

# It's Not Impossible: Bringing Derived Words Out of the Shadows in an Electronic Dictionary

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## Abstract

The paper proposes that expanded and improved treatment of morphological information is both needed and newly possible in electronic English dictionaries, including dictionaries for native speakers. The focus is dictionary selection, treatment, and presentation of derived words. Inconsistencies and inadequacies can be attributed not only to print's legacy, but also to assumptions about native speakers' automatic acquisition and application of word formation rules that are challenged in this paper, and to the more philosophical problem of how the lexicalized word relates to the morphologists' word. Word Formation Rules developed in linguistics and the properties of electronic media enable lexicographers to produce and display new entry information and new navigational pathways through dictionary data.

**Keywords:** English dictionaries; morphology; derivation; electronic dictionaries

## 1. Introduction

Is it a word? This is one of the questions for which a dictionary can provide answers. In many cases, however, a dictionary search will not return an answer. We can all think of numerous reasons why that would be, some of which might be overridden by online aggregation or integration of dictionaries, some of which would not. The present study focuses on one reason in particular, and that is the inadequacy of morphological, or word formation, information in the typical English monolingual dictionary. For "inadequacy," one might substitute the word "latency," for it has been estimated that in a 100,000-word dictionary, 80% of the words are complex words formed from other words by means of derivation. Morphologists use dictionary data in formulating theories and rules of word formation. Yet the only explicit dictionary treatment of words *as* derived words occurs in run-ons of a headword entry, where a limited type of derived words are listed, minimally with part of speech, sometimes with syllabification and pronunciation, and rarely, as in *Collins Cobuild*, an example sentence.<sup>1</sup> Users who look up *latent* may or may not find the noun *latency* listed in that entry, and, if they do find *latency*, there will necessarily be no headword entry for it. A search on the word *squashable* will yield no results in any dictionary, nor will *crushworthy*, but *crushproof*, *crushable*, and *crusher* are listed under *crush* in *AH4* and a search on them will turn up that entry. Morphological information, allied with electronic media and computation, can be used both to guide users in the deciphering and production of words that do not appear in a given dictionary or, perhaps, any dictionary, and to

lay new navigational pathways by which users can more easily find relevant existing words in a dictionary.

Now many English dictionaries do include information about word formation in headword entries for affixes and combining forms. *Merriam-Webster Online's* (2011) explanatory notes remark that such entries "make understandable the meaning of many undefined run-ons which for reasons of space would be omitted if they had to be given etymologies and definitions; and to make recognizable the meaningful elements of new words that are not well enough established in the language to warrant dictionary entry."

The notion of using affix entries to make undefined run-ons understandable is not entirely consistent with what explanatory notes tell the user about run-ons themselves. Of its selection of run-on derived words, *Webster's New World Dictionary* says: "We included words one might reasonably expect to encounter in literature or ordinary usage, and then only when the meaning of such derived words can be immediately understood from the meanings of the base word and the affix." (1982:xiv) The meaning of derived word run-ons has been variously described by dictionaries as "self-explanatory," "immediately understood," and "readily derivable," but the user may need to compose the meaning herself by consulting an affix entry.

## 2. Morphological Information in Dictionaries

Along with the two locations most often referenced in discussions of how dictionaries present morphological information about derived words, 1) run-on derived words and 2) entries for affixes, a third location can be added which broadens the scope of the problem and the solution, namely, 3) headword entries for lexicalized derived words: the 80%.

<sup>1</sup> Notable exceptions: some online dictionary sites, notably wordnik.com and thefreedictionary.com, return examples from a corpus of the word form entered, even if the word is a derived word sub-entry. Wordnik search, further, returns examples for words that have no representation in its dictionary sources. Vocabulary.com displays derived word data visually, with frequency information, upon look-up of a member of that word family.

## 2.1 Derived Word Run-ons

Because lexicographers have followed the principle that derived word run-ons have self-explanatory or readily derivable meaning and do not need definitions, the best, most useful derivations of a base often are not listed with their base because they are headword entries. They may be nearby alphabetically in English but are not purposefully so. Being able to see words around or near the word a user has looked up, while it has an important role in the translation of print dictionaries into electronic dictionaries, serves as poor compensation for the lack of structured navigational pathways connecting words that are closely related structurally. Thus under the adjectives *mediate*, *ferocious*, and *atrocious*, we find the derived noun run-ons *mediateness*, *ferociousness*, and *atrociousness*, but not *mediacy*, *ferocity*, and *atrocidity*, let alone the prefixed derived adjectives *immediate* or *unmediated*.

word	headword	run-on	occurrence COCA
mediation	3/4	1/4	2355
mediator	2/4	2/4	1298
mediate	4/4	0/4	1139
mediational	0/4	1/4	67
mediately	0/4	3/4	16
mediacy	1/4 (AH4)	1/4 (MW)	8
mediatorial	0/4	1/4	1
mediateness	0/4	1/4	0
mediatorially	0/4	1/4	0

Table 1: status of derived words

Inconsistency in dictionaries' treatment of derived forms has of course been noticed before and often. In 1993, Bauer and Nation stated that lexicographers are not "deciding in a principled and consistent way on what derived forms to include as full entries, defined sub-entries, and non-defined sub-entries, and what forms not to include" (Bauer & Nation, 1993:255). Table 1 offers just a glimpse of this all-too-familiar inconsistency. The four dictionaries considered are *Merriam-Webster Online*, *American Heritage 4*, *Collins English Dictionary*, and *Longmans Dictionary of Contemporary English*. More recently, in 2010, AH4's inconsistent treatment of derived words is noted with reference to the real estate given to headwords *retrench* and *retrenchment*, despite the latter's transparency, while much more frequent derived words under *retaliate* have run-on status (Delahunty & Garvey, 2010:240-1). Jackson and Amvela write: "The morphological aspects of lexical description are not systematically covered by dictionaries. Where morphemic relationships are indicated, they are evident more from the alphabetical ordering and nesting practices of dictionaries, rather than from any consciously explicit treatment." (Jackson & Amvela, 2000:168) Although more general-purpose dictionaries now include headword entries for affixes and combining forms, the "analytical work" is still left to the user (Jackson & Amvela, 2000:168).

## 2.2 Lexicalized Derived Words

Lexicalized derived words, such as *mediation*, are headwords with full entries, often with their own run-on derived words but no structured reference back to their base, thus completing the absence of explicit relationship that begins in the undefined run-ons. However, although a structured relation (metadata) is missing, morphology nevertheless often creeps back in via the definitions, when the base is used to define the word. Sometimes the definition of a derived headword is almost entirely morphosemantic and, from the point of view of the user, frustratingly circular. As seen earlier in Table 1, *mediacy* appears in *Merriam-Webster* as a derived word under *mediate*, but as a headword in *American Heritage*:

**mediacy**  
the state or quality of being mediate. (AH4)

Table 2: morphosemantic definition

The success with which dictionary definitions handle or juggle the distinction between morphosemantic information on the one hand and word sense on the other is uneven, and even when approached according to a set of coherent editorial guidelines, can be confusing for users (and lexicographers).<sup>2</sup> For native speaker and learners dictionaries, avoiding circularity in definitions is a valid consideration, indeed of utmost importance; however, defining a derived word without any reference to the base word means we lose morphological information and prevent morphological awareness.

We can attribute a significant portion of conventions related to derived words to the impressive legacy of print dictionaries of English. Still, it is important to examine the message in the medium, as well as the medium's incontrovertible material disadvantages (and advantages). Print's space, storage, and graphical display limitations are paralleled in a principle of non-redundancy that is not entirely materially-based. The same principle of non-redundancy that in part prohibits defining run-on derived words and also prohibits the appearance of a lexicalized derived headword as (also) a run-on under its base (*atrocidity* under *atrocious*) loses its hold in the writing of definitions themselves. In addition to the problem of unsystematic selection of derived words and unrationalized delegation of them to their proper slot, dictionaries often do not manage to adequately distinguish morphosemantics (of the latent kind) from lexical meaning. This "latent" representation of morphology in dictionaries creates interference in the communication of lexical information. An approach to a possible solution might lie in creating a fuller, more explicit, more independent and self-contained layer of morphological data that would be integrated with but distinct from dictionary data.

<sup>2</sup> For a vivid, amusing documentation of the difficulty, see Gove's advice to the lexicographers working on *NID3* with regard to entering "self-explanatory words" (1966).

### 2.3 The Morphological Word vs. the Lexicon

One reason for the kinds of inconsistency we see in dictionaries' treatment and presentation of derived words is that, as has been already touched on, morphological words are not the kind of words a dictionary is all about. A dictionary provides users with information about the lexicon, the properly attested mappings of words with their arbitrary, idiosyncratic, acquired sense. The lexicon is for the "lawless." (De Sciullo & Williams, 1987:3) These words are the nodes around which information clusters. The goal of morphology, on the other hand, is "the enumeration of the class of possible words of a language" (Aronoff, 1976:17-18). "It is the task of morphology," Aronoff (1976:19) writes, "to tell us what sort of new words a speaker can form."

The morphologist's word is a different creature from the lexicographer's word. The words morphology treats of are words formed by consistent rule-based processes applied to lexical units, not only describable by syntax or syntactic demands. The word formation rules of morphology produce words whose meaning is, must be, compositional and predictable. Scalise and Guevara (2005:62) explain that: "The meaning of a complex word is always compositional when it has been created by a (synchronically) productive WFR. With time, a complex word may acquire unexpected or idiosyncratic meanings, i.e. meanings that cannot be derived from its constituents," and they cite the standard example of the word *transmission*. Thus, words as once and future rule-bound, synchronic formations, and their structural relation to other such words, fall almost by definition outside the lexicon. And yet, as we have seen, morphology is latently and often necessarily present in definitions (as well as in lexicalized headwords), creating interference in the communication of lexical sense.

### 2.4 Affix entries and Word Formation Rules

Affix entries are as isolated from run-ons and headwords in electronic dictionary displays as they are in print, but it is here that dictionaries provide information about word formation most explicitly.

As Table 3 makes evident, dictionaries can differ significantly in their treatment of affix entries. Dardano et al., considering monolingual Italian dictionaries, propose that "information contained in dictionaries on affixes and combining forms must include not only the meaning of these elements, but also the way in which they form new words." (2006:1117) By these criteria, *Collins English Dictionary* exceeds *The American Heritage College Dictionary* (Table 3) on several points, because the affix is presented as functioning in a process that forms words of one category from words of another category and makes a regular semantic change to the base.

AHCD3	CED
-al <sup>1</sup> <i>suff.</i> Of, relating to, or characterized by: <i>parental</i> . [ME< OFr. < Lat. <i>-alis</i> , adj. <i>suff.</i> ]	-al <sup>1</sup> <i>suffix forming adjectives</i> of; related to; connected with: <i>functional sectional tonal</i> [from Latin <i>-ālis</i> ]
-al <sup>2</sup> <i>suff.</i> Action; process: <i>retrieval</i> . [ME <i>-aille</i> <OFr. < Lat. <i>-alia</i> , neut. pl. of <i>alis</i> .]	-al <sup>2</sup> <i>suffix forming nouns</i> the act or process of doing what is indicated by the verb stem: <i>rebuttal recital renewal</i> [via Old French <i>-aille, -ail</i> , from Latin <i>-ālia</i> , neuter plural used as substantive, from <i>-ālis -al<sup>1</sup></i> ]
-al <sup>3</sup> <i>suff.</i> Aldehyde: <i>citronellal</i> [ <i>&lt;al(DEHYDE)</i> ]	-al <sup>3</sup> <i>suffix forming nouns</i> 1. indicating an aldehyde <i>ethanal</i> 2.(Medicine/Pharmacology) indicating a pharmaceutical product <i>phenobarbital</i> [shortened from aldehyde]

Table 3: suffix entries in two dictionaries

The briefest look at morphologists' work on Word Formation Rules (WFR), however, suggests how much further dictionaries have to go--or could go, as motivation and resources allow. For the most ambitious undertakings, lexicography will need to take advantage of the work morphologists have done on WFR, which, with the advent of electronic dictionaries and other lexical databases, has gained new potential for practical applications.<sup>3</sup>

"Word Formation Rule" is in a sense the morphologists term for affix. A WFR involves process and uncovers and explicates regularity at a fine level. A WFR for

<sup>3</sup> Here it should be noted that significant projects based in Europe are under way which provide work or user interfaces that access morphological databases: MuLexFor (Cartoni & Lefer, 2010), elexico (Klosa et al., 2006; Storjohann, 2005), and Word Manager (Domenig & ten Hacken, 1992). Canoo.com uses Word Manager to develop software products, one category of which is "Unknown Word Tools," which can "analyze unknown (i.e. not lexicalized) words based on word formation rules" and "recognize unknown (i.e. not lexicalized) words based on word formation rules." (Canoo.com).

suffixation is the suffix morpheme itself and rules regarding the input and output. Word Formation Rules encompass:

1. the part of speech of the word a suffix forms (-ness, -ment, -ion, -al<sup>2</sup> form nouns)
2. the features of the base it “selects”: part of speech (-ness selects adjectives, -ive selects verbs, -al<sup>2</sup> selects verbs); bound or free morphemes (or both); Latinate or native bases (or both), and even register.
3. the suffixes’ position in relation to the base and to other suffixes.
4. phonological and orthographical changes a suffix effects in the base, if any (Table 4), such as stress patterns, pronunciation, and spelling.
5. semantic effects. For example, -al selects verbs to forms “abstract nouns denoting an action or the result of an action” (Plag, 2003:109).
6. restrictions on output. For example, semantic restrictions entail that meaning must be compositional (synchronically). A phonological restriction on output prevents, for example, *candidity* and *obsoletity* from being possible words (Plag, 2003:115).
7. productivity and distribution. For example, information on present and historical productivity of affixes. Questions of whether an affix is productive, and how productive, and in which registers and domains, are practically untouched by English dictionaries for native speakers.

suffixes triggering alternation		suffixes not triggering alternation	
-(at)ion	alternation	-ness	religiousness
-y	candidacy	-less	televisionless
-al	environmental	-ful	eventful
-ize	hypothesize	-ship	editorship
-ive	productive	-ly	headmasterly
-ese	Japanese	-ish	introvertish

Table 4: Phonological effects of suffixes (Plag, 2003:101)

Even a small sampling of the information about affixes uncovered by Word Formation Rules will hint at their untapped potential for dictionary development and use. For example, of words formed with -ity, “Words belonging to this morphological category are nouns denoting qualities, states or properties usually derived from Latinate adjectives (e.g. *curiosity*, *productivity*, *profundity*, *solidity*)” (Plag, 2003:115). All adjectives suffixed with -able, -al and -ic or ending in the [Id] sound can take -ity as a nominalizing suffix (*readability*, *formality*, *erraticity*, *solidity*) (Plag, 2003:115). And of -ity’s phonological features: “All words formed with this

suffix have their main stress on the antepenultimate syllable” (Plag, 2003:119). Of the suffix -al, we learn that it only selects verbs with final stress (*arrival*, *accrual*, *reappraisal*, *overthrowal*, *recital*, *referral*, *renewal*, *abettal*) (Plag, 2003:76).

One approach to utilizing work on WFR to improve dictionary treatment of morphological information is to re-evaluate and expand information provided on affixes in dictionaries. Prcic, for example, through his examination of the big four monolingual ELL dictionaries, proposes ten categories of information that should be represented in affix entries. Prcic’s categories: Spelling, Pronunciation, Input/Output units, Sense distinctions, Definitions, Cross-references, Usage labels, Productivity, Examples and Terminology (Prcic, 1999, cited in Lefer, 2010:1).

Another tack would be to make this expanded information on affixes (and concomitantly bases) available at or from individual headword entries, thus meeting the user at the point where she seeks and obtains information while engaged in a particular use case (de Caluwe, 2011). De Caluwe builds on the writings of ten Hacken and is one of the few sources that explicitly makes a case for the usefulness of word formation information in dictionaries for native speakers: “Providing the user looking for the meaning of a word with information on the paradigmatic, *in casu* morphological relations, of that word with other items in the lexicon really constitutes an added value to the user, on the condition of course that it will not lead to *information stress*“ (de Caluwe, 2011).

Online dictionaries have not yet exploited the granularity of data and metadata now possible to allow users to “look inside this word.” Using a set of word formation rules compiled with “users and uses” in mind, a rough draft of classifying, tagging, and indexing dictionary data can be automatically generated and then manually edited. Derived words, whether undefined run-ons or headwords, can be graphically marked to convey their word parts with a simple asterisk. Hyperlinked affixes and bases would allow users to click or hover and open a pop up box containing at least affix entries and at most full morphological dictionary entries. The ability to customize display, to show or hide fields, or to choose to see only lexical or only morphological information can be applied to counteract clutter or “information stress.”

### 3. Morphological Awareness in the Curriculum

A particular use case scenario for which there are evidence-based user needs and potential market demand has emerged quite recently from education research, specifically studies in literacy, vocabulary acquisition, and vocabulary teaching in K-12 for native speakers. The case for the importance of word formation information in dictionaries for second-language learners has been well represented. Ten Hacken (2006:243), for example, writes:

“In second language acquisition, word formation is important for the decoding of words the learner does not know, for the production of regular new words when the learner has not acquired the standard word, and for the creation of a tighter network structure in the mental lexicon, which facilitates vocabulary acquisition.”

Research by Bauer and Nation (1993), Nagy et al. (1984; 1989), and others has shown the effectiveness of teaching vocabulary in “word families” rather than as individual words. The vocabulary load of a reading text is reduced significantly when the unit of learning and measurement of text difficulty is word families, a set of words related by derivation, rather than the individual word. According to Nagy and Anderson (1984), “The less aware a student is of word relations, the more distinct words need to be learned.” As students progress from learning to phonologically decode and encode in writing high-frequency words to encountering longer, more morphologically complex lower-frequency words, “knowledge of word-formation processes becomes necessary for reading and spelling words” (Nagy & Anderson, 1984:). More than half of the unfamiliar words students encounter in middle school and beyond will be words whose meaning they will be able to deduce from context, if those students are equipped to discern morphological structure (Nagy et al., 1989). These findings were published more than 20 years ago, and their message seems to be edging closer to the threshold of standardization. A 2009 study states that, “To date, national attention in the United States has focused on evidence based practices related to phonological decoding, but not to evidence-based practices related to word formation, which may be critical for fostering literacy achievement in fourth grade and beyond” (Berninger et al., 2010:156). Joanne F. Carlisle (2010:3) writes that “(m)orphological awareness, defined as the ability to reflect on, analyze, and manipulate the morphemic elements in words, can be considered one form of students’ developing linguistic awareness. Morphological awareness develops gradually, as students come to understand complex relations of form and meaning.” These recent conclusions come out of a psycholinguistically-inflected reading research. As well as representing a welcome pendulum-swing away from the emphasis on the meaning-less decoding of “phonics,” they reflect interestingly and critically on assumptions that native speakers acquire and apply word formation rules unconsciously or automatically to decipher and produce unfamiliar derived words.

#### 4. Conclusion

In Atkins and Rundell (2008:48), the lexicographer is said to deal with “the probable, not the possible.” This phrase appears when the authors ask how we “cope as lexicographers” with the “individual departure from ‘normal’ modes of expression” that generate the countless words that do not appear in dictionaries. “As always,” they write, the answer will depend to some

extent on ‘users and uses’: the kinds of people the dictionary is designed for and the reference needs which the dictionary aims to cater for. But a good basic principle is that... the job of the dictionary is to describe and explain linguistic *conventions*... Our focus in other words, must be the probable, not the possible.” (Atkins & Rundell, 2008:48). Neither every word that has ever been used by individual members of a language community, nor every linguistically legitimate word in a language can or should be included in a dictionary. These fall into the category of “possible or potential words,” not “probable words.”

Nevertheless, the boundary between word probability and word possibility, where documentation of attested words and their frequency and usages stops and the range and likelihood of possible words begins, is a shifting boundary depending on “users and uses,” on the parts of the lexicon and of the language possessed by the intended user, on how well and in what way those parts are possessed, and on the uses intended to be served by a given dictionary.

Native speaker students of English constitute a set of users for whose individual mental lexicons lexicalized words may have the status of merely “possible words.” Bauer and Nation’s classification of affixes into seven levels of increasing difficulty and complexity acknowledges and provides stepping stones for the mental lexicon to convert possible words into vocabulary (1993).

Even outside the context of educational institutions, dictionary entries can provide answers to questions all kinds of users might ask about words: is it a word? is it a possible word? is there an adjective/verb/noun form of this word? Can I add prefix X or suffix Y to this word? “For a long time,” Dardano et al. (2006:125) write, “lexicographers have not acknowledged the importance of explaining the mechanism of Word Formation and educating users to create their own neologisms and apply them to everyday life.” There is a range of possible responses to this observation. We might create search capabilities that can recognize user queries as possible or nonpossible derived words and that offer users explanation of relevant Word Formation Rules, and provide data that suggest frequency, domain, and register, from corpus examples of the queried word. Or we might map derivational morphology onto dictionary entries in order to guide users to navigate more effectively among existing headwords related by morphological structure. Both of these directions expand the usefulness of dictionaries and allow the human subject of language to harvest the potential of technology’s transformation of dictionaries.

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