

EFFECTS OF WORD CLASS AND TRAINING METHOD ON VOCABULARY LEARNING IN A SECOND LANGUAGE

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Abstract

It is not fully known whether nouns or verbs are easier to learn in a second language. A noun learning advantage has been observed for children in many languages (e.g., Gentner, 1982), but few have examined whether mature second language learners show a similar pattern. In the current study 84 university students were trained with nonce words for 96 familiar, concrete concepts (half nouns, half verbs), half labeled ostensibly, and half in contexts that allowed label meanings to be inferred. Vocabulary knowledge was assessed through recognition tests after a delay of either five minutes or one week. No evidence of a word class advantage was found—participants did not demonstrate a noun advantage. Ostensive training was superior to inferential training at five minutes but not after one week.

Key words: vocabulary learning, second language, noun bias, nouns, verbs

1. Introduction

Today we are in a more globalized society than ever before. With continued international integration, bilingualism and multilingualism are becoming ever-more desirable assets. Learning a new language necessarily includes learning its vocabulary. Two important classes of content words are particularly key in advancing proficiency in a foreign language—nouns and verbs. Which of the two is easier to learn? Few studies have empirically tested this question with adult learners. This, itself, is interesting because there is a rich history of research on the noun advantage in childhood L1 acquisition, but few researchers have investigated whether a noun advantage exists among mature L2 learners. If verbs are verifiably more difficult to learn than nouns, then perhaps formal instructional materials should be designed to emphasize them. A vocabulary dominated too much by nouns or verbs would seem inefficient for would-be communicators—language and thought are based on propositions composed of noun and verb arguments. The current paper presents an empirical investigation of adults learning common noun and verb nonce labels with and without contexts to aid.

The theoretical background for the current study is based on theories associated with L1 acquisition but which also can be brought to bear on second language vocabulary

development. Next I review the available work on noun versus verb learning in adult learners, and then introduce my rationale for including training methods and other features in this study.

1.1 Young word learners

Certainly there are many cognitive differences between child and adult ways of understanding linguistic input, but their goals are the same—to figure out how labels refer to meanings. Some studies with children have suggested nouns are easier to learn than verbs for reasons examined.

Children seem to approach the language puzzle by picking out simple and concrete nouns (especially proper names like ‘mommy’ and ‘daddy’), and smaller numbers of other word classes such as verbs (‘go’), performatives (‘hi’), modifiers (‘hot’), and function words (‘and’) (Tomasello, 2003). One important factor to explain which words are learned earlier is frequency (Huttenlocher, 1991). However, Gentner (1982) was the first to show evidence of a “noun bias”—a pattern of early vocabulary development dominated by nouns—in young children’s early vocabulary knowledge from the six different languages she investigated. Further research supported this pattern of findings in other languages (Bornstein et al., 2004) and even in a second language among children raised bilingually (Levey & Cruz, 2003). This acquisition pattern cannot be explained by the input frequencies of nouns and verbs (Sandhofer, Smith, & Luo, 1999).

One of the earliest and best explanations of the noun bias in childhood, the natural partitions and relational relativity hypothesis, was advanced in the first study recognizing the noun advantage in childhood (Gentner, 1982). This theory states there are two reasons nouns are learned faster than other word classes, and verbs slower than nouns—namely, because nouns are naturally, perceptibly partition-able into whole objects; and because relational concepts (verbs and adjectives) lack predictability about the relationships they encode between nouns and their states or changes. This is evident in the variation of verb meanings encoded within and between languages (Gentner, 1978, 1982). Gentner’s hypothesis has been usefully applied to explaining acquisition findings in cross-cultural (e.g., Bornstein et al., 2004; Caselli et al., 1995; Gentner, 1982) as well as experimental settings (Childers & Tomasello, 2002; Schwartz & Leonard, 1984; Imai et al., 2008). This theory could serve just as well to predict better noun than verb learning by adult learners in natural settings. However in the current study, verbs were made to be equally identifiable with nouns. Therefore a null effect of word class could also fit within this account.

The syntactic complexity (Pinker, 1994; Naigles, 1990) and inherent complexity arguments (Akhtar, Jipson, & Callanan, 2001; Tomasello, 1992, 2003), as their names suggest, are based on the assumption that verbs are inherently more syntactically and conceptually complex than nouns, and that is why verbs are harder to learn than nouns. Re-applied to second language learning, this theory would predict no effect in the current study because verbs and nouns were presented without syntactic complexity (presented individually, one consistent word order), and verb complexity was further reduced by representing verbs in L1-equivalent ways. Therefore a null effect would be consistent within these views.

A cultural emphasis argument is that nouns are learned faster than verbs in cultures that value them more, but that the reverse pattern could be expected where valuation is reversed (Gopnik & Choi, 1990, 1995). Greater relative valuation of verbs over nouns is indicated by subject- and/or object-dropping. In such languages, a noun is simply not mentioned in the utterance because it is sufficiently understood between speaker and listener. Current study participants were university students at an American university, mostly native-English speakers. English is typically considered a noun-friendly language, so this theory would specify a noun advantage among native-English speakers as they have been acculturated by a noun-friendly linguistic value system.

The noun-dependency hypothesis suggests that verbs are harder to learn because they require noun knowledge for their requisite arguments (Greenfield & Alvarez, 1980; Gleitman, Cassidy, Nappa, Papafragou, & Trueswell, 2006; Gentner, 2006; Waxman & Lidz, 2006; Sandhofer & Smith, 2007; Tomasello, 2003). That is, because a verb is a relation between one or more nouns and a state or change, verbs knowledge is necessarily reliant upon noun argument knowledge. Nouns must be known in order to use or understand verb meanings. Although this hypothesis is logical, it is difficult to falsify – it may not be possible to manipulate verb dependency on nouns because verbs are, by their very nature, dependent on nouns. The noun-dependency hypothesis relates to languages learned in the wild, not under artificial conditions; therefore the current design could not assess this hypothesis fairly.

Of the hypotheses reviewed here, only the cultural emphasis argument would clearly predict a noun advantage in the current design. Next I review the few available studies in which nouns or verbs were learned or identified by adults.

1.2 Second language word learners

One might presume, given the extant literature on the childhood “noun bias,” there might be some parallel literature assessing whether there is such thing as an adulthood “noun advantage,” but the research in this area is scant, and conclusions tentative. The few empirical studies which either directly or indirectly address a possible second language word class effect on learning are reviewed below.¹

One clue that suggests a noun advantage beyond toddlerhood comes from a case study of a 9-year-old girl from Russia who immigrated into the U.S. living with American foster parents (Isurin, 2000). She learned nouns faster than verbs. Although she had not yet reached maturity, her case provides a link between studies of young

¹ Missing from my brief review here is a theoretical background of second language vocabulary learning which I felt would not be worth mentioning for lack of relevancy to the current experimental paradigm—existing adult word learning theories do not suggest whether word class should relate to word difficulty when words are learned under ostensive and inferential conditions as they were in this study. For example, cross-situational learning (e.g., Kachergis & Shiffrin, 2012) offers that this is a useful and likely way that adults learn words in ambiguous contexts, but such understanding does relate to ostensive learning, does not offer whether cross-situational methods are easier applied to nouns or verbs, or whether one method, say cross-situational learning, is more efficient than other methods (e.g., syntactic bootstrapping, Piccin & Waxman, 2007).

learners and mature ones. It also suggests that nouns may be easier to learn than verbs when their concepts are already known in a previously learned language.

Indirect evidence of a possible noun advantage in second language learners comes from Gillette and colleagues who reported on their Human Simulation Paradigm (Gillette, Gleitman, Gleitman, & Lederer, 1999). Adults were shown video interactions between mothers and their infants. The videos were silenced, and beeps were inserted in places where the mothers uttered mystery words. The test was to see whether adult participants might guess mystery words based on what they could see from the filmed interaction. Only the earliest acquired nouns and verbs by children were sampled for experimentation. Participants were better at guessing noun meanings than verb meanings. They also showed benefits of noun knowledge and syntactic frame knowledge for guessing verb meanings. Besides making a powerful argument for the importance of context and syntactic knowledge for learning new vocabulary, this study provides evidence of a descriptive noun advantage in adulthood, and supports prior noun knowledge as a prescription for better verb learning. This study does not provide direct empirical evidence of a noun learning advantage, *per se*; participants were not required to learn or remember, but only to guess reference meanings. This study suggests nouns are more identifiable than verbs in natural settings, supporting Gentner's (1982) natural partitions theory. Interestingly, Gillette et al. also found that concreteness, which was correlated with lexical class, could account for the observed noun advantage. This suggests early word learning may be directed toward concrete or salient elements. Similar results have been found by others (Gleitman et al., 2006; Snedeker & Gleitman, 2004).

Ludington (2013) directly studied noun and verb vocabulary learning among English speakers using Hebrew as the target language. English speakers learned labels for common, concrete L1 nouns and verbs from images each containing an actor performing an action labeled with two-word phrases (in consistent, noun-verb syntax). There was some evidence of a noun advantage, but not after adjusting for subjective ratings of English target word imageability (one measure of concreteness). Utterance and syllable lengths were longer in verbs than nouns, but tests of these measures indicated they did not relate to word learning outcomes.

The word class effect observed in the studies reviewed above (Gillette, Gleitman, Gleitman, & Lederer, 1999; Gleitman et al., 2006; Snedeker & Gleitman, 2004) could be explained by differences in concreteness. Ellis and Beaton (1993) reviewed studies of imageability and concreteness. These psycholinguistic factors (and 'meaningfulness') are highly correlated, and are defined in terms of one another. Imageability may be a more parsimonious account of word learning order than word class (Gleitman, Cassidy, Nappa, Papafragou, & Trueswell, 2005; Ludington, 2013). Imageability provides a useful psycholinguistic metric to study word learning ease; for example, imageability was found to account for age of acquisition outcomes in a sample of verbs (Ma, Golinkoff, Hirsh-Pasek, McDonough, & Tardif, 2009). To measure imageability in the current study, a sample of participants was asked to rate the imageability (ease of creating a mental image) of English words (the L1 labels of images used in the current study). This measure was used to control target feature which has traditionally confounded attempts to study word class learning effects. A number of other target

features were also measured to assess and control their contributions to word learning. In sum, studies reviewed above suggest adults may show a small noun advantage, but that it might be better labeled a concreteness advantage.

1.3 Training methods

Perhaps one training method is better for learning one-word class, and another method for another class. Nouns and verbs do function very different, linguistically. The proportional distributions of nouns and verbs in naturalistic input allows children to learn a lot about relatively few verbs, and a little about relatively many nouns (Sandhofer, Smith, & Luo, 2000). That nouns still come out ahead in early acquisition may speak to the difficulty of verb learning but not necessarily to the inappropriateness of the learning method per se. Verb learning probably requires much more input than noun learning, when the learner has little idea what noun arguments or relational features should be incorporated. Discovering verb meaning is a bit like solving a mystery—it requires a lot of clues and takes a lot of time. But by suffering through these experiences, perhaps we become better at learning verbs this way—by inferring their meaning. It is plausible, then, that verbs lend themselves more naturally to discovery under inferential conditions than by direct labelling. There are fewer constraints on possible verb meanings than possible noun meanings. Nouns, compared to verbs, are more “given by the world” (Gentner, 2006, p. 544).

Two training methods were used in the current research: an ostensive, paired associate (but with images) method, and an inferential method. Ostensive labelling is basically word-to-picture, decontextualized, paired associate learning. Decontextualized vocabulary training methods are often criticized for being ineffective due to lack of meaningful exposure. Oxford and Crookall (1990) reviewed vocabulary training methods and grouped them along a contextualization continuum. Paired associate and flashcard methods were placed at the decontextualized end of this spectrum. In the current study, the ostensive method is essentially a kind of paired associate learning, but pairing a foreign word with a picture rather than an L1 word. Oxford and Crookall argued that the paired-associate method does not provide exposure to a sufficiently meaningful context, but that word-to-picture learning, which is a partially contextualized approach, is more efficient than the paired-associate (word-to-word) training method. They argue that fine shades of meaning, which might be gained through natural reading, may be missed in the paired associate method, but that it may be a worthwhile method for early vocabulary initiates. The current study did not aim to test whether more contextualized training methods could improve inference accuracy. Rather, as current learners were absolute beginners, and they learned the target (nonce) language in a laboratory, the word-to-image associate method was judged as a suitable training method.

The other training method used in the current study, the inferential method, requires learners to infer which of two words refers to which of two referents using the mutual exclusivity principle (Markman & Wachtel, 1988). This principle states that when two labels are uttered and one of those labels is known to refer to one referent, the other label ought to refer to another referent. This inference seems more cognitively involved than

learning from ostensive labeling, so it was predicted that inferential learning would lead to slower learning but also slower forgetting.

Modern language teaching and learning practices emphasize the use of natural contexts to support inferential processes. While inferential training seems more natural and congruent with everyday use of the L2, it may or may not be more time-efficient than de-contextualized approaches. In his review of L2 vocabulary pedagogy, Nelson and Schrieber (1992) compared four hypotheses of word recall and concluded that context cues to word meaning and imagery were tenable hypotheses. Schwanefflugen Akin, and Luh (1992) studied context availability and imagery in word recall and found that context knowledge was of primary value to participants, but that imagery was a second type of cue participants used to help recall when context information was not used. Hulstijn (1997) recommends use of both mnemonic (e.g., linking words to images; similar to the ostensive training method used in the current study) and inferential learning from natural contexts. Hulstijn's support of inferential learning methods is that, by using them, vocabulary knowledge gets linked to meaningful contexts (inferential contexts). This account suggests a major benefit of the inferential learning approach because context becomes part of vocabulary knowledge, an earmark, for greater recall.

2. The current study

An empirical investigation of noun and verb learning rates was undertaken. On studies reviewed above, a slight noun advantage was expected but only because current nouns tended to be more concrete. Two training methods were tested to see which one would be more beneficial for learning nouns and verbs. A nonce language was created to overcome the issue of different word lengths between nouns and verbs, which could occur in natural languages (Ludington, 2013). Delay was manipulated to test whether either of the two word classes or training methods might see slower forgetting rates, which would have important practical applications.

The following research questions were formulated for the present study:

1. Is there a word class effect among adults learning simple L2 vocabulary? Might it be accounted for by stimulus features?
2. Does the training method—ostensive versus inferential—matter?
3. Does training method or word class (or their interaction) interact with delay?

2.1 Method

2.1.1 Participants

Ninety participants from the University of California, Los Angeles were recruited through an online participant recruitment system used by the university, signed a consent form, participated in exchange for course credit, and were debriefed afterwards, as approved by the institution's review board. Some participants were dropped due to participants' failure to return for the second part of the experiment (5) or for

experimenter failure to present all materials (1). The mean age of the remaining 84 participants was 20.8 years, $SD=4.19$ years. More females (62) than males (22) participated. Most participants spoke English as their most proficient language (67 out of 84), and most reported at least some ability in one or more foreign languages (two did not report any foreign language ability; average number of foreign languages reported at any proficiency was 2.5).

2.1.2 Design

Word class (nouns, verbs), training method (ostensive, inferential), and delay (5 minutes, 1 week) variables were manipulated within participants. The dependent variable, correct target selection (recognition), was measured on a binary scale (correct vs. incorrect). The correct target was randomly placed among three foils, so chance performance was at 25%. Outcomes, nested within participants, were analyzed by participant.

For 28 participants, context images were dropped from ostensive conditions to equate number of target occurrences per trial in ostensive and inferential conditions. This was done to isolate the training method effect from the number of occurrences effect.² Delay was not manipulated among these participants (held at five minutes). This procedural change was documented and its effect included in models to account for it.

2.1.2.1 Counterbalancing extraneous factors

Steps were taken to counterbalance extraneous variables. Ostensive conditions involved presenting two target words and their referents individually. The order in which these two isolate images were presented was counterbalanced within participants (noun, verb vs. verb, noun). Two random pairings of nonce words to targets (counterbalanced between nouns and verbs) resulted in two “languages” (Languages A and B; see Appendix 1), which were randomly assigned and counterbalanced between participants. Two learning schedules used between participants: one in which participants were trained, tested after five minutes, trained on a second list, and tested one week later, and another schedule in which participants were trained, tested one week later, then trained on a second list and tested after five minutes. Learning schedules were

² Because these context images were redundant labeling events in ostensive conditions, it was assumed they should not directly affect how participants link words to their referents. Despite this logic, compared to the context-present, the context-removed condition led to higher recognition rates (context-removed $M=.68$, context-present $M=.51$; $OR=.70$, $p=.001$). This suggests the additional target presentation in context images were unnecessary or even inhibited learning (at a five-minute delay). This may have been because including context images increased total training time by 50%, or because participants became more bored or confused with the presentation of context images in ostensive conditions due to target redundancy or uncertainty about the role of context images for vocabulary training in these conditions.

randomly assigned and counterbalanced between participants to even out proactive and retroactive interference effects (due to learning or retrieving word lists closer or further apart in time).

2.1.2.2 Continuous variables

A number of continuous variables were measured in order to potentially gain greater statistical control of the data. Participants reported their age, self-rated English proficiency (scale of 1-10), and language proficiency in other languages. Stimulus measurements were garnered from prior research (Ludington, 2012) from 29 participants (undergraduates from the same university, recruited in the same way as current participants). These measures included three word-related factors (word familiarity, concept frequency, word imageability) and four image-related factors (quality of depiction, number of alternative interpretations, name agreement for referents in isolate and in context images). Measures are presented in Table 1. Details of measurement can be found in Ludington (2012). One auditory factor (utterance length of nonce words to nearest .01 second) was also measured.

Factor	Scale	N	Nouns		Verbs	
			Mean	SD	Mean	SD
Familiarity	1 to 7	26	6.45	0.84	6.49	0.62
Frequency	1 to 5	20	3.87	0.43	3.43	0.55
Imageability	1 to 7	26	6.67	0.48	6.68	0.35
Quality of depiction	1 to 5	20	4.91	0.09	4.75	0.22
Alternative interpretations	raw #	20	3.77	1.98	5.60	3.20
Isolate name agreement	0 to 1	19	0.90	0.13	0.86	0.11
Context name agreement	0 to 1	10	0.90	0.07	0.78	0.15

Table 1. Norming sample sizes, means, and standard deviations for item factors

2.2 Materials and procedures

2.2.1 Nonce words

Real foreign languages contain a mix of familiar and unfamiliar phonemes and phonemic structures; word lengths may also sometimes vary systematically along the noun / verb divide (Ludington, 2013). To control these extraneous factors, a set of nonce words were formed for the current study. A total of 72 one-syllable words and 24 two-syllable words were formed, 96 nonce words total, half assigned as nouns and half as verbs. These were formed using a consonant-vowel-consonant (CVC; one syllable), or a CVCVC (two syllables) pattern. Some words were adopted from Vitevitch and Luce (1999) or constructed from the same phonemes (17 consonant phonemes, 7 vowel phonemes) because familiar phonemes are more perceivable but not necessarily easier to remember than unfamiliar phonemes (Appleman & Mayzner, 1981). To mimic real words, consonants position rules were developed to guide construction of nonce words

(listed in Table 2). These nonce words were then spoken by a male, American, native English speaker and recorded with Audacity (build 1.3.12 Beta) to form the auditory stimuli for this study. Words for isolate images were spoken individually, and two-word phrases for context images were spoken with normal sentential intonations (to maintain their ecology as complete phrases).

Utterance lengths, measured to the nearest hundredth of a second, for words randomly assigned as nouns ($M=.91$, $SD=.19$) and as verbs ($M=.96$, $SD=.22$) in Language A did not differ, independent $t(94)=-1.05$, $SE=.042$, $p=.30$. Language B was formed by re-assigning noun labels to verbs randomly, and verbs to nouns.

Position in syllable																						
Initial			D	F	G	H	J		K	L		N	P	R	S	Sh	T	Th		W	Y	Z
Medial	Ai	Ee	Eh	Ir	O	Oo	Uh															
Final	B	Ch	D	F	G	H		Jsh	K	L	M	N	P		S		T	Th	V			Z

Table 2. Phonemes used to construct nonce word stimuli

2.2.2 Images

Ninety-six (48 noun and 48 verb) black-and-white line drawings images of various everyday items and actions, illustrated in referential isolation, were mostly obtained from the Internet.³ These formed a convenience sample selected because they were concrete, and because a decent image of them could be obtained. All targets came from basic level English words, not too semantically specific or general. Nouns were mostly animals (e.g., kangaroo) and professions (e.g., doctor), and a few inanimate objects (e.g., refrigerator); verbs were common, familiar actions that could be performed with parts of the human body, such as ‘eating’ (one exception was ‘hatching’; all targets are listed in Appendix 1).

Importantly, verbs could all be used intransitively (i.e., without specification of a direct object), though some could be considered either transitive or intransitive, such as the verb ‘to write’. While transitive verbs require acting and acted-upon noun arguments, intransitive verbs only require an actor (noun argument in the subject position). By only intransitive verbs, I could properly present verbs in two-word phrases that would make sense to English speakers without the need of an additional noun argument. Each context image illustrated an actor performing an action.

Isolate images were images of nouns and verbs illustrated in referential isolation to convey primarily one (noun or verb) concept per image. Isolate images of verbs necessarily portrayed an actor or part of one to enact them, but artistic means were employed to place greater emphasis on the action than on the actor. Images were edited

³ One major source of the images was an online database of line drawings of hundreds of objects and actions, along with naming norms for language researchers, by the Center for Research in Language at the University of California, San Diego: <http://crl.ucsd.edu/~aszekely/ipnp/>. Another source was searching Google’s “images” option, filtering to search only black-and-white line drawings. Some context images were hand-drawn contributions by Kay Lee and Goldie Salimkhan to help with this research.

to maximize name agreement. Adobe Photoshop and Windows Paint were used to crop or delete distracting or unnecessary background details or features so that greater attention would be drawn to relevant parts. Movement marks and lines of motion were added to verb images to improve movement interpretations.

Context images each contained an actor performing an action. Context images linked a target noun and a target verb together. To exemplify these and their presentation order, one isolate image presented 'cow', another presented disembodied hands and a foot on a shovel to depict 'digging', and then a context image presented 'cow digging' (with a picture of a cow digging into dirt with a shovel.)

Image heights and widths were measured and summed (height + width) for each image, and these sums were submitted for testing to ensure size differences were not confounded between nouns and verbs. Noun image dimension sums (877 pixels, $SD=100$) did not differ from those of verb images (864 pixels, $SD=135$), independent $t(94)=.516$, $SE=24.33$, $p=.607$.

2.2.3 Learning

2.2.3.1 Instructions

In each learning segment, participants were informed that they would learn words, not to respond, and that their memory of word meanings would later be tested. Participants describe their task to the experimenter to confirm understanding.

2.2.3.2 The learning program

A Toshiba laptop computer (screen size: 19 inches diagonally) presented words, sounds, and images with Superlab 4.0. Each trial was composed of a series of two or three events, each 3 seconds long. An inter-stimulus interval (a blank, white slide) of 0.1 seconds interposed between all events. In each event, an image and auditory stimulus (nonce word) were presented. Sound files were edited to include approximately 100 milliseconds of silence before sound onset to avoid simultaneous onsets of visual and aural stimuli. Trials were presented as a continuous progression throughout each training segment.

The 96 words were split into two lists of 24 nouns and 24 verbs each (see Appendix 1) to form 24 two-word trials (see Appendix 2). The two word lists were tested after one each of two delay levels so that all participants experienced both delays (five minutes, and one week). A set of eight trials formed each training segment. Trials were presented six times each; all trials were presented once before they were repeated in a different random order on each repetition without interruption. Each of these 5- to 7-minute training segments occurred at either the ostensive or inferential level. Two inferential training segments and one ostensive training segment were viewed at each of two

appointments.⁴ Segments were preceded by two practice trials to illustrate the image progression pattern (or training method) for that segment. The two inferential learning segments were always presented consecutively to minimize instructional changes between segments. The ordering of segments was ostensive, inferential, inferential at one of two learning sessions, and inferential, inferential, ostensive at the other of the two. Order of segment orders was counterbalanced between participants. Between segments, participants engaged in a distractor task—a Sudoku puzzle—for 30 seconds to reduce pro- and retroactive interference effects arising from other segments.

2.2.4 Testing

Superlab 4.0 was used to present English words in Times New Roman 18-point font in the center of the screen as four vertically numbered options. For each test item, a sound file (the same that presented nonce words for training isolate images) was presented, and participants had to indicate which English word matched the meaning of the spoken word by pressing one of four number keys (#1-4). Two practice test items were used to familiarize participants with the testing format. Key press responses were scored by Superlab as correct or incorrect.

Foils were chosen from among the currently tested word list so that all choices were equally familiar. Each set of foils always included the word presented with the target during training; this sensitized the test to detecting associations to isolate images and not their more general context images. Each target word occurred four times during testing, once as the correct answer, and three other times as a foil option.

After two-thirds of the participants were run, errors in the test file were discovered: some test trials did not contain a correct target among the answer choices. Four such errors were discovered from Language A files and 10 from Language B files. These test trials were fixed before running the final third of participants, and data from bad trials were removed before analysis. After removing bad data, an average of 93 (instead of 96) data points were collected per participant.

2.3 Results

Logistic regression, a technique well suited for testing effects on binary outcomes, was employed. An alpha of .01 was considered significant, and $.01 < p < .05$ as suggestive. Participant factors measured and tested were sex, age, self-rated English proficiency, and proficiencies in other reportedly-known languages summed. None of these variables reached significance (all $p > .22$). Experimental language (Language A, Language B) was not significant, $p = .78$. The remaining results are organized according to the research questions laid out earlier. All unadjusted effects are presented in Table 3.

⁴ This mismatch in the number of each type of training segment was necessary for balanced data points between conditions because only half as many targets could be learned inferentially per inferential trial. Under ostensive presentation conditions, both targets per trial could be trained ostensibly, whereas under inferential conditions, only one of each pair of targets could be trained inferentially.

Category	Variable	Value range	OR	95% CI	P-value
Words	Word familiarity	min=4.31, max=7.00	1.18	1.08-1.30	<.001
	Word imageability	min=4.42, max=7.00	1.24	1.10-1.40	<.001
	Concept frequency	min=1.70, max=5.00	1.08	1.03-1.13	.001
	Utterance length	min=0.60, max=1.40	0.82	.65-1.04	.101
	Experiment language	0=Language A	0.98	.71-1.34	0.878
Images	Quality	min=3.00, max=5.00	1.13	.95-1.36	0.178
	Alt. Interpretations	min=1, max=17	0.98	.96-1.00	0.025
	Name agree, isolates	min=0.48, max=1.00	1.69	1.08-2.67	0.023
	Name agree, context	min=0.08, max=1.00	1.30	1.01-1.66	0.039
Participants	Age	min=16, max=52	1.00	.96-1.04	0.943
	Sex	0=female	1.25	.87-1.78	.225
	English-L1	0=yes	0.92	.62-1.36	.663
	English proficiency	min=7, max=10	1.03	.88-1.20	.731
Independent variables	Class	0=noun	0.98	.89-1.07	0.624
	training method	0=ostensive	0.75	.68-.83	<.001
	delay	0=5 min	0.32	.28-.35	<.001
	occurrences per trial	0=one	1.14	1.03-1.26	0.012

Table 3. Unadjusted effects of all tested variables

2.3.1 Question #1: Is there a word class effect among adults learning simple L2 vocabulary? Might it be accounted for by stimulus features?

Modeled alone, word class was not significant, OR=.98, 95% CI=.89-1.07, $p=.62$. It cannot be claimed with certainty that nouns and verbs generally do not differ in learnability because this sample was not a random sample of the population of nouns and verbs in a language. Instead it was a convenience sample selected by their being considered in English, by being concrete, and because an image of them could be found.

Next, I investigated which if any stimulus features might account for word learning variance to see if there were any systematic differences in learnability between these nouns and verbs. Word-related factors were first tested, unadjusted. Subjective ratings of English word familiarity, concept frequency, imageability, and age of acquisition were individually regressed on word learning outcomes and found to be reliably associated ($p<.005$) or nearly so (age of acquisition $p=.02$). Next, these word-related factors were jointly modeled with word class to see whether they might reveal learnability difference between classes. However in this model, familiarity suffered collinearity with frequency and imageability (familiarity VIF>10, 10.87; UCLA Statistical Consulting Group, n.d.), so familiarity was removed from the model (with virtually no effect on the adjusted effect of word class). Word class (OR=.98, $p=.44$) and the remaining word-related predictors were unreliable contributors (frequency and imageability $p=.19$ and $.06$, respectively). Frequency and imageability, both highly reliable predictors when

individually modeled, did not reliably contribute to explaining model variance in this model because shared factor contribution is removed in testing. Indeed, frequency and imageability were sizably correlated together, $r = .64$, $p < .001$. Because of this, and because imageability was the more reliable predictor of the two, adjustment by imageability was sufficient.⁵ Word class, adjusted by imageability and also by number of target occurrences per trial, was not reliable ($OR = .98$, $p = .70$). Imageability ($OR = 1.25$, $95\% CI = 1.11-1.40$, $p < .001$) was highly reliable.

Next, image-related factors were tested: quality of depiction, number of alternative interpretations, and name agreement for referents in isolate and in context images (details of measurement, provided in unpublished dissertation research, may be obtained by contacting the author or searching online). In independent models, some of these approached significance (number of alternatives $p = .03$, isolate image name agreement $p = .02$, context image name agreement $p = .04$). Modeling them jointly with word class resulted in no factor reaching significance (all $p > .12$). Utterance length, a feature of auditory stimuli, was unrelated to word learning outcomes, $p = .10$; adjusting word class by utterance length did not result in a reliable effect of word class, $p = .76$.

For a cleaner test of the cultural emphasis argument (Gopnik & Choi, 1990, 1995) that nouns will be advantaged particularly for English-as-first-language speakers, the word class effect was tested with only the 67 participants who reported English as their dominant language. There was no effect of word class in this sample, $OR = .99$, $p = .92$. To conclude about word class, the answer to Question 1 appears to be, no noun or verb advantage was evident in the data. Although some word-level and image-level factors were reliably associated with word learning, adjusting by them did not alter the null effect of word class.

2.3.2 Question #2: Does the training method—ostensive versus inferential—matter?

Ostensive training conditions—those with context images, and those without—were tested against inferential conditions. This analysis showed that participants recognized more words trained ostensibly than inferentially, $OR = .83$, $95\% CI = .74-.94$, $p = .003$. To ensure this effect was not merely due to mismatch in the number of target occurrences per trial between ostensive and inferential conditions, training method was adjusted by number of occurrences. Training method was highly reliable, $OR = .55$, $95\% CI = .45-.66$, $p < .001$ (number of occurrences was also highly reliable, $OR = .69$, $95\% CI = .57-.82$, $p < .001$).

To be even more certain of training method's effect on learning, analyses were conducted with context-included and context-excluded portions of the data separately. Context-included data came from the first 56 participants of the study. Among these participants (for whom ostensive conditions included two occurrences per trial), training method was reliable, $OR = .83$, $95\% CI = .74-.94$, $p = .003$. The context-excluded data came

⁵ Frequency is often correlated with imageability (e.g., Ludington, 2013). Frequency was dropped from further models for its failure to contribute additional value beyond imageability, and for lacking a theoretical relationship to concreteness as a construct.

from the last 28 participants (for whom ostensive conditions included only one occurrence per trial). For these participants, training method was again a reliable effect, $OR=.60$, 95% $CI=.50-71$, $p<.001$. Thus participants recognized significantly more targets trained by the ostensive method than by the inferential method.

2.3.3 Question #3: Does training method interact with word class? Might these interact with delay?

Unsurprisingly, there was a strong effect of delay, $OR=.32$, 95% $CI=.28-.35$, $p<.001$ —the odds of identifying a word's target meaning after 5 minutes were approximately 3 times greater than after one week. The interaction between training method and word class was tested to see whether one of the two training methods was particularly effective with one of the two word classes, but it was not significant, $OR=1.17$, 95% $CI=.95-1.43$, $p=.14$ (adjusting for imageability, delay, and number of occurrences per trial). Word class was not significant in ostensive trials ($OR=.93$, $p=.24$) or inferential trails ($OR=1.09$, $p=.31$; adjusting for imageability, delay, and number of occurrences per trial). Testing whether word class or training method or their interaction differed by delay was accomplished in three separate models, each adjusting for word imageability, number of occurrences, and independent variables. Word class did not interact with delay ($OR=1.11$, 95% $CI=.90-1.37$, $p=.32$; adjusting for imageability, training method, and number of occurrences per trial). At the five-minute delay test was $OR=.94$, 95% $CI=.84-1.07$, $p=.36$, and at the one-week test was $OR=1.05$, 95% $CI=.89-1.23$, $p=.60$. Method of learning did not interact with delay, $OR=1.17$, 95% $CI=.93-1.46$, $p=.17$. At five minutes, its effect was $OR=.54$, 95% $CI=.44-.65$, $p<.001$, and at one week, its effect did not reach significance, $OR=.86$, $p=.11$. A three-way interaction model was tested to see whether the interaction between word class and training method differed by delay. This 7-factor model adjusted for the independent variables and all three two-way interactions was not reliable ($OR=.68$, 95% $CI=.44-1.05$, $p=.08$).

3. Discussion

The current study's aims were to assess the evidence for a noun advantage in beginning second language vocabulary learners, and to compare ostensive and inferential training method efficacies. This study presents some of the strongest experimental evidence to date demonstrating a distinct lack of any advantage for one or the other word class when English-speaking adults learn foreign vocabulary. There was no indication that nouns or verbs were any easier than one other, even after adjusting for target meaning, utterance length, image quality, and other important stimulus features.

Comparing training methods, it was found that ostensive training, with or without accompaniment by context images, was superior to inferential training. Evidence did not support the hypothesis that inferential learning would be useful for verb learning, or offer a deeper level of processing to slow the rate of forgetting. Next I consider current findings framed within the word learning theories mentioned earlier.

Five noun advantage arguments based on the L1 literature were mentioned in the introduction. Reflecting on these, four of them could not be fairly assessed with the current study's design. The syntactic complexity argument (Pinker, 1994; Naigles, 1990) did not lend well to testing in the current study because I eliminated syntactic complexity by constraining all labeling phrases to two words. The inherent complexity of verb meaning argument (Akhtar, Jipson, & Callanan, 2001; Tomasello, 1992, 2003) could not be judged because current verb meanings were simplified by taking them directly from learners' L1 (meanings were known by all participants before this study). One might argue that, whether the learners' L1 contains the definition of a novel verb or not, the problem of identifying an L2 verb's meaning is still the same puzzle. Implicit in the design of the current study is the idea that mature learners can jump to L1-like interpretations of L2 words (assessed by their matching those words to L1 definitions). The noun-dependency hypothesis (Greenfield & Alvarez, 1980; Gleitman et al., 2006; Gentner, 2006; Waxman & Lidz, 2006; Sandhofer & Smith, 2007; Tomasello, 2003) could not be fairly assessed because learners did not lack for L2 verb argument knowledge (L1 nouns), which this hypothesis specifies is a prerequisite for verb learning. One might argue learners could not have known in advance that the current L2 verbs depended on L1-equivalent noun arguments, but learners appeared quick to assume this. Finally, the natural partitions / relational relativity hypothesis (Gentner, 1978, 1982; Gentner & Boroditsky, 2001) might not be fairly assessed in the current study. This hypothesis states that nouns should be relatively easier to learn because their meanings are naturally partition-able from context (so they may be identified in images with ease); learners should be less certain about which aspects of actions or state-changes, and which relations between which arguments, are encoded by verbs. Although L2 verb meanings could not be fully ascertained from line drawing illustrations, the current task forced learners to associate L2 words to their impressions, which they did without trouble (as well as with nouns). The hypotheses mentioned thus far all attribute the noun advantage to greater conceptual or syntactic complexity of verbs, which the current study could not weigh in on.

Only the cultural emphasis argument (Gopnik & Choi, 1990, 1995) can be weighed in upon in the context of this study. This theory suggests those who have been fully acculturated into the English linguistic and cultural norms for most or all of their lives ought to demonstrate a stronger preference for noun learning than verb learning because nouns are linguistically and culturally more valued in English. Evidence supporting this premise comes from English propositional syntax: English subject-verb-object ordering places nouns in the utterance initial and utterance final positions, both honorary due to their greater saliency and memorability (Au, Dapretto, & Song, 1994; Seidl & Johnson, 2006; Goldfield, 1993). A second form of greater status of nouns in English is the noun bias in maternal input in short (but not longer) sentences, and that mothers prompt their toddlers to produce nouns more than verbs (Goldfield). Linguistically and culturally, English-speakers appear to value nouns more than verbs. Native speakers of English should be acculturated to this value system and disproportionately attend to and learn nouns in greater proportion than verbs. This was not demonstrated; therefore the current evidence undermines the cultural emphasis argument.

This study was not without its faults. The sample size was somewhat small, especially for multifactor modeling. One rule of thumb devised to figure how many factors should be allowed in models with limited sample sizes is $N=50 + 8k$, where N is the sample size and k is the number of factors to be modeled (Green, 1991). Following this rule of thumb would mean keeping the model to only four factors. Hosmer and Lemeshow (2000) suggested $N = 20k$ in logistic regression, which would similarly result in advising four or fewer factors given the current sample size.

Also, a design alteration partway through data collection should have been avoided, ideally. One tricky issue with contrasting two training methods was that of equating the number of occurrences as well as presence of context in each trial. Inferential trials presented targets only once (in context images), but ostensive trials presented targets twice per trial (once alone as an ostensive labeling experience, and once in the context image). The number and type of context images shown between training methods was equal, but the number of target occurrences was not. This might have been corrected by presenting a second unique context image so that, together with the first, learners could infer word meanings between pairs of context images.

It could not be known whether participants initially assumed L1 interpretations of targets from their pictures, yet that is how knowledge was assessed. Alternative interpretations of targets could not be assessed. Participants were assessed in how well they could identify the target meaning of each noun and verb using English words. The assumption that learners interpreted target concepts using English words should be confirmed.

What is clearer is that, whatever participants' interpretations, verbs were not disadvantaged relative to nouns. If we accept that learners translated targets into English words, the observed null effect of word class could be due to already having lexemes for these target concepts. That is, learners could have jumped to L1 interpretations of targets presented with L2 vocabulary, either due to the nature of learners or the nature of the task. Learners were able and willing to define meanings with L1 words. This study suggests a pre-potent interpretive technique that mature L2 learners use to find and create meaning when learning L2 vocabulary.

4. Conclusions

The current study did not find a noun advantage among second language learners. Theories reviewed here offer explanation for its presence in early childhood, and why it might exist for mature language beginners in naturalistic or immersive learning circumstances. When second language learners must learn new nouns and verbs without direct translations into their L1, the task must be harder. L2 words can have different meanings than their closest L1 synonyms. Better weighing of more vocabulary learning theories could be accomplished by investigating noun and verb learning under more naturalistic learning contexts.

Mature beginners of a foreign language probably regularly use L1 meanings to interpret L2 word meanings. This vocabulary learning strategy would be highly efficient but without guaranteed accuracy. Linking L2 words to L1 meanings enables learners to efficiently gain access to word meanings, a need that is arguably far greater than the

need to be exactly right. This strategy is usefully applied in widely used paired-associate training strategies such as current ostensive conditions, flash cards, and dictionary use. Although critics point to its inadequacies, de-contextualized learning is without a doubt faster than contextualized approaches such as authentic text exposures. It is true that de-contextualized approaches do not permit learning various shades of actual L2 word meanings (Oxford & Crookall, 1990). However they are valuable when learners demand quick gains in L2 vocabulary, and can be accepting of slight definitional errors. Given this goal, on the results of this study, ostensive learning fared well against inferential learning.

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Appendix A

	Nouns	Nonce Lang. A	Nonce Lang. B	Verbs	Nonce Lang. A	Nonce Lang. B
List 1	alligator	YAINOOP	PAITH	bungee jumping	THOS	KIRF
	apple	PUV	YIRG	clapping	YIRG	PUV
	armadillo	KOS	PIRVEET	climbing	PIRVEET	KOS
	astronaut	PECH	REZ	digging	DOOV	WIRJSH
	cat	LUZ	FEECH	dribbling	JEV	FOOCHAIZ
	cow	JIRS	THOOK	golfing	DEEJSH	KAICH
	deer	NUTH	NOOLUF	jumping	NOJSH	KEEM
	doctor	SHEK	FET	jumproping	YOJSH	WOOG
	dog	KEEM	NOJSH	kayaking	THEKOJSH	LEET
	fish	TOOZIRN	DAIJSH	kissing	NOOV	NAIP
	flower	BEZ	SOOCH	knitting	SHAIJSH	SEEG
	frog	SHOOF	TAIV	laughing	DAIJSH	TOOZIRN
	hippo	YUZ	LAITH	parachuting	JOOCH	NIRL
	kangaroo	YEEL	GEEMIRB	singing	CHUPOJSH	ZUNOK
	king	REEJSHUL	WUF	skiing	ZAIB	ROOP
	monkey	ZUNOK	CHUPOJSH	sledding	DAIBIRV	RUZ
	moose	TUZ	YAIK	sleeping	LUCHOF	BEJEEG
	officer	RUZ	DAIBIRV	smoking	WES	WODUF
	rabbit	WOZ	ZEL	sneezing	HEZIRP	TEB
	sailor	ZEEJSH	LIRV	spinning	YEEB	SHENIRK
sheep	DIRCH	YEF	swimming	LIRV	ZEEJSH	
spider	SIRJSH	YOOCH	typing	YOOCH	SIRJSH	
turtle	RAIG	THEEG	winking	SHIRM	FEKOTH	
zebra	GAIVEM	ZIRCH	writing	ZIRCH	GAIVEM	

	Nouns	Nonce Lang. A	Nonce Lang. B	Verbs	Nonce Lang. A	Nonce Lang. B
List 2	angel	ROOP	THOS	bathing	PAITH	YAINOOP
	baby	LEESHECH	WIRCHUP	cooking	REZ	PECH
	bear	WIRJSH	DOOV	crying	WIRCHUP	LEESHECH
	bird	FOOCHAIZ	JEV	drinking	THUL	GAIK
	boy	GAIK	THUL	eating	SUF	ZOOG
	car	KIRF	SUF	fishing	WUF	LUZ
	computer	KAICH	DEEJSH	hatching	THOOK	JIRS
	dragon	WOOG	YOJSH	hugging	NOOLUF	NUTH
	duckling	LEET	THEKOJSH	ironing	FET	SHEK
	elephant	ZOOG	REEJSHUL	mopping	SOOCH	BEZ
	fireman	NAIP	SHAIJSH	painting	TAIV	SHOOF
	hedgehog	NIRL	JOOCH	pointing	LAITH	YUZ
	horse	TOJSH	ZUL	praying	ZUL	TOJSH
	mailcarrier	SEB	HAISHOV	reading	GEEMIRB	YEEL
	nurse	DOJSH	NAISES	running	YEF	HEZIRP
	octopus	SEEG	ZAIB	shouting	HAISHOV	SEB
	penguin	BEJEEG	LUCHOF	sitting	YAIK	TUZ
	pig	WODUF	WES	skateboarding	NAISES	DOJSH
	princess	TEB	NOOV	snorting	ZEL	WOZ
	refrigerator	SHENIRK	YEEB	surfing	NETOOD	SAICH
robber	SAICH	NETOOD	talking	FEECH	DIRCH	
strawberry	LEZ	DEB	walking	DET	LEZ	
telephone	LOJSHUV	NEV	waving	NEV	LOJSHUV	
witch	FEKOTH	SHIRM	whispering	THEEG	RAIG	

Appendix B

Target phrases	
List 1	List 2
alligator dribbling	angel hugging
apple jump roping	baby drinking
armadillo climbing	bear bathing
astronaut bungee jumping	bird reading
cat sleeping	boy skateboarding
cow digging	car talking
deer winking	computer surfing
doctor smoking	dragon hatching
dog singing	duckling crying
fish kissing	elephant sitting
flower sneezing	fireman pointing
frog swimming	hedgehog waving
hippo knitting	horse snorting
kangaroo skiing	mail carrier praying
king typing	nurse mopping
monkey clapping	octopus eating
moose sledding	penguin painting
officer writing	pig cooking
rabbit laughing	princess ironing
sailor kayaking	refrigerator running
sheep golfing	robber shouting
spider parachuting	strawberry walking
turtle spinning	telephone fishing
zebra jumping	witch whispering