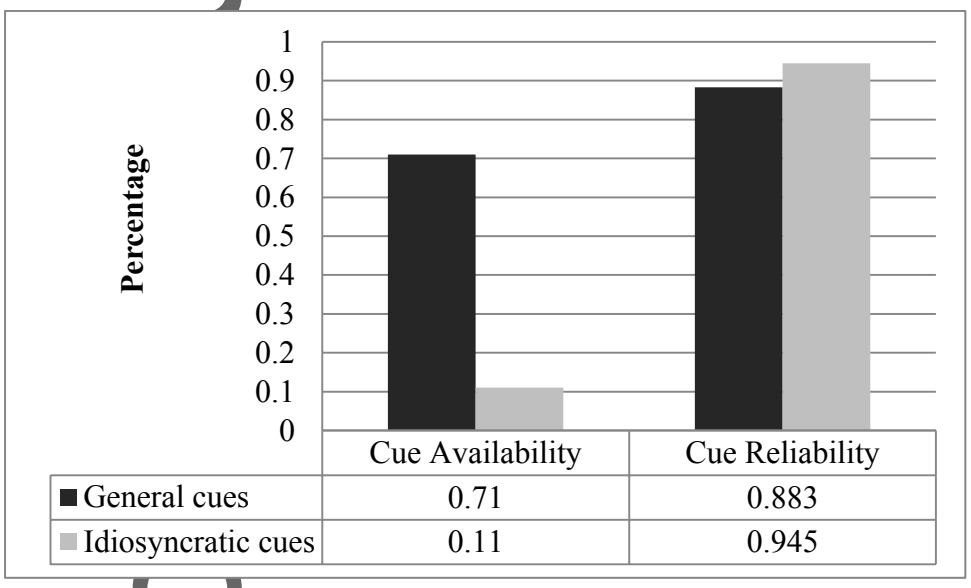
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availabilities: General cues accounted for 71% of tokens in the text count, whereas idiosyncratic cues only accounted for 11%. The rest of the tokens were largely idiomatic usages (e.g., *by Ø hand*, *in Ø person*). With regard to *reliability*, however, we did not observe a significant difference between general cues (M = 0.883, SD = 0.228) and idiosyncratic cues (M = 0.945, SD = 0.094). Both types had relatively high reliabilities.

<INSERT FIGURE 3 ABOUT HERE>

FIGURE 3

Availability and Reliability Distributions of General and Idiosyncratic Cues



Summarizing the results of Study 1, our text counts indicate that the frequency distribution of article cues is Zipfian. Overall, article cues have high reliabilities with only a few exceptions. General cues are much more available than idiosyncratic cues. Therefore, the Competition Model expects that they would be the ones that are first learned. Learners have more opportunities of being exposed to the usage of general cues in the input and of practicing their usage in the written output and hence

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more chances of receiving feedback. On the other hand, learners have limited experience with idiosyncratic cues in the input, written output, and corrective feedback. Therefore, we predict that their acquisition will be delayed. Once learners become aware of these less available cues, their subsequent learning will be based largely on their relative reliability.

<A>STUDY 2: INITIAL ACCURACY OF ARTICLE USAGE

<B>Methodology

<C>Procedure for Studies 2 and 3. These studies were administered online during two sessions of data collection in a computer lab: Session I included a pretest (25 minutes) and the first training session (45 minutes), and Session II included the second training session (45 minutes) and an immediate posttest (25 minutes). There was an interval of 2 days between the two sessions. The study was programmed in JavaScript by a professional research programmer.

Participants first went through a login procedure as instructed. They registered for a username and filled out an online background questionnaire right before they took the pretest. The questionnaire collected information about the participants' L1 background, L2 learning experiences, and other demographic information. Then, the first author described the procedure of the study to them and provided them the URLs (http://sla.talkbank.org/english/demo) they needed to access the sessions. There were clear instructions on the computer to guide participants through training and testing. They were reminded not to stop in the middle of a session due to the need to record response time during training and testing. The first author and the students' English instructor were present at the computer lab to monitor data collection. Data was automatically saved to our server in the form of computer logs.

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<C>*Participants.* The participants in Studies 2 and 3 were 64 Chinese intermediate–advanced learners (22 males, 42 females) at a university in Beijing specializing in foreign language education and research. All participants were 1st-year and 2nd-year English majors. Their average age was 19.5 (range between 19 to 20 years old). Their first language was Mandarin Chinese, and they were learning English as a foreign language. Their average years spent learning English was 9 years (range between 7 to 11 years). Three students (4.6% of the total) had a short-term study abroad experience (in Great Britain and in the United States) for no longer than 8 months. None had participated in any related research. We administered the Michigan Test of English Language Proficiency (MTELP). Their average score was 83.5/100 (*SD* = 10.2/100), which placed most of them between the "very good" (upper intermediate) and "high command" (advanced) categories.

<C>*Pretest Format.* The format of the pretest was an offline computer-based cloze test that measured participants' article usage in sentential contexts, for example, "*We've finished ___food in the fridge*". Participants used a drop-down menu to choose one from three options: *the*, *a/an*, and *Ø*. Four items were placed on one test screen to avoid placing too many items on each screen. The computer program randomly selected four items from the test pool for each screen. Participants could decide which item to do first on a test screen. Our computer logs documented the accuracy and response time of the participant's first choice for any test item. Participants were not allowed to move to the next screen unless they had made all four choices on a screen. At the end of the test, they were informed of their average accuracy scores.

We selected 23 cues from the article cue list in Study 1. The selection criteria are described under "Design and Materials" in Study 3. To create the test and training stimuli, we started by compiling a pool of 700 sentences. The sentences were selected from the coded texts in Study 1, the Corpus of Contemporary American English (COCA) (Davies, 2008), and the Article Book (Cole, 2000), and were modified to include lexical items that matched the learners' proficiency level. We

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also composed sentences to serve as members of contrasting pairs. The sentences were selected or composed based on a criterion that each sentence should provide an adequate obligatory context for the use of the target article without additional referential or contextual information. The goal was to avoid any misinterpretation of article usage due to influences from the larger discourse. For example, in the sentence "Yes, ____ *bread is on the table,*" it is possible to imagine a larger discourse in which this sentence is a response to a previous question "*Do we have bread?*" In our current study, we avoided selecting sentences that could lead to such interpretations by choosing sentences that provided obligatory contexts for the use of the articles. The participants were also explicitly told that all the test and training sentences stood alone without other referential contexts. They were asked not to assume a prior or later discourse for each sentence. Two English native speaker research assistants validated the sentences and the obligatory contexts for article choices.

The sentences ranged from 9 to 12 words and had an average word count of 10.4 words. 368 sentences were selected from this pool and randomly distributed to the pretest and the posttest. The distribution ensured that each cue would be tested on 8 sentences at the pretest and 8 at the posttest: 23 cues × 8 sentences per cue × 2 tests = 368 sentences. There were no repeating items at the two tests. The remaining sentences in the pool that were not selected for tests were used for training. Training items did not overlap with test items. As in previous studies on the Competition Model and L2 instruction (Presson et al., 2014; Presson, Sagarra, et al., 2013; Zhao et al., under review), the dependent variables for the cloze test were accuracy of performance and response time. There was only one correct response for each item. If the learner chose that response, we judged the response to be accurate. Only the response time of correct responses was analyzed (Jiang, 2013).

<*C*>*Data Analysis.*The log data collected from the pretest was subjected to a data trimming procedure. This step allowed us to remove the data of participants whose average response time was 3

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standard deviations above or below the mean. We did not identify any outlier participants from this step. All the 64 participants remained in the final pool.

The mean accuracy and response time of general and idiosyncratic cues were calculated by taking the mean of the sub-cues. Within general and idiosyncratic cues, we separated definite article cues from indefinite and zero article cues. Due to the small number of *a/an* cues, we grouped the indefinite article cues with zero article cues. Gain accuracy scores in Study 3 were calculated by subtracting mean accuracy at the pretest from mean accuracy at the posttest for each participant. The same algorithm applied to the calculation of gain response time scores.

The data were analyzed using SPSS (version 21.0, IBM Corp.). The specific inferential statistics tests are described in the following Results sections. The alpha value was set at .05 for all tests. The distribution of scores in our data met the assumptions of analyses of variance (ANOVAs). In reporting our results, we included effect sizes (partial eta-squared $\eta^2 p$ and Cohen's *d*) and followed the guidelines suggested by Oswald and Plonsky (2010) for interpreting Cohen's *d* in SLA research: *d* = .40 is a small effect size, *d* = .70 is a medium effect size, and *d* = 1.00 is a large effect size. The cloze test reliability was verified by means of the internal consistency of responses to the items that made up the test. The Cronbach alpha coefficient was .781, which was computed on the basis of pretest accuracy.

<B>Results for Study 2

<C>General Cues Versus Idiosyncratic Cues. Our text count in Study 1 indicated that general cues have higher overall validity than idiosyncratic cues, mainly because of their higher availability. Based on the Competition Model, we predict that general cues are better acquired than idiosyncratic cues. Our analysis of accuracy and response time at the pretest confirmed this prediction.

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Table 2 presents the descriptive statistics of pretest mean accuracy and response time (in seconds) of general and idiosyncratic cues and the sub-types (general–*the*, general–*Ø/a/an*, idiosyncratic–*the*, idiosyncratic–*Ø*). A two-way repeated measures ANOVA indicated main effects for type (general vs. idiosyncratic) [$F(1, 63) = 507.05$, $p < .001$, $\eta^2p = .889$] and form (*the* vs. *a/an/Ø*) [$F(1, 63) = 33.88$, $p < .001$, $\eta^2p = .350$], and no interaction between type and form [$F(1, 63) = 2.364$, $p = .129$, $\eta^2p = .036$]. General cues had significantly higher accuracy than idiosyncratic cues; *the* cues had significantly higher accuracy than *a/an/Ø* cues. Paired samples *t*–tests further indicated that within each type, the accuracy differences between forms were also significant: general–*the* cues had a significantly higher accuracy than general–*Ø/a/an* cues ($t = 11.180$, $p < .001$, $d = 1.4$); idiosyncratic–*the* cues had a significantly higher accuracy than idiosyncratic–*0* cues ($t = 2.504$, $p = .015$, $d = .31$).

<INSERT TABLE 2 ABOUT HERE>

TABLE 2

Pretest Accuracy and Response Time of General and Idiosyncratic Cues

		Pretest Accuracy	*SD*	Pretest Response Time	*SD*
General cues		.811	.081	5.881	.783
	General–*the*	.906	.063	6.021	.894
	General–*Ø/a/an*	.717	.136	5.742	.886

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Idiosyncratic cues		.573	.078	6.406	1.041
	Idiosyncratic–*the*	.637	.206	6.119	1.302
	Idiosyncratic–*Ø*	.519	.199	6.652	1.275

A two-way repeated measures ANOVA on response time at the pretest showed a main effect for type (general vs. idiosyncratic) [$F(1,63) = 22.87$, $p < .001$, $\eta^2 p = .266$] and an interaction between type and form [$F(1,63) = 14.67$, $p < .001$, $\eta^2 p = .189$]. Participants spent significantly less time processing general cues than idiosyncratic cues. But they did not spend less time processing *the* cues than *Ø/a/an* cues. Paired samples *t*–tests indicated that idiosyncratic–*the* cues had significantly shorter response time than idiosyncratic–*Ø* cues ($t = -2.807$, $p = .007$, $d = .35$). But general–*the* cues had significantly longer response time than general–*Ø/a/an* cues ($t = 2.637$, $p = .011$, $d = .33$). This finding was unexpected, since general–*the* cues had significantly higher accuracy than general–*Ø/a/an* cues. All the other results showed the trend of association between higher accuracy and shorter response time except for this instance.

<*C*> *Cue Validity and Pretest Accuracy.* We also wanted to examine the extent to which availability and reliability could determine accuracy in the use of individual cues. For this analysis, we looked at data from 20 cues that are involved in 10 contrasting pairs we used in Study 3. In these cue pairs, one cue points to one form of the article and the other points to another form. Table 3 presents the results for these 10 cue pairs.

<INSERT TABLE 3 ABOUT HERE>

TABLE 3

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Contrasting Pairs (Availabilities, Reliabilities, Pretest Accuracies, Effect Sizes)

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	Contrasting Pair	Availability	Reliability	Accuracy	*t*-Test *p*-Value	Effect Size *d*
1	*non–countable → Ø*	.120	1.000	.735	*p* = .002	.413
	non–countable with post-modifiers → the	.025	.785	.840		
2	*plural → Ø*	.154	1.000	.631	*p < .001*	1.17
	plural with post-modifiers → the	.063	.392	.910		
3	*singular countable with post-modifiers → the*	.119	.435	.901	*p < .001*	.91
	singular countable → a/an	.115	.988	.694		
4	*the architecture of XX → the XX's architecture → Ø*	.001	1.000	.582	*p = .988*	.002
		.001	1.000	.581		
5	*political/military institution → the political/military institution as adjective → Ø*	.005	.980	.691	*p < .001*	.52
		.001	1.000	.474		
6	*XX University/College → Ø*	.002	.980	.664	*p = .500*	.09

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	the University/College of XX → the	.001	.960	.620		
7	*XX Street/Road/Avenue → Ø*	.006	.971	.492	$p < .001$	.60
	the Street/Road/Avenue of XX → the	.001	.975	.764		
8	*'go to' habitual location → Ø*	.007	1.000	.693	$p < .001$	.60
	'go to' recreation activity → a/an	.0003	1.000	.833		
9	*geographical feature names → the*	.051	.943	.608	$p = .022$	.29
	exceptions of geographical feature names → Ø	.004	.852	.453		
10	*construction names → the*	.021	.924	.553	$p = .029$	.28
	exceptions of construction names → Ø	.015	.881	.398		

The results showed that, except for Pair 4 and Pair 6, there were significant accuracy differences between contrasting cues. In seven of these pairs, participants were more accurate with the cue that favored choice of the definite article *the*. This reflects an overall bias in this group toward the use of the definite article as the default form. The only other pair with a significant difference between the two cues was pair 8. However, that contrast pair did not include the definite article. These results indicate that learners treat the definite article as the default marking and that they acquire the use of cues associated with the definite article more readily than those associated with the zero article and indefinite article.

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<A>STUDY 3: CUE TRAINING

Based on the analysis of Study 1, we designed an online tutorial to improve the accuracy of article marking in this learner group. The participants were the same 64 advanced learners described for Study 2. The posttest had the same format as the pretest described for Study 2, although the specific items were different. In accord with a reviewer's request, we also collected control data from 10 participants with approximately the same demographics as the experimental groups. The purpose of the control study was to examine whether any learning improvements that the experimental groups would make were due to treatment effects rather than due to practice on the test. While the experimental groups received article training, the control group received a comparable amount of time of computer-based English preposition training (Zhao et al., under review) and took the same pretest and posttest as the experimental groups.

<B>Methodology

<C>Design and Materials. The design of Study 3 involved the construction of a set of 13 contrasting pairs (Appendix B) containing 23 individual cues. Each of the 13 contrasting pairs was trained using 25 pairs of training sentences. The 325 (25 × 13) sentence pairs were randomly presented to all participants once.

Cues were selected to represent contrasting levels of availability, reliability, and generality. The contrasts were designed to represent a "minimal" difference in structure and function. For example, "*noncountable* → *Ø*" and "*noncountable with post-modifiers* → *the*" were grouped into a contrasting pair since they differ in forms (*Ø* vs. *the*) while sharing the semantic/syntactic feature of noncountability. The manipulation of the last three contrasting pairs in Appendix B was slightly different from the rest of the pairs. Because we could not identify a cue directly in contrast with the three cues of "*second mention with variation* → *the,*" "*part of* → *the,*" and "*disease names* → *Ø,*" we

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used the cue "*singular countable → a/an*" to create sentences that have the same target noun phrases but different article forms.

Article training was provided in the format of a computer-based sentence-level cloze task. Each computer screen presented a contrasting pair of training sentences with two target articles to be filled, for example, "*Alice is interested in ___ wealth.*" and "*Alice is interested in ___ wealth of her parents*". Participants used a drop-down menu to make article choices out of three options: *the*, *a/an*, and *Ø*. Because we did not aim at investigating the distinction between the two forms of the indefinite article, we merged the two in our tabulation of the cloze choices. Participants could decide which sentence to do first on a screen. They were given feedback immediately after they made a choice. Feedback was shown on the same training page and was given regardless of correct or incorrect choices. Participants could control how long they spent in reading feedback. They were only allowed to move to the next screen when they had made both choices correctly. The participants could keep track of their own accuracy at the bottom of the computer screen during training (not during the pretest or posttest).

Cue focusing was operationalized through two instructional mechanisms: contrasting cue presentation and explicit feedback. As in previous instructional studies using the Competition Model (Presson et al., 2014; Presson, Sagarra, et al., 2013; Zhao et al., under review), the manipulation of cue presentation was held constant among conditions, whereas the type of explicit feedback was treated as an independent variable. The current study examined the potential difference between metalinguistic and analogical feedback.

The metalinguistic feedback group received feedback in the form of a cue statement followed by a metalinguistic description, for example, "*noncountable → Ø*" [Use the zero article when noncountable nouns are used alone with no post-modifiers]. The analogical feedback was in the form of exemplar sentences (e.g., *I love to eat <u>Ø bread</u>*) or exemplar noun phrases (e.g., *<u>the</u> Congo River*,

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the River Thames). The same feedback, either metalinguistic or analogical, was given to all training items of the same cue. The participants were randomly assigned to either feedback group: metalinguistic feedback condition (n = 33) and analogical feedback condition (n = 31). Participants in the two conditions spent a comparable amount of time on task during training: The metalinguistic feedback group spent an average of 12.22 seconds on a training screen, whereas the analogical feedback group spent an average of 12.24 seconds on a screen.

<B>*Results for Study 3*

<C>*Instructional Effectiveness.* A comparison of accuracy and response time between the pretest and the posttest showed that cue focusing produced effective instructional effects among the experimental groups: The mean accuracy of all the 23 cues increased from .677 at the pretest to .879 at the posttest; the mean response time of all cues dropped from 6.178 seconds at the pretest to 4.277 seconds at the posttest. Paired samples t–tests indicated that this was a significant accuracy increase (t = 26.668, $p < .001$, d = 3.31) and a significant decrease of response time (t = 16.841, $p < .001$, d = 2.10).

The control group started at the mean accuracy rate of .628 and the mean response time of 8.30 seconds at the pretest. One-way ANOVAs showed that the control group's pretest performance was not different from the experimental groups in terms of mean accuracy [$F(2,71) = 2.175$, $p = .121$, $\eta^2p = 0.058$], but different on the basis of response time [$F(2,71) = 31.227$, $p < .0001$, $\eta^2p = 0.468$]. At the posttest, the control group showed a mean accuracy of .687 and a mean response time of 7.285 seconds. They had significantly lower accuracy [$F(2,71) = 39.766$, $p < .0001$, $\eta^2p = 0.528$] and longer response time [$F(2,71) = 77.881$, $p < .0001$, $\eta^2p = 0.687$] than the experimental groups. Due to the fact that the control group was already slower than the experimental groups at the pretest, we ran a separate ANOVA on the basis of reduced response time from pretest to posttest and found that the

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amount of reduced response time of the control group was significantly less than that of the experimental groups [$F(2,71) = 4.834$, $p = .011$, $\eta^2p = 0.120$]. These findings indicated that the learning gains we observed from the experimental groups could not be due to practice on the test.

We now present the results from the experimental groups. Figure 4 presents the bar graphs (with standard errors) of pretest and posttest accuracies of the four categories of article cues. Paired samples *t*–tests indicated that the accuracy increases for the four categories were all significant: general–*the* ($t = 10.154$, $p < .001$, $d = 1.27$), general–*Ø/a/an* ($t = 11.583$, $p < .001$, $d = 1.45$), idiosyncratic–*the* ($t = 7.780$, $p < .001$, $d = .97$), and idiosyncratic–*Ø* ($t = 12.935$, $p < .001$, $d = 1.62$). Similarly, the response time decreases of the four categories were also significant: general–*the* ($t = 15.661$, $p < .001$, $d = 1.96$), general–*Ø/a/an* ($t = 11.877$, $p < .001$, $d = 1.48$), idiosyncratic–*the* ($t = 11.274$, $p < .001$, $d = 1.41$), and idiosyncratic–*Ø* ($t = 12.706$, $p < .001$, $d = 1.59$).

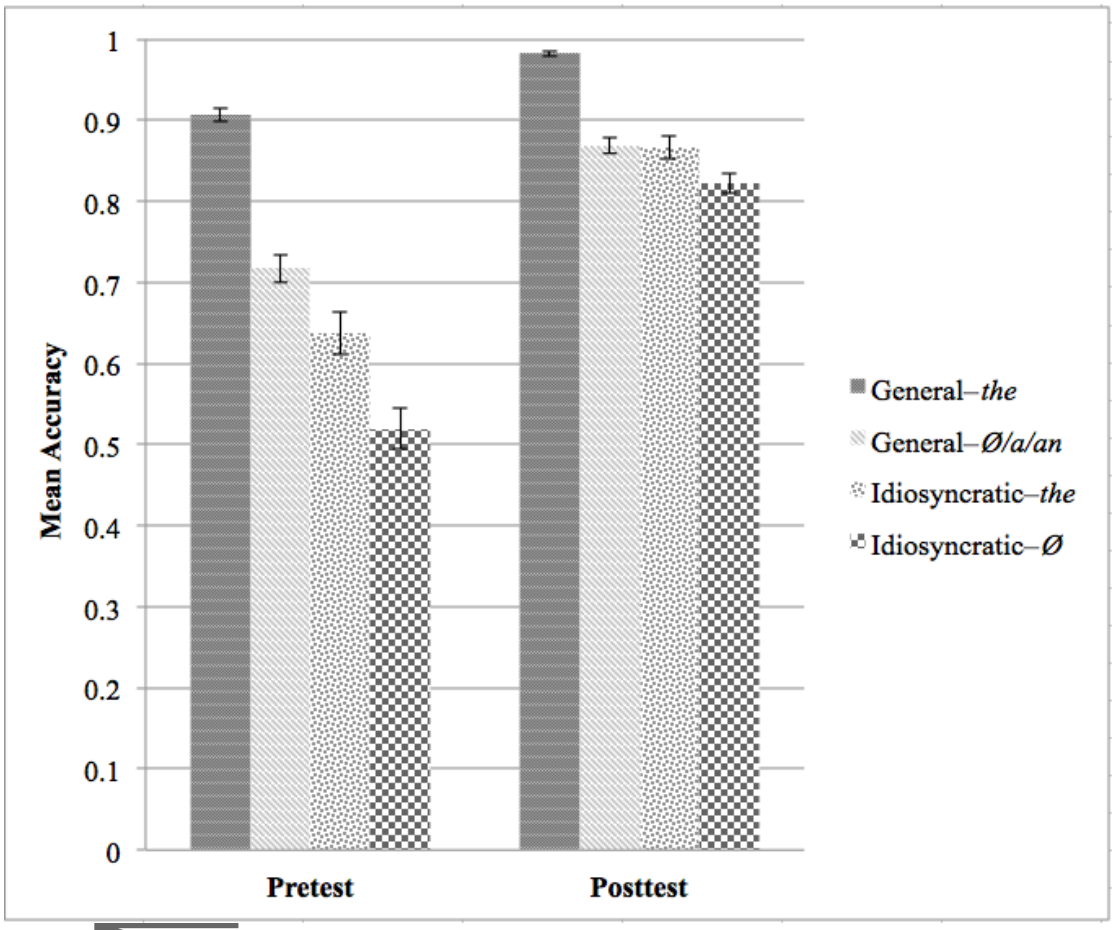
<INSERT FIGURE 4 ABOUT HERE>

FIGURE 4

Error Bars of Pretest and Posttest Accuracies of Four Categories of Article Cues

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A two-way repeated measures ANOVA was conducted to compare the amount of accuracy gains on general versus idiosyncratic cues and on definite article versus indefinite/zero article cues. We found main effects for both type (general vs. idiosyncratic) [$F(1,62) = 93.95$, $p < .001$, $\eta^2p = .602$] and form (*the* vs. *a/an/0Ø*) [$F(1,62) = 8.65$, $p = .005$, $\eta^2p = .122$], and no interaction between the two [$F(1,62) = .003$, $p = .957$, $\eta^2p = 0.00$]. Learners showed significantly more accuracy gains on idiosyncratic cues than on general cues, and more gains on *a/an/0* cues than *the* cues. Despite the greater gains on idiosyncratic cues, a repeated measures ANOVA showed that the mean accuracy of general cues at the posttest was still significantly higher than that of idiosyncratic cues [$F(1,63) = 76.12$, $p < .001$, $\eta^2p = .547$], while the posttest accuracy of *the* cues was significantly higher than

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a/an/0 cues [$F(1,63) = 74.09$, $p < .001$, $\eta^2p = .540$]. In addition, the pattern of posttest accuracy showed a significant interaction between type (general vs. idiosyncratic) and form (*the* vs. *a/an/Ø*) [$F(1,63) = 24.91$, $p < .001$, $\eta^2p = .283$].

Another two-way repeated measures ANOVA examined changes in response time from the pretest to the posttest as a function of form and type. We found a main effect for type (general vs. idiosyncratic) [$F(1,63) = 14.83$, $p < .001$, $\eta^2p = .191$], but not for form (*the* vs. *a/an/Ø*) [$F(1,63) = 2.49$, $p = .119$, $\eta^2p = .038$], and a significant interaction between type and form [$F(1,63) = 7.76$, $p = .007$, $\eta^2p = .110$]. Idiosyncratic cues showed significantly more response time reduction than general cues. Paired samples *t*–tests showed significantly greater time reduction for general–*the* cues than for general–*Ø/a/an* cues ($t = -4.215$, $p < .001$, $d = .53$), but no significant difference between idiosyncratic–*the* and idiosyncratic–*Ø* cues ($t = .698$, $p = .488$, $d = .09$). At the posttest, according to a repeated measures ANOVA, the main effect for type (general vs. idiosyncratic) that we observed at the pretest no longer existed [$F(1,63) = .604$, $p = .440$, $\eta^2p = .009$]. After training, participants processed general and idiosyncratic cues at a similar speed, with both being faster than the pretest levels. But the main effect for form remained at the posttest [$F(1,63) = 33.09$, $p < .001$, $\eta^2p = .344$]. Participants spent significantly less amount of time processing *the* cues than *a/an/Ø* cues. There was no interaction between type and form [$F(1,63) = 2.31$, $p = .134$, $\eta^2p = .035$].

In short, we conclude that the article instruction designed based on the principle of contrast and explicit feedback was effective in terms of both dependent measures. We observed more learning on idiosyncratic cues than on general cues in terms of both accuracy gains and reduced response time. Meanwhile, the zero article and indefinite article cues showed significantly more learning than the definite article cues in terms of accuracy gains, but not in terms of reduced response time.

<C>Metalinguistic Feedback Versus Analogical Feedback. Table 5 presents the descriptive statistics of the accuracy and response time of the two treatment conditions at the pretest and the

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posttest. Independent samples *t*–tests suggested that, when comparing the mean accuracy and response time of all cues at the pretest, metalinguistic feedback and analogical feedback were not significantly different from each other (accuracy: $t = -.115$, $p = .909$, $d = .03$; response time: $t = 1.504$, $p = .138$, $d = .38$).

<INSERT TABLE 4 HERE>

TABLE 4

Pretest and Posttest Accuracy and Response Time of Metalinguistic and Analogical Feedback

	Metalinguistic feedback		Analogical feedback	
	Accuracy	Response time	Accuracy	Response time
Pretest	.676 (*SD* = .077)	6.339 (*SD* = .554)	.678 (*SD* = .062)	6.026 (*SD* = 1.027)
Posttest	.886 (*SD* = .073)	4.565 (*SD* = .858)	.872 (*SD* = .055)	4.007 (*SD* = .518)

At the posttest, independent samples *t*–tests indicated that there was no significant difference of mean accuracy between the two feedback conditions ($t = .875$, $p = .385$, $d = .22$). However, there

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was a significant difference of posttest response time between the two conditions (t = 3.176, p = .002, d = .80): The participants in the analogical feedback condition processed posttest sentences significantly faster than the participants in the metalinguistic feedback condition. This finding applied to both general and idiosyncratic cues: Analogical feedback generated significantly faster response time than metalinguistic feedback regarding both general cues (t = 3.474, p = .001, d = .86) and idiosyncratic cues (t = 2.527, p = .014, d = .63) at the posttest.

<A>GENERAL DISCUSSION

Three studies were reported in this article. Based on the constructs of the Competition Model, Study 1 systematically evaluated the availability and reliability of form–function mappings in the English article system. Articles were found to follow the Zipfian distribution in terms of their frequency distribution. However, all of the cues demonstrated a high level of reliability.

Study 2 examined the accuracy of learners' use of article cues prior to training. It revealed a greater control at pretest of the more available general cues as opposed to less available idiosyncratic cues, as well as an overall tendency to treat the definite article as the default. There are two factors that work against the early acquisition of the idiosyncratic cues. First, learners have much less experience with idiosyncratic cues in both the L1 input and L2 production. Though small in terms of token frequency, there are many article cues that belong to this category, which makes it difficult to detect, understand, and make effective use of each of these cues. Second, idiosyncratic cues are semantically opaque, so that learners cannot rely on metalinguistic awareness of grammatical rules to reason their usage. All these factors contributed to the difficulty of acquiring idiosyncratic cues in L2 learning.

The default use of the definite article in our data could also be attributed to two factors. The observation in Study 2 that response times were slower for uses of the definite article could be due to

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the fact that, when learners were faced with difficult choices, they applied the definite as the default. This account aligns with Master's (1987, 1997) observation that learners with no article system in their L1s go through a stage during which they hypothesize that all nouns require *the*. This pattern of overgeneralization of the definite article can also be attributed to transfer from the learners' L1. Mandarin Chinese does not have an article system, but it has a widespread and frequent use of demonstratives (*zhe–ge* 'this' and *na–ge* 'that') which function to signify definiteness (Li & Thompson, 1981). There has been evidence showing that the demonstratives *zhe–ge* and *na–ge* take on some of the functions in modern Chinese that the definite article plays in English (Huang, 1999; Li & Thompson, 1989). Robertson (2000) found that Chinese learners of English overused demonstratives (*this* and *that*) in oral elicitation tasks where *the* was the more appropriate option. Ionin et al. (2012) further hypothesized that transfer leads learners to (initially) equate definiteness with demonstrativeness. Thus, the default use of *the* in our data from Chinese EFL learners can be attributed, at least partially, to transfer of demonstrative semantics.

Study 3 demonstrated the effectiveness of applying cue focusing in article instruction among L2 learners. The most important finding in this study was that the training manipulation was extremely successful. As judged by the criteria of Oswald & Plonsky (2010), the effect size in this study was extremely large. This finding is interesting psycholinguistically and important pedagogically.

This study also demonstrated greater learning for idiosyncratic cues than for general cues in terms of both accuracy gains and response time reduction. This relatively greater improvement for idiosyncratic cues could be attributed to fact that the learners' awareness of these cues was lower than for the general cues, thereby leaving more room for improvement. The computer-based training provided a large amount of practice items that compensated for the lack of input the learning of idiosyncratic cues. Meanwhile, idiosyncratic cues have high reliability. Explicit feedback with reliable

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information of form–function mappings enabled learners to quickly catch up on this poorly acquired category of cues.

For the dependent variable of response time, there was a significant type and form interaction at the pretest, but not at the posttest. The interaction at the pretest was mainly due to general–*the* cues, which had higher accuracy but longer response time than general–*a/an/Ø* cues. We excluded the possibility of a confound of uneven sentence lengths among different categories of cues by maintaining tight control over the number of words in the test sentences (10–11 words per sentence). A plausible account is that learners needed to spend time identifying the post-modifier construction in sentences relying on this cue. Once they located the structure, they had a higher accuracy of performance due to the reliable association between the post–modifier structure and the definite article among all the test items of general–*the* cues.

<B>*Metalinguistic Feedback Versus Analogical Feedback*

The results from Study 3 showed that analogical feedback outperformed metalinguistic feedback in terms of response time but not accuracy at the posttest. This result partially supported the finding in Presson, Sagarra, et al., (2013) of no accuracy difference between the two types of computer-based explicit feedback. However, our results pointed to an advantage of analogical learning (Herron & Tomasello, 1992) in terms of promoting more fluent application of new knowledge obtained from feedback with high-frequency exemplars. This advantage for analogical feedback applied to both general and idiosyncratic cues.

<A>CONCLUSION

These studies represent the first systematic investigation of form–function mappings in the English article system. Our analysis of availability and reliability for 86 cues revealed a Zipfian distribution in which the most frequent cues accounted for the overwhelming majority of cue uses.

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Idiosyncratic cues were much lower in availability, but both general and idiosyncratic cues were high in terms of reliability.

Study 2 provided a clear picture of what types of article usages were easy or difficult for L2 learners and hints as to why this might be so. The distinction between general cues and idiosyncratic cues was also an important predictor of results in each of these studies. These two cue types were shown to have significantly different cue availabilities in L1 text counts and L2 performances. The findings on general and idiosyncratic cues confirmed the predictions of the Competition Model. Due to their higher availability, general cues were better acquired than idiosyncratic cues in terms of both accuracy of performance and processing time. On the pretest, definite article cues were already better acquired than zero article and indefinite article cues. This effect appears to arise from a transfer of Chinese demonstrative marking to English definiteness marking. Among the general cues, learners relied heavily on structural cues such as post-modifier constructions as reliable indications of the definite article, even though our text counts showed that such an association was not fully reliable.

In Study 3, cue focusing techniques, featured by contrasting cue presentation and explicit feedback, were found to promote effective learning of article cues. After training, learners produced more accurate judgments of article choices with a faster processing speed. This positive learning effect was observed among all types of article cues and these effects were highly significant. Idiosyncratic cues improved more than general cues, while zero article and indefinite article cues gained more than definite article cues. Finally, metalinguistic feedback was found to be equivalent to analogical feedback in terms of promoting accuracy gains. However, analogical feedback led to sharper improvements in reaction time, suggesting that it had a more direct effect on fluency improvements.

Overall, these findings are encouraging for L2 learners and teachers, confirming that learners can pick up even the more difficult and less frequent article cues, given the right type and amount of

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instruction. The three studies reported in the current article were not without limitations. First of all, we could not administer delayed posttests to measure long-term retention of learning in Study 3. Future studies should incorporate delayed posttest(s) to investigate whether general and idiosyncratic cues maintain their improved performance over time. Such investigations will also further our understanding of cues with different properties. Second, we only used one type of instrument, a sentence-level cloze test with no time pressure, as the measurement of learning outcomes. Future studies should consider adopting and comparing a variety of instruments such as sentence- or discourse-level cloze tests with and without time pressure, and controlled or free production tasks such as translation tests or picture description tasks. Such measures could assess whether learners can transfer what they learn to better performance in more authentic contexts of language use. In addition, a comparison between results collected with different instruments investigates potential differences between metalinguistic and analogical feedback. Third, we only selected 23 cues for training in this study. Though the selected cues accounted for approximately 80 percent of token frequency among all article cues in our corpus analysis, there are many cues that were not included in the instruction. One important reason is that not all article cues can be displayed through contrastive pairs. We will need to explore other methods to study a wider variety of cues, as well as more advanced article usages.

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APPENDIX

Appendix A: Corpus Text Sources

1. Academic

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8. Novel

Hemingway, E. (1957). *A farewell to arms*. New York: Scribner.

9. Recipe

Orange chiffon cake. (1992, March). Accessed 13 June 2017 at http://www.epicurious.com/recipes/food/views/Orange-Chiffon-Cake-11583#ixzz1hoH94nGb

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Appendix B: Trained Article Cues in Contrasting Pairs

Pair	Cue	Cue Name	Metalinguistic Explanation and Selected Example

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No.	No.		
P1	1	*non–countable with post-modifiers → the*	Use *the* when a noncountable noun is post-modified by a relative clause or a prepositional phrase. (*They try to protect <u>the</u> land they own at all cost.*)
	2	*non–countable → Ø*	Use *Ø* with unmodified noncountable nouns. (*They try to protect <u>Ø</u> land at all cost.*)
P2	3	*plural with post-modifiers → the*	Use *the* when the plural noun is post-modified by a relative clause or a prepositional phrase and is uniquely identifiable. (*I have found you <u>the</u> people who used to work as Chinese–English translators.*)
	4	*plural → Ø*	Use *Ø* with plural nouns unless they are uniquely identifiable. (*Do you need <u>Ø</u> people who can translate English to Chinese?*)
P3	5	*singular countable with post–modifiers → the*	Use *the* when the singular countable noun is post–modified by a relative clause or a prepositional phrase and is uniquely identifiable. (*I thanked <u>the</u> travel agency who helped me find a cheap air ticket.*)
	6	*singular countable → a/an*	Use *a/an* when the singular countable noun is not made concrete or instantiated by any modifier. (*I am working with <u>a</u> travel agency to find a cheap air ticket.*)

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P4	7	*the architecture of XX → the*	Use *the* when describing constructions that are made specific through the addition of post–modifiers. (*<u>the</u> Statue of Liberty*)
	8	*XX's architecture → Ø*	Use *Ø* when the names of constructions are modified by possessive nouns (such as London's). (*<u>Ø</u> New York's Statue of Liberty*)
P5	9	*political/military institution → the*	Use *the* when established institutions (e.g., political and military institutions) are used alone. (*<u>the</u> World Bank*)
	10	*political/military institution as adjective → 0*	Use *Ø* when established institutions (e.g., political and military institutions) are used as adjectives to modify other nouns. (*<u>Ø</u> World Bank loans*)
P6	11	*XX University/College → Ø*	Use *Ø* when the name of a university has this structure: XX University. (*<u>Ø</u> Harvard University*)
	12	*the University/College of XX → the*	Use *the* when the name of a university has this structure: the University of XX. (*<u>the</u> University of Edinburgh*)
P7	13	*XX Street/Road/Avenue → Ø*	Use *Ø* when the names of streets, roads, avenues, lanes, or boulevards have this structure: XX Street/Road/Avenue/Boulevard. (*<u>Ø</u> Fifth Avenue*)
	14	*the Street/Road/Avenue of XX → the*	Use *the* when the names of streets, roads, avenues, lanes or boulevards have this structure: the

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			Street/Road/Avenue/Boulevard of XX. (*the Avenue of Stars*)
P8	15	*'go to' habitual location → Ø*	Use *Ø* when the word '*go*' is used with a habitual location or of a habitual transport method. (*go to Ø school*)
	16	*'go to' recreation activity → a/an*	Use *a*/*an* when the word '*go'* is used with recreational activities. (*go for a dance*)
P9	17	*geographical feature names → the*	Use *the* with major geographic features such as rivers, oceans, seas, and deserts. (*the Ohio River, the Pacific Ocean, the Red Sea, the Sahara Desert*)
	18	*exceptions of geographical feature names → 0*	Use *Ø* with the names of individual lakes, bays, and mountains. (*Ø Lake Michigan*, *Ø Hudson Bay*, *Ø Mount Whitney*)
P10	19	*construction names → the*	Use *the* with the names of hotels, theaters, bridges, and buildings. (*the Hilton Hotel, the Majestic Theatre, the Brooklyn Bridge, the Empire State Building*)
	20	*exceptions of construction names → Ø*	Use *Ø* with the names of halls, stadiums and hospitals. (*Ø Carnegie Hall, Ø Yankee Stadium, Ø Hillsdale Hospital*)
P11	21	*second mention with variation → the*	Use *the* when the noun has already been mentioned before, and the second way in which it is mentioned is slightly different from the first. (*I saw a peacock at the zoo. The bird*

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			had beautiful feathers.)
	6	*singular countable → a/an*	Use *a/an* when the singular countable noun is not made concrete or instantiated by any modifier. (*I saw <u>a</u> beautiful bird at the zoo.*)
P12	22	*part of → the*	Use *the* when describing an object that is a unique part of some overall scene, event or object being discussed. (*I'm returning this coat for a refund. <u>The</u> zipper broke after one day.*)
	6	*singular countable → a/an*	Use *a/an* when the singular countable noun is not made concrete or instantiated by any modifier. (*I'm looking for a coat with <u>a</u> strong zipper.*)
P13	23	*disease names → Ø*	Use *0* with the names of diseases (except the flu, the measles, and the mumps). (*His uncle has <u>Ø</u> cancer.*)
	6	*singular countable → a/an*	Use *a/an* when the singular countable noun is not made concrete or instantiated by any modifier. (*His uncle is launching <u>a</u> war on cancer.*)

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