Derivative Word Forms: What Do Learners Know?

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Some teachers and researchers may assume that when a learner knows one member of a word family (e.g., *stimulate*), the other members (e.g., *stimulant, stimulative*) are relatively easy to learn. Although knowing one member of a word family undoubtedly facilitates receptive mastery of the other members, the small amount of previous research has suggested that L2 learners often have problems producing the various derivative forms within a word family. This study examined the ability of 106 graduate and undergraduate nonnative-English-speaking students to produce appropriate derivatives in the four major word classes (i.e., noun, verb, adjective, and adverb) for 16 prompt words. The results indicated that it was relatively uncommon for subjects to know either all of the four word forms or none of them. Subjects usually had partial knowledge of the derivatives, with productive knowledge of two or three forms being typical. In a comparison of derivational mastery and knowledge of the prompt words on a four-stage developmental scale, the subjects showed increasing knowledge of noun and verb derivatives at each stage, but adjective and adverb forms appeared to be more difficult for them. The results may imply a need for more direct attention to the teaching of derivative forms.

The ability to use the appropriate form of a word in a given grammatical context is essential for developing grammatically suitable language. For example, learners need to produce *precise* when an adjective is required but *precision* in a context requiring a noun. Without this ability, learners must either use only the form of the word they know or substitute another word that fits the grammatical frame. What does knowledge of a word like *precise* imply for knowledge of a related word, such as *precision*? If a learner can use one appropriately, can the teacher or researcher assume that the learner knows the other as well?

Research on L2 vocabulary acquisition has not addressed this question directly, but current views of vocabulary knowledge suggest the complexity of the question by positing vocabulary knowledge as multicomponential, including knowledge of a word's spelling, meaning, collocations, register traits, and grammatical and morphological characteristics (Nation, 2001). Because of the many components to be mastered, vocabulary knowledge must necessarily be incremental, as it would be impossible to learn all of these components fully from only one exposure to a word. At the same time, the likely interrelationships among the components (Schmitt, 2000) suggest that acquisition of one is likely to be connected to acquisition of the others. This article summarizes the key concepts and studies related to acquisition of related word forms, and reports results of a study that investigated the extent to which a learner's general mastery of a target word implies knowledge of related words.

KEY CONCEPTS IN VOCABULARY RESEARCH

Word Family

A *word family* is defined as "a base word with its inflections and derivatives (*stimulate* + *stimulated, stimulates, stimulating, stimulation, stimulant,* and *stimulative*)" (Schmitt & McCarthy, 1997, p. 331). Word families have been used to calculate the size of vocabularies, for example, the number of words in English and the number of words that learners know (Nation & Waring, 1997). The notion of word families is also important to language practitioners, who have long recognized that word-family knowledge is a critical aspect of knowing a word (Nation, 1990; Richards, 1976; Schmitt & Meara, 1997).

The definition of a word family is couched in solely linguistic terms, but psycholinguistic evidence also suggests that the mind groups known members of a word family together, giving a psychological justification for using the word family as a unit for counting and teaching (Bertram, Baayen, & Schreuder, 2000; Nagy, Anderson, Schommer, Scott, & Stallman, 1989). What psycholinguistic research has not discovered, however, is the extent to which learners' acquisition of a word relates to their knowledge of the other words in the word family. For example, when a learner demonstrates knowledge of the verb *stimulate,* what can one expect of the learner's production when the context calls for the noun *stimulation* or the adjective *stimulating?*

Inflections and Derivations

Knowledge of the members of a word family is essential to productive language use, but the different members will not necessarily carry the same learning burden. For example, inflections and derivations seem to impose different learning burdens. The rule-based nature of inflections (i.e., those members formed by attaching the suffixes *-ed, -ing,* and *-s* to a verb) appears to facilitate learning; that is, because the vast majority of verbs in English take these suffixes in a regular and consistent manner, learners should be able to form new inflections by applying grammatical rules (i.e., system-based learning) rather than having to determine each new form from scratch.

Conversely, the formation of derivatives (i.e., members created by adding suffixes to typically produce a different word class, e.g., *stimulate* → *stimulant*) is not always governed by such transparent rules, so learners must often decide on the correct form case by case (i.e., item-based learning). English does have regularities that constrain suffix choice in the formation of derivatives, but they are sometimes opaque and inconsistent, and many learners, or even teachers, are unlikely to be fully aware of them.[1] Learners are therefore likely to see derivatives as idiosyncratic, with no principled way to choose among forms such as *vitality,* ?*vitalness,* and **vitalant.* This view in turn leads to learners essentially having to memorize each item. In addition, Laufer (1997) suggests that English morphemes are not only irregular but also deceptive in the ways they combine to form derivatives. For example, when learners in the current study were asked to form nouns, they used accurate noun suffixes to create the inaccurate forms **releasement, *minimizement, *persistment,* and **survivtion.* It comes as no surprise that derivations are generally acquired after inflections, at least by native speakers (Berko, 1958).

Facilitation

Some evidence suggests a certain amount of transferability, or facilitation, among members of a word family in that learners may be able to

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[1] Although linguistic inquiry is increasingly aware of the "extent of lexical idiosyncrasy, especially in morphological and syntactic properties" (Bybee, 1988, p. 120), some patterns that emerge may be helpful to the language teacher or learner. For example, the noun-forming suffix *-ity* attaches only to an adjective (e.g., *obesity*), and the verb-forming suffix *-ify* attaches either to an adjective (e.g., *purify*) or to a noun (e.g., *codify*) (Selkirk, 1982). Similarly, the verb-forming suffixes *-ize, -en,* and *-ify* select intransitive adjectives (e.g., *solid, formal*) but not transitive adjectives (e.g., *proud, faithful*) (Di Sciullo, 1997). See Bybee (1988) for a discussion of rules and representations governing morphology.

recognize unknown members of a word family from a member they already know. For example, research shows that native-speaking children recognize the word stems within suffixed words before they recognize the meaning of the attached derivational suffix (Tyler & Nagy, 1989) and that the word stem is "the reading unit" (Beauvillain, 1994, p. 317) for prefixed and suffixed words. In addition, native speakers appear to be sensitive to the difference between stem morphemes and nonsense morphemes, suggesting that word stems are used for access to the words of which they are a part (Taft, 1994). These studies indicate that learners can recognize the word stem within a longer affixed word and typically use that stem to recognize the complete word. This finding suggests that a known word stem in an unknown derivative can facilitate the recognition of that derivative; for example, knowing *reflect* may well aid recognition of the unknown *reflection*. (Of course, not all stems are as transparently related to their derivatives, e.g., *example—exemplify*.)

In addition, although learners "spontaneously rely on morphological knowledge to learn novel lexical material" (Sandra, 1994, p. 261), making the relationship between stem and derivative salient can facilitate the learning of the unknown derivative, particularly when the semantic relationship between stem and derivative is not transparent. Sandra (1993, cited in Sandra, 1994) found that highlighting the connection between known Dutch stems and unknown suffixed words helped subjects learn the suffixed words in these nontransparent cases (e.g., *sleutelaar* [*key* + *-er*] = someone who puts the number key on bank cards). In a laboratory setting, Freyd and Baron (1982) found that subjects learned nonword paired associates (*skaffist* = *thief*) faster when they had had previous exposure to the meaning of the nonword stem (*skaf* = *steal*).

A strong version of this facilitative effect is exemplified by Bauer and Nation (1993), who suggest that "the important principle behind the idea of a word family is that once the base word or even a derived word is known, the recognition of other members of the family requires little or no extra effort" (p. 253). As stated above, some facilitation is undoubtedly in effect in the case of reception; however, the facilitative effect may well be less robust in terms of production. Unfortunately, little direct research has investigated the L2 acquisition of productive derivational knowledge, but that which exists indicates that the process is more complex than the above receptively based principle suggests.

PERSPECTIVES ON DERIVATIONAL ACQUISITION

Psycholinguistics

Most psycholinguistic research has focused on the L1, and much has investigated morphological learning and processing under laboratory conditions. A large amount of the work on morphology has involved knowledge of inflections (e.g., Salaberry, 2000); psycholinguistic modeling of the acquisition process (e.g., Feldman, 1995); factors that affect the processing of morphology, such as semantic transparency (e.g., Zwitserlood, 1994); the interactions between learner strategies and input (Kim, McGregor, & Thompson, 2000); the role of phonology (e.g., Stemberger, 1995); the size of the word family (e.g., Bertram et al., 2000); and the frequency of the members within a word family (e.g., Nagy et al., 1989). Though useful for theoretical discussions of the derivative acquisition process, these studies give limited insight into the relationships among members of a word family, particularly in a nonlaboratory, L2-based context.

Receptive Derivational Knowledge

A second major morphological research strand concerns receptive morphological knowledge and reading. The research shows that individuals learn derivations incrementally over a long period of time in an L1 (Nagy, Diakidoy, & Anderson, 1993; Tyler & Nagy, 1990). Reading seems to be a key to the acquisition of L1 derivation, which expands greatly as natives begin to read more. Reading facilitates derivational knowledge in particular because derivational suffixes are more common in the written mode than in the oral mode and are particularly associated with formal and academic discourse (Chafe & Danielewicz, 1987).

One would expect the acquisition of L2 derivations likewise to be an incremental process taking place over a period of time, with reading having a similar beneficial effect. If so, it is unsurprising that learners would find derivations challenging until they had amassed a substantial amount of reading exposure, a state of affairs that does not occur for many learners. The relative lateness (or nonachievement) of L2 derivational acquisition fits with a psycholinguistic model posited by Jiang (2000), who suggests that the learning of syntactic and morphological specifications forms the last stage of L2 word learning and that many words fossilize before this stage. Therefore, morphological specifications such as derivational suffixes are frequently not integrated within the L2 lexicon. Moreover, even if learners receive substantial exposure, it is not

clear to what degree receptive contact through reading (or speech) leads to the ability to use derivatives productively.

Productive Derivational Knowledge

A small number of experimental studies have concentrated on productive knowledge of derivational morphology in an L2. A longitudinal study of three postgraduate students studying in a university in the United Kingdom (Schmitt, 1998) found that even these advanced students had definite gaps in their productive derivational knowledge, especially of the adjective and adverb forms. Furthermore, although they were immersed in the exposure-rich environment of PhD study, over the course of an academic year two of the three students did not appear to advance much in their knowledge of the target words with regard to derivation.

In a larger group study designed to trace the changes in word knowledge over one academic year, Schmitt and Meara (1997) found that, although participants showed an average gain of 330 words, they were able to generate only 15% of the possible derivatives. Similarly, a study focusing on knowledge of target words from the Test of English as a Foreign Language (TOEFL) (Schmitt, 1999) found that undergraduate-bound international students could provide derivatives for all four major word classes (i.e., noun, verb, adjective, adverb) in only 12 of 180 cases. These results give an initial indication that a strong facilitative effect does not operate in the productive mode, or at least not one that works equally well for all word classes. To the contrary, these results suggest that L2 learners have considerable trouble acquiring the full complement of word family members even when they already know one member or more.

These findings have been collaborated by studies looking at the writing of L2 learners. For instance, on a composition written for university placement, derivational morphology accounted for 10.6% of the errors of students who failed an overall examination battery and for 6.2% of the errors of passing students (Bardovi-Harlig & Bofman, 1989). In another study, Singaporean university students often answered cloze blanks in the verb position with derivatives from other word classes, leading Ooi and Kim-Seoh (1996) to conclude that inadequate knowledge of word derivatives was a significant problem for their relatively advanced students. Moreover, an analysis of 20 compositions written by third-year Thai university students found that nearly 10% of the lexical errors identified were due to incorrect derivational suffixation (Hemchua, 2001). On the other hand, Dušková (1969) found that derivational

infelicities constituted only about 2% (19/1,007) of the errors in her corpus of Czech learners' writing, although they made up about 10% (19/180) of the morphological errors.

In sum, evidence suggests that acquiring the productive use of derivative members of a word family can be problematic for learners of English, but there is not sufficient research investigating the degree of the problem or describing it in any detail.

THE RESEARCH

To address the integrated/incremental nature of vocabulary acquisition and use, researchers are beginning to turn to methods for investigating multiple aspects of vocabulary knowledge while attempting to capture the degrees of partial knowledge that L2 learners are likely to have (e.g., Schmitt & Meara, 1997 [vocabulary size, derivative and association knowledge]; Laufer, 1998 [receptive, prompted productive, and free productive degrees of mastery of vocabulary]; Read, 1998 [meaning-based associations and collocations]; Shimamoto, 2000 [spoken form, written form, meaning, collocation, and vocabulary size]). In like fashion, this study investigated productive derivational knowledge across members of a word family and in relation to more global knowledge of the target words. Specifically, the research questions were

1. How many of the four major derivative classes (i.e., noun, verb, adjective, adverb) of a particular word do learners know to a productive degree of mastery?

2. Which of the four major derivative classes are learners most likely to know productively?

3. What is the relationship between productive derivational word knowledge and more global knowledge of a word?

METHOD

Participants

The participants in this study were 36 native-speaking university students (21 first-year and 15 postgraduate), and 106 nonnative learners of English as follows:

- 50 advanced ESL students in an intensive English (preuniversity) program at a U.S. university

- 36 advanced ESL undergraduate and graduate students taking one ESL writing course at a U.S. university
- 20 graduate ESL students completing a master's degree in English language teaching (MA-ELT) at a university in the United Kingdom

The U.S. participants had a mean TOEFL score of 518 (SD = 31.80), whereas the MA-ELT participants had a much higher level of proficiency, as indicated by a mean TOEFL score of 610 (SD = 15.80). Although the mean TOEFL score is based on only four participants (many had taken the International English Language Testing System [IELTS] instead, M = 6.6), the group was able to handle master's-level course work, so the score is probably a fair reflection of the group's proficiency.

To avoid the familiarity speakers of Romance languages might have with English morphology, we focused mainly on learners who spoke noncognate languages. Of the 106 participants, 94 were Asian.[2] The mean age of the U.S. group was 22.7 years, and of the UK group, 31.6 years; 74 participants were females, and 32 were males.

Target Words

Our priority in this study was to select target words and word families that this population was expected to know and use. Because the participants were either university students or nonnative speakers of English who aspired to study in an English-medium university, we chose words from the Academic Word List (AWL; Coxhead, 2000). The AWL contains words that occur in a wide variety of academic contexts and can be seen as essential support vocabulary for reading texts on academic topics, regardless of the discipline. We selected 20 words from the range of 10 frequency-based sublists of the AWL while balancing among the four word classes as much as possible. After piloting, we chose these 16 prompt words: *access, assume, authority, coherent, ethnic, ideology, inevitably, liberal, minimize, persist, philosophy, precise, release, select, survive,* and *traditional.* (*Access* and *release* can each be either a noun or a verb; the AWL includes relatively few adverbs, so we chose only one adverb [*inevitably*]

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[2] One should not assume, however, that all the languages spoken by the Asian participants are equally different from English in terms of morphology. A reviewer insightfully commented that grammatical morphemes play a minimal role in some Oriental languages (e.g., Chinese and Thai), whereas other languages are rich in their verbal morphology (e.g., Korean and Japanese). In addition, morphological information is represented differently in alphabetic and logographic writing systems, and several Asian languages use a logography. Thus, the languages spoken by the Asian participants would have varying typological distances from English, but none would be as close to English as Romance languages are.

as a target word.) Based on frequency data from the British National Corpus (BNC, 1995), each word was the most frequently occurring member of its word family; that is, *select* occurred more frequently than *selection, selective,* or *selectively*. The one exception was *precise*, of which *precisely* was the most frequent derivative.

Frequency, rather than factors relating to morphological difficulty, was the key criterion in selecting the target words. The relative difficulty of each word family is not relevant to the current study, but large differences in relative difficulty of the suffixes relating to the various word classes could have affected the number of derivatives produced in each word class category. However, an analysis of the target word families (see Appendix A) indicated that they were comparable to each other in terms of morphological difficulty according to the list of English affixes created by Bauer and Nation (1993).

Bauer and Nation's (1993) list of affixes has seven levels based on the criteria of frequency, productivity, predictability, regularity of the written form of the stem, regularity of the spelling of the affix, regularity of the spoken form of the affix, and regularity of function. For most of Bauer and Nation's levels, the noun, verb, and adjective word classes took similar numbers of affixes. For example, affixes from Level 4 of Bauer and Nation's list were acceptable with seven nouns, five verbs, and five adjectives. In addition, the three word classes took the basic stem word form (e.g., *survive*) in a similar number of cases (noun, six; verb, seven; adjective, six). All of the adverb forms took the *-ly* suffix, typically building on the adjective form. Because the adjective class appears similar in difficulty to the noun and verb classes, the adverb class should not be much more inherently difficult, considering that the *-ly* suffix is frequent, regular, and transparent. In sum, this analysis suggests that the sampling method produced a group of word families with broadly similar levels of morphological difficulty across the four word classes examined.

Instrument

Section 1

To investigate the learners' knowledge of derivatives in conjunction with their global knowledge, we needed a measure of the learners' degree (or depth) of lexical knowledge. One way of measuring depth of knowledge is to use a developmental scale describing ever-increasing levels of mastery of a word (see Read, 2000, for a thorough discussion of scale instruments). For this study we chose a slightly revised version of the Test of Academic Lexicon[3] (TAL; Scarcella & Zimmerman, 1998), in

which participants self-identify four levels of word knowledge (see Appendix B):

A   I don't know the word.
B   I have seen the word before but am not sure of the meaning.
C   I understand the word when I see it or hear it in a sentence, but I don't know how to use it in my own speaking or writing.
D   I know this word and can use it in my own speaking and writing.

Because the TAL is a self-rating test, we took steps to ensure that it produced an accurate estimate of the participants' lexical knowledge. First, the TAL included four Englishlike nonwords (*artivious, instrotion, ploat,* and *sloist*), and the instructions indicated the following:

> In addition, there are a number of imitation words included with the real words. Carefully consider how well you know each word before marking the survey, so that you don't say that you know a word which does not exist.

The instrument of any subject who judged a nonword at Level C or D was eliminated from the study, as we could not be confident of the subject's other answers. However, because the nonwords were purposely Englishlike, we did not consider it unreasonable for a learner to believe that he or she had seen a nonword before but did not know it, so we did not eliminate instruments with nonwords rated at Level B.

In addition, participants demonstrated their productive knowledge of words rated at Level D by producing a sentence illustrating the meaning of each word. We judged whether the illustrated meaning was appropriate, obtaining interrater agreement in 98.2% of the cases (1,099/1,119), but did not judge grammatical, stylistic, or collocational appropriateness. As such, Level D should be interpreted as basic, rather than complete, productive mastery. Some sentences did not unequivocally illustrate the meaning (e.g., "I hate philosophy"). For the analysis, we retained words for which the sentences were ambiguous and eliminated only words for which the sentences clearly indicated an incorrect meaning sense (3.2%, 36/1,119). The reasoning for this decision was that (a) the nonword results gave evidence that the participants were being careful in their judgments; (b) most participants marked some words at Levels A, B, and

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[3] We selected the TAL for this study because it assesses levels of word knowledge, it can be administered to large numbers of participants, and it is easily scored. It utilizes the distinctive categories of word knowledge and other insights from the Vocabulary Knowledge Scale (VKS; Paribakht & Wesche, 1993), which was designed to estimate the early development of knowledge of specific words in an instructional situation; it requires considerable linguistic expertise and time and is difficult to use with large numbers of participants.

C, suggesting that they reserved Level D for words they were fairly certain about; and (c) even if a subject produced one or two sentences that were ambiguous concerning meaning, many more sentences demonstrated acceptable mastery of meaning.

Section 2

The second part of the instrument was designed to elicit a demonstration of the participants' productive knowledge of the derivative forms of a word family, specifically the primary word classes of noun, verb, adjective, and adverb. (Many of the families also contain members that involve prefixation, but we thought it infeasible to include these in a consistent way across all of the target words.) We wanted to be careful not to rely on the participants' metalinguistic knowledge by framing the prompt in metalinguistic terms, for example, by asking, "What is the noun form of *survive?*" Alderson, Clapham, and Steel (1997) found that even native speakers often lack this kind of grammatical metalinguistic knowledge. Therefore, drawing on an idea from Nagy et al. (1993), we presented a series of four similar, contextualized sentences for each prompt word, to which participants could respond whether or not they had the respective metalinguistic knowledge. The participants were instructed to write the appropriate derivative form of the target word in each blank. They were instructed to place an *X* in the blank if they believed no derivative form existed and were informed that the prompt word could be the proper form without alteration. The format of the target word and prompt sentences was as shown in Appendix B.

The sentences were written to be similar semantically and to recycle as much vocabulary as possible. The vocabulary was drawn exclusively from the 2,000-word General Service List (West, 1953), with the exception of *student, relaxed, yesterday, methods,* and *passport*—all high-frequency words that one would expect the participants in this study to have known at their stage of proficiency. The sentences were mainly designed to constrain the possible derivatives for each sentence to one word class. We provided the word classes for the missing word in each sentence, although the participants did not need this information to fill the blanks. The sentence format also had the advantage of providing context for the derivative forms, in contrast to the previous studies described in the section Productive Derivational Knowledge, which asked subjects to provide the word forms in isolation.

During the formulation and piloting of the sentences, a key concern was producing a list of derivatives that would be accepted as answers. Inevitably, for some of the word classes more than one alternative was acceptable. For instance, in the noun-focused stimulus sentence for the

target word *coherent,* both *coherence* and *coherency* are appropriate forms. In other cases, a prompt word may not have a typical derivative for a certain word class. In order to compile the answer norms in a principled manner, we drew on three sources of information. First, we consulted four learner dictionaries (*Cambridge International Dictionary of English,* 1995; *COBUILD English Learner's Dictionary,* 1989; *Longman Dictionary of English Language and Culture,* 1992; *Oxford Advanced Learner's Dictionary,* 1995) and extracted all listed derivatives. Second, we checked the frequency of these derivatives in the BNC and considered eliminating those that had very low frequency counts or did not exist in the corpus. Third, 36 native-English-speaking university students (21 first-year and 15 postgraduate) completed the instrument. Balancing the information from these three sources, we compiled a principled list of acceptable derivatives (see Appendix A).

The native speakers did not always agree completely concerning the norm list, in some cases (e.g., the noun form of *liberal* or the adjective form of *authority*) being split among several answers. Because the native speaker results were direct responses to the instrument used in the main study, we weighted them more heavily than the dictionary and corpus evidence, so for many word classes several derivative forms were considered acceptable. In other cases (e.g., the verb form of *traditional*), a large percentage of the native-speaking group indicated a certain derivative form (e.g., *traditionalize* for the verb form of *traditional*) whereas another large percentage indicated that no typical derivative form existed. On the basis of this behavior, we decided to accept either a derivative form or *X* in these cases.

Procedure

We piloted a 20-word draft version of the study instrument (including the revised TAL and a derivative elicitation section) with 38 English for academic purposes learners from 11 different L1s to choose 16 well-performing items and 4 nonwords. In the pilot and main studies, the participants were given instructions on how to carry out the task. The TAL rubric included two examples of how to complete the knowledge scale, and the rubric for the derivative section contained one example. All proctors were ESL instructors, who were given these written instructions:

1. Answer student questions about the Information Form (p. 1) as needed. Assure students that their names will not be used and the results are for a research project.
2. Read the instructions of Section 1 as the test begins.

3. Students should work at their own pace. As individuals complete Section 1, have them turn it in before starting Section 2. They are on their own to read the directions for Section 2.

We checked the validity of the respondents' judgments in two ways. First, we determined whether any of the participants had rated nonwords at Level C or D. Participants claiming to know a nonword were assumed not to be providing valid information and were eliminated from the study, leaving 106 participants. Next, we verified the words that each participant had claimed to know well (i.e., at Level D) by examining the sentence constructed for that word. In a few instances (40), the sentences illustrated clearly incorrect meanings, leaving us with conflicting evidence as to the true state of the learner's lexical knowledge (i.e., D rating vs. incorrect sentence). We therefore deleted these words from the analysis, reducing the pool of words for the analysis from 1,696 (106 participants (16 words) to 1,656 words.

The answers on the derivative section were then checked against the list of acceptable derivatives. We counted misspellings as correct as long as the intended derivative could be discerned, as we were more interested in knowledge of the derivatives than in complete mastery of their correct spellings. We made this decision in light of the native-speaking respondents' tendency to misspell derivatives often (e.g., *persist<u>ent</u>ly* and *persist<u>ant</u>ly* were given with similar frequency). Although the verb sentences were designed to require uninflected forms, we disregarded any attached inflections, as our focus was on derivational, not inflectional, suffixes. For example, "We decided to *selected* one car" was counted as correct.

Analysis

Analysis focused on the words themselves rather than on the participants' overall scores. To gain an indication of how many of the four major derivative classes learners knew, we calculated the percentages of words for which learners produced none, one, two, three, and four derivative forms by dividing the number of derivative forms produced for a target word (e.g., 0) by 1,656, the number of words included in the analysis. For example, for 91 of the 1,656 words (5.5%), the participants produced no correct derivatives. Because word knowledge was assumed to be different for the ESL students than for the more advanced MA-ELT students, we performed separate calculations for each group.

To find evidence about which of the derivative classes learners are most likely to know productively, we calculated the percentages of derivative forms produced correctly within the four major word classes

based on the total (1,656 words). Finally, to look at the relationship between knowledge of particular word categories and level of word knowledge based on the TAL ratings, we divided the number of cases in which the subjects produced the particular derivative by the total number of words rated within a given TAL category, resulting in a percentage. For example, the combined nonnative subjects rated 121 words at TAL Level A. In 24.8% (30/121) of the cases, they were able to produce the correct noun derivatives.

RESULTS

Results did not support a strong facilitative effect for knowledge of words within a word family. Instead, learners tended to know only some members of a family, with nouns and verbs the most likely to be known. Even for words rated as well known, word family knowledge was partial.

Number of Derivative Classes

The first question was how many of the four word forms learners in this study could produce. For the whole group of participants, the mean number of derivatives produced was 37.6 (SD = 9.84) out of a possible 64.0 (16 target words $\times$ 4 derivatives per word), or 58.8%. This means, on average, that the participants produced two of the four possible derivatives for a given word family. However, the number of derivatives produced varied across groups, with the ESL students tending to produce two or three forms and the more advanced MA-ELT students tending to produce three or four forms.

The students failed to produce any derivatives for only a small percentage of the target words (ESL, 6.6%; MA-ELT, 0.3%; see Table 1). On the other hand, full mastery of the word family (all four forms) was evident in a relatively small percentage of the cases, as even the advanced postgraduate students produced fewer than 45% of the possible derivatives for words they rated at Level D on the TAL ("I know this word and can use it in my own speaking and writing"). These results indicate that the data do not support the strong version of the facilitative effect among word family members; knowing one member of a word family does not imply productive knowledge of all (or even most) of the other word forms.

TABLE 1
Words for Which Participants Produced Zero, One, Two, Three, and Four Derivative Forms

Student group	Total no. of words	Derivative forms produced									
		0		1		2		3		4	
		No.	%	No.	%	No.	%	No.	%	No.	%
For all prompt words (1,656)											
ESL[a]	1,353	90	6.6	291	21.5	417	30.8	383	28.3	172	12.7
MA-ELT[b]	303	1	0.3	12	4.0	54	17.8	106	35.0	130	42.9
ESL & MA-ELT[c]	1,656	91	5.5	303	18.3	471	28.4	489	29.5	302	18.2
For prompt words rated at Level D (1,089)											
ESL[a]	818	19	2.3	149	18.2	253	30.9	249	30.4	148	18.1
MA-ELT[b]	271	1	0.4	10	3.7	50	18.4	89	32.8	121	44.6
ESL & MA-ELT[c]	1,089	20	1.8	159	14.6	303	27.8	338	31.0	269	24.7

[a]$N = 86.$ [b]$N = 20.$ [c]$N = 106.$

Which Derivative Classes?

The second question was which of the derivative classes participants were most likely to know productively. The results indicate that the participants knew some classes better than others (see Table 2). Verb derivatives were the best known, with 67% produced; nouns were next, at 63%. Adjectives and adverbs were less well known (54% and 52%, respectively). These results are roughly in line with previous research, which generally shows nouns as the best known word class and adverbs as the least known, with verbs and adjectives in between (Phillips, 1981; Rodgers, 1969). The higher figure for verbs in this derivationally focused study probably is due to the fact that verbs are usually word stems; therefore, learners did not have to produce derivational affixes in supplying grammatically appropriate verbs. The results are also congruent with the results of other studies, which generally predict that noun and verb classes will be less difficult to learn than adjective and adverb classes. One explanation is that the class of noun or verb carries semantic information (e.g., nouns are names of places, persons, or things, and verbs represent actions) that is fundamental to meaning (see Braine, 1987, for a discussion of L1 word class acquisition theories).

TABLE 2
Derivative Forms Produced According to Word Class

| Student group | Total no. of words | Derivative forms produced | | | | | | | |
| | | Noun | | Verb | | Adjective | | Adverb | |
		No.	%	No.	%	No.	%	No.	%
ESL[a]	1,353	787	58.2	868	64.1	677	50.0	629	46.5
MA-ELT[b]	303	254	83.8	244	80.5	226	74.6	234	77.2
ESL & MA-ELT[c]	1,656	1,041	62.9	1,112	67.1	903	54.5	863	52.1

[a]$N = 86$. [b]$N = 20$. [c]$N = 106$.

Derivational Knowledge and Global Vocabulary Knowledge

The third question asked to what extent a relationship exists between reported knowledge of a word and productive derivational knowledge. The percentages of derivatives produced by the participants increased with the level of overall word knowledge they claimed (see Table 3). For example, the two ESL groups combined rated 121 target words at TAL Level A and produced the correct noun derivative for 30 (24.8%) of these nouns. The percentage of correct noun derivatives produced increases steadily across the TAL levels to 72.2% for words reported as known. This relationship is evident for verbs, too, but not for adjectives or adverbs, both of which participants produced in a less regular pattern.

The percentage of derivatives produced by all students was 36.8% for words reported as unknown (Level A) and 65.5% for words reported as known well (Level D). Learners produced a surprisingly large percentage of derivatives for target words they rated as fully unknown (Level A). At the other end of the range, for words rated as productively known (Level D), the less proficient ESL learners produced only 60.9% of the possible derivatives, and the more proficient MA-ELT learners, 79.4%, both far short of full mastery. These results support the notion that full mastery of the word forms of a word family is difficult for L2 English learners.

The performance of the native speakers indicates a high but less than complete productive knowledge of the derivational morphology. Overall, productive control of the complete range of derivative forms of a word family seems to be advanced knowledge that even natives cannot be guaranteed to fully master.

TABLE 3
Derivative Forms Produced for Words Rated at Each TAL Level

Student group	A No.	A %	B No.	B %	C No.	C %	D No.	D %
				TAL Rating				
				All words				
ESL[a]	171/476	35.9	311/704	44.2	486/960	50.6	1,994/3,272	60.9
MA-ELT[b]	7/8	87.5	10/12	83.3	80/108	74.1	861/1,084	79.4
ESL & MA-ELT[c]	178/484	36.8	321/716	44.8	566/1,068	53.0	2,855/4,356	65.5
Native speakers[d]	—	—	—	—	—	—	2,093/2,296	91.2
				Nouns				
ESL[a]	28/119	23.5	68/176	38.6	134/240	55.8	557/818	68.1
MA-ELT[b]	2/2	100.0	1/3	33.3	22/27	81.5	229/271	84.5
ESL & MA-ELT[c]	30/121	24.8	69/179	38.5	156/267	58.4	786/1,089	72.2
Native speakers[d]	—	—	—	—	—	—	536/575	93.2
				Verbs				
ESL[a]	31/119	26.1	95/176	54.0	138/240	57.5	604/818	73.8
MA-ELT[b]	1/2	50.0	3/3	100.0	20/27	74.1	220/271	81.2
ESL & MA-ELT[c]	32/121	26.4	98/179	54.7	158/267	59.2	824/1,089	75.7
Native speakers[d]	—	—	—	—	—	—	513/574	89.4
				Adjectives				
ESL[a]	56/119	47.1	71/176	40.3	111/240	46.3	439/818	53.7
MA-ELT[b]	2/2	100.0	3/3	100.0	20/27	74.1	201/271	74.2
ESL & MA-ELT[c]	58/121	47.9	74/179	41.3	131/267	49.1	640/1,089	58.8
Native speakers[d]	—	—	—	—	—	—	516/572	90.2
				Adverbs				
ESL[a]	56/119	47.1	77/176	43.8	103/240	42.9	393/818	48.0
MA-ELT[b]	2/2	100.0	3/3	100.0	18/27	66.7	211/271	77.9
ESL & MA-ELT[c]	58/121	47.9	80/179	44.7	121/267	45.3	604/1,089	55.5
Native speakers[d]	—	—	—	—	—	—	528/575	91.8

[a]$N = 86.$ [b]$N = 20.$ [c]$N = 106.$ [d]$N = 36.$

DISCUSSION

The results indicate that knowledge of one word in a family does not necessarily imply productive knowledge of other forms in that family. If learning the derivative forms in a word family were relatively automatic once a student knew one member, the participants would have either (a) marked prompt words and their derivative forms as unknown (Level A) or (b) produced all derivative forms for prompt words reported as known (Level D). All the values in the Level A column of Table 3 would have been 0%, and all the values in the Level D column would have been 100%. Likewise, in Table 1, the highest percentages would have been in the 0 (no forms produced) or 4 (four forms produced) columns. Instead, the trend seems to be that the participants knew some, but not all, derivatives. In fact, the combined nonnative participants had productive knowledge of derivatives in all four major word classes in only 18.2% of the cases. This percentage was only slightly higher (24.7%) for words that they indicated they could use in their speech and writing (Level D).

These findings are in line with the previously mentioned studies challenging the facilitative effect of word family knowledge in the productive mode. The figures in Table 3 indicate that a learner who knows a word receptively or productively is likely to be able to produce either two or three of its four word class derivatives. In addition, learners are likely to know one or two of the derivative forms even for words that they would rate as unknown. Like most (or perhaps all) other forms of lexical knowledge, derivational knowledge seems to be learned incrementally, with learners typically knowing some, but not all, of the derivative forms in a word family.

Increases in the numbers of forms known are evident in the differences among the three groups of participants: The ESL students knew the fewest derivative forms, the proficient and experienced MA-ELT students knew more, and the native speakers knew the most. These differences suggest that global mastery of derivative forms may increase with general proficiency, although even very advanced users of English are likely to have some gaps in their derivational knowledge.

The ESL learners showed clear, consistent improvement in their ability to produce noun and verb derivative forms through the four learning stages represented by the TAL scale. Conversely, their performance on the adjective and adverb word forms was more erratic. The data indicate that the learning of adjective and adverb derivative forms does not track as closely with improving general word knowledge as the learning of noun and verb derivative forms.

Although learners seem to manage some derivational knowledge even for words reported as unknown, extending this knowledge to all four word forms seems to be difficult. Learners may plateau at a certain level

of derivational acquisition owing to factors other than difficulty alone. For example, Jullian (2000) suggests that advanced learners experience a "lexical acquisition plateau" (p. 37) in which they manage to communicate with a restricted vocabulary and therefore do not feel the need to incorporate new terms. Similarly, Laufer (1991) has suggested that when advanced learners can communicate adequately with restricted vocabulary, they lack the "communicative need" (p. 441) to inspire them to expend the effort to learn additional items. In terms of derivational knowledge, this suggestion may be particularly relevant; learners can often be understood when they use incorrect word forms. Furthermore, in her active vocabulary threshold hypothesis, Laufer suggests that learners' productive and receptive vocabularies differ considerably: "Even though our passive vocabularies develop throughout our lifetime, long after the grammar of a language has been acquired, our productive lexicon will grow only until it reaches the average level of the group in which we are required to function" (p. 445).

IMPLICATIONS FOR TEACHING

This study indicates that teachers cannot assume that learners will absorb the derivative forms of a word family automatically from exposure. Rather, in this area, explicit attention to form may be of value. The call for explicit instruction in suffixes is not new (see Thorndike, 1941); Nation (1990, 2001) has long argued for the explicit teaching of word parts. In addition, Laufer (1991) suggests that the teacher should create the necessity for vocabulary enrichment, thus helping learners progress beyond the average productive vocabulary level of the group in which they are functioning. Although there is insufficient L2 research to inform a comprehensive approach, the following set of suggestions drawn from the literature may prove useful in setting up such instruction (see Nation, 2001, chapter 8, for detailed pedagogical advice).

When presenting a new word to students, also introduce its derivative forms. Learning lexical items with their derivative forms may help learners begin thinking in terms of word families instead of individual words (Schmitt, 1994). After learners gain some awareness of regularities in English word formation, teachers can ask them to infer the derivatives of a new word. Factors found to facilitate learning of new words include a combination of unproblematic pronunciation, derivational regularity, and morphological transparency (Laufer, 1997). A word family that does not have these general characteristics—which can make learning its various derivatives easier—might be a logical target for teaching.

Instruct learners in English affixes. Instruction in affixes can involve work with word formation regularities, such as those found in the *Cambridge International Dictionary of English* (1995, pp. 262–264). Learners might also memorize a list of key words as a mnemonic aid for the component morphemes to use in new words (Nation, 1990, pp. 168–174). When providing this instruction, teachers should remember that suffix use can be deceptive, leading to inaccurate forms, such as the above-mentioned **releasement* and **survivtion*. Learners need instruction in the use of suffixes along with a healthy dose of caution.

Emphasize adjectives and adverbs as needed. Because adjective and adverb forms appear to be the least likely members of a word family to be known, teachers might logically emphasize them in explicit instruction to the extent that other factors (e.g., frequency of use) suggest their importance.

Suggest academic reading when appropriate. Identification of the relationship between derivational knowledge and types of input was beyond the scope of this study, but L1 research suggests that reading aids in the acquisition of derivatives. Academic texts in particular provide exposure, which facilitates acquisition (Chafe & Danielewicz, 1987; Nagy et al., 1993; Tyler & Nagy, 1990). Academic reading might have a similar beneficial effect for ESL learners.

CONCLUSION

An interesting finding in the research was that the responses of the native-English-speaking participants showed a great deal of creativity and sometimes a lack of consensus on the correct derivatives. Perhaps even proficient speakers generate inappropriate word forms based on partial derivational knowledge. This tendency can serve as a teaching opportunity. When the creative forms may be acceptable, they should be acknowledged as such; when they are not acceptable, teachers should try to capitalize on the partial knowledge that these errors indicate. For example, the teacher might explain that a certain suffix is correct for the desired part of speech but not with the particular word given. A reminder that the derivational system in English seems deceptively regular but is in fact arbitrary may be useful; using derivative forms accurately is no easy task, so the failure of ESL learners to use derivatives correctly is not surprising.

Research on ESL learners' writing suggests that derivational errors are a significant problem even if they are not especially numerous compared with other errors, such as article errors or verb inflection errors (Bardovi-

Harlig & Bofman, 1989). Given the general state of incomplete derivational knowledge indicated by this study, why are derivational errors not more widespread? We suspect that learners may avoid derivative forms. Learners may prefer to use a particular word but realize they are unsure of the appropriate derivative, or they may simply learn how to express a particular idea without needing to attempt unknown derivatives. In this case, a considerable portion of a learner's lexicon may remain unused due to the lack of requisite knowledge of derivation. This aspect of lexical knowledge and use seems an opportune target for additional research.

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APPENDIX A

Accepted Derivative Forms of Prompt Words

Noun	Verb	Adjective	Adverb
assumption	*assume*	assumed X	X
authority authorization	authorize	authorized authoritive authoritative	authoritively authoritatively
tradition	traditionize X	*traditional*	traditionally
selection	*select*	selective select selected	selectively
access accessibility	*access*	accessible accessed	accessibly X
ethnicity	X	*ethnic*	ethnically
philosophy	philosophize	philosophical philosophic	philosophically
inevitability	X	inevitable	*inevitably*
liberality liberalization liberalness liberty	liberalize	*liberal*	liberally
release	*release*	released	X
survival	*survive*	surviving	X
ideology	X	ideological X	ideologically
precision preciseness	X	*precise*	precisely
minimum minimization	minimize	minimal minimum	minimally
coherence coherence	cohere X	*coherent*	coherently
persistence persistency	*persist*	persistent	persistently

Note. The most frequently occurring member of each word family is in italics; *X* indicates a judgment that no typical form exists.

APPENDIX B

Instrument

Section 1

Directions: For each of the words that is listed below, select the ONE blank that best describes how well you know the word. IF YOU SELECT BLANK D, PLEASE WRITE A SENTENCE WHICH USES THE WORD AND SHOWS ITS MEANING.

Make sure you show the meaning of the word in the sentence. If the meaning is unclear or incorrect, you will be marked down. In addition, there are a number of imitation words included with the real words. Carefully consider how well you know each word before marking the survey, so that you don't say that you know a word which does not exist.

A	B	C	D
I don't know the word.	I have seen the word before but am not sure of the meaning.	I understand the word when I see or hear it in a sentence, but I don't know how to use it in my own speaking or writing.	I know the word and can use it in my own speaking and writing. [If you select this blank, please write a SENTENCE which uses the word and shows its meaning.]

Section 2

Directions: Most words can be changed to different parts of speech. For example, the word STIMULATE is a verb but can be changed to a noun form (STIMULATION) or an adjective form (STIMULATING). In the case of STIMULATE, there is no adverb form, but many other words do have an adverb form.

In this section, look at each word and write the correct form in each sentence. If there is more than one possibility (e.g., more than one adjective form) you only need to write one. If there is no form, put an "X" in the blank on the left. Sometimes the form will not need changing, as it is already correct (such as STIMULATE in the example below).

EXAMPLE:

stimulate		
<u>stimulation</u>	Noun	A massage is good _____.
<u>stimulate</u>	Verb	Massages can _____ tired muscles.
<u>stimulating</u>	Adjective	A massage has a _____ effect.
___X___	Adverb:	He massaged _____.

1. assume
    Noun   He made an _____ that she likes meat.
    Verb   He can _____ that she likes meat.
    Adjective He had an _____ idea that she likes meat.
    Adverb   He decided _____ that she likes meat.

2. authority
    Noun   The judge had the _____ to let us view the tax records.
    Verb   He decided to _____ the viewing of the tax records.
    Adjective The _____viewing of the tax records was unpopular.
    Adverb   All judges speak _____.

3. traditional
    Noun   The celebration of Thanksgiving is an American _____.
    Verb   Americans _____ Thanksgiving.
    Adjective Thanksgiving is a _____ American holiday.
    Adverb   Thanksgiving is _____ celebrated in American families.

4. select
   Noun   There was a large _____ of cars to buy.
   Verb   We decided to _____ one car.
   Adjective The best cars were bought by ___ car customers who chose carefully.
   Adverb   We looked at the cars _____.

5. access
   Noun   The university student was given _____ to the library.
   Verb   The student wanted to _____ the library.
   Adjective The helpful librarians make it an _____ library.
   Adverb   The library was _____ located.

6. ethnic
   Noun   The people in his neighborhood shared the same _____.
   Verb   The neighborhood _____.
   Adjective The people lived in _____ neighborhoods.
   Adverb   The neighborhoods were divided _____.

7. philosophy
   Noun   She explained her _____ of life to me.
   Verb   She was known to _____ about her life.
   Adjective She was known as a _____ person.
   Adverb   She discussed her life _____.

8. inevitably
   Noun   A disagreement between the two politicians was an _____.
   Verb   A disagreement _____.
   Adjective The _____ disagreement between the politicians was loud.
   Adverb   A disagreement _____ occurred.

9. liberal
   Noun   The _____ of the law was opposed by some politicians.
   Verb   They did not want to _____ the law.
   Adjective His _____ opinions were not accepted by the politicians.
   Adverb   He voted _____.

10. release
    Noun   The _____ of the prisoner was delayed.
    Verb   The police had to _____ the prisoner yesterday.
    Adjective The _____ prisoner left town.
    Adverb   The prisoner left town _____.

11. survive
    Noun   A young child fought for _____ after the accident.
    Verb   The child _____ the accident.
    Adjective The child was the only _____ member of the family after the
              accident.
    Adverb   The child lived _____.

12. ideology
    Noun   The first politician had a different _____ from the second
              politician.
    Verb   The two politicians _____ differently.
    Adjective The two _____ politicians differed.
    Adverb   The two politicians differed _____.

13. precise
    Noun   A doctor must work with _____.
    Verb   A doctor _____.
    Adjective Medical care requires _____ work.
    Adverb   Doctors must work _____.

14. minimum
   Noun   Advanced warning of the storm resulted in a _____ of damage.
   Verb   The advanced warning of the storm helped to _____ its damage.
   Adjective   The storm caused _____ damage.
   Adverb   The area was damaged _____.

15. coherent
   Noun   The judge was impressed by the _____ of the lawyer's argument.
   Verb   The lawyer makes sure her points _____ with one another.
   Adjective   The lawyer made _____ arguments.
   Adverb   The lawyer argued _____.

16. persist
   Noun   The judge changed his mind because of the lawyer's _____.
   Verb   The lawyer would _____ until the judge changed his mind.
   Adjective   The _____ lawyer persuaded the judge to change his mind.
   Adverb   The lawyer argued _____.