

Devising a Method for the Identification of Derivational Formations: English Back-Formations

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Abstract

The study proposes and tests a method for the identification of back-formed words, presumably applicable to any type of formation. It describes the method and an experiment with selected back-formation types to prove the functionality of the method. It is based on a formal approach: the starting point is the selection of potential source words for back-formations according to affixes typically involved in the process; the next step is the verification of the hypothetical back-formations on the Internet. On a general level, the success of this method in locating back-formations that might otherwise go unnoticed leads to the idea that the method may in principle have a wider application and could be adapted to search for other types of derivational formations. If true, it could help close the frequently occurring gap between the data used in word-formation analysis and the current state of the lexicon (especially in the area of neologisms).

Keywords: word-formation, back-formation, affix, identification, neologism, productivity

1. Introduction

Back-formation (hereafter referred to as BF in the sense of both the process and its result) is one of the minor, but still rather productive means of word-formation. To simplify the description of the process, we can see it as a type of de-affixation. An existing morphologically complex word is stripped of its affix (usually a suffix) and results in what is, or is supposed to be, its morphological base. As with other word-formation processes, the result is a new lexeme, i.e. a new item of vocabulary with its own lexical meaning, different from that of the source word. The main motivating force of BF is the need for the syntactic recategorization of the concept in

communication, while the longer, morphologically (more) complex form has been used for some time already. The formations are based on analogy with existing derivational pairs. The following relatively recent examples represent the most frequent types of words which result from the process of BF at present:

- accreditate* (1989), v. < *accreditation* n.; of a school, course, etc.: to certify a school as meeting standards set by external assessors or regulators
- back-calculate* (1988), v. < *back-calculation* n. (resolving a problem backwards from the result to the start); to perform back-calculation
- feather-bed* (1962), v. < *feather-bedding* n.; make sb. comfortable by favourable, esp. economic or financial treatment; specifically: to employ superfluous staff
- skirt-chase* (1981), v. < *skirt-chaser* n.; slang: to pursue women with amorous attentions
- valet-park* (1983), v. < *valet parking* n. (N. American: a service provided at a restaurant, etc., in which an attendant parks patrons' motor vehicles); to provide the service of valet-parking
- word-process* (1985), v. < *word processing* n.; computing: to edit, produce, etc. by electronic means, using a word processor

These examples actually exemplify the main features of such newly formed words: the resulting item is most frequently a verb (all the examples) or a compound (all except *accreditate*); it is often marked regionally (*valet-park*, US) or stylistically (*word-process*, computing; *skirt-chase*, slang); the verbs are most often formed from action nouns (*accreditate*, *back-calculate*, *feather-bed*, *valet-park*, *word-process*), or from agent nouns (*skirt-chase*), the removed affix is typically a suffix, the most frequent suffixes being *-ing* (*feather-bed*, *valet-park*, *word-process*), *-ation* (*accreditate*, *back-calculate*) and *-er* (*skirt-chase*). In addition, there is another quality that has been observed recently: although many of the resulting words are presented in general dictionaries as stylistically neutral, they tend to be used in a limited number of contexts, especially words associated with professional areas such as business, economics, industry or education, etc. Such words can be considered either formal (*accreditate*) or belonging to a professional jargon (*feather-bed*). Also, many of these words at the same time involve meaning transfer, e.g. metaphor or metonymy (*feather-bed*, *skirt-chase*).

BF has been mentioned or more or less described by many morphologists (e.g. Adams, Bauer, Plag, Katamba, Lieber, Štekauer, Biermeier). The most frequent features that the authors often discuss are the diachronic or synchronic relevance of the phenomenon, its analogical nature, re-analysis of the source words, and the increasing share of verbal compounds resulting from the process. More extensive coverage of BF is given by Marchand (1969) and especially by Pennanen (1966). A monograph picking up where Pennanen left off in the survey of BF development is currently in print (Stašková 2014).

2. Recognizability of BFs

One of the questions that arises when we are thinking about this process and its contribution to English vocabulary is to what extent speakers have insight into how it works. For instance, with suffixation most people are certainly aware of *sitting* being formed from *sit* by adding the suffix *-ing* to it. Analogously, most speakers probably assume that *babysitting* is a word formed by suffixation from the verb *babysit*, and only very few will realize at all that the verb came into being later than the action noun and that the direction of the word-formation is actually opposite: *babysit* (v.) < *babysitting* (n.). Quite likely they would be surprised if told that compared to *decide* (v.) > *decision* (n.) the pair *televise* (v.) < *television* (n.) is the product of a reverse process. In fact, it is exactly the analogy with affixation that leads speakers to form a BF intuitively from an existing complex word, though some of them no doubt create new words by BF knowingly and purposely.

It seems that this question is to a large extent a matter of synchronic or diachronic attitudes to BF. Authors dealing with BF differ in their approaches, but many of them realize the necessity of combining both. Biermeier admits that “it is synchronically difficult (if not impossible) to determine if *to burgle* was back-derived from *burglar* or if, on the other hand, the verb serves as the base to which the suffix *-ar* was attached” (140). He draws attention to Bauer’s view that BF must be allowed for in synchronic description if it is still productive. Pennanen also approaches the phenomenon both synchronically and diachronically and in this respect, Biermeier considers Pennanen’s formulation to be the most pregnant: “Back-formations are normally not recognized as such by the average speakers. To them they are synchronous phenomena of the language system; in this sense back-formation is relevant only in the diachronic aspect. On the other hand, there are speakers, who deliberately employ a back-formed word, or even coin one” (Pennanen 149). This can be illustrated by two examples: *stupend* (v., “to amaze, dumbfound”, 1904 < *stupendous* adj.) is presented in the OED as G. B. Shaw’s word; the noun *plore* (“a museum exhibit which demonstrates some scientific principle in action”, 1989 < *explore* v.) is commented on by Ayto in the following way: “*Plore* is a term introduced by Professor Richard Gregory to describe the exhibits in his Exploratory, an innovative museum of science opened in Bristol in 1987” (247). In certain situations, speakers, in order to reach a particular, especially humorous, emotional or emphatic effect, deliberately create a BF, which may either only occur as a nonce word, or may be accepted by others and gradually win its place in vocabulary, as an example taken from the web page Digital Spy shows (*songwrite*, v. < *songwriter*, n.): “Speaking about his talents, he added: I can songwrite, I can produce, I master vocal everything, I can teach...” (Fletcher, online).

Lieber emphasizes on the one hand the contrast between the historical fact of the origin of the source words and the resulting BFs, and on the other the ability (or rather inability) of the ordinary speaker to recognize back-formed words in the language: “Indeed speakers are sometimes surprised to learn that the verb did not exist before the corresponding noun, so ordinary-sounding has the verb come to be” (51). She illustrates this idea with examples like *peddle* and *edit*, back-formed from

peddler and *editor*¹.

Another question on which many authors are in agreement is the fact that back-formed words are often felt ugly, odd or even ridiculous by ordinary native speakers (Greenbaum, Lieber and others). Lieber herself illustrates this fact with her own feeling when hearing the verb *incent* in 2007, in a public speech by a governor, and she says: “In context, it clearly was a back-formation from the noun *incentive*, and it sounded quite odd at the time” (52). In fact, the verb was not so new at that time; Merriam Webster’s Dictionary introduces the date of origin 1981, OED even 1977.

Let us now imagine a situation that a language user wants to know which words in the vocabulary have been coined as a result of BF. One of the easiest possibilities is to consult a good electronic dictionary with a searching tool, in which they enter a request such as “*back-formation in etymology*” and get a list of entries containing this description of the origin. By this method an ordinary user of language is able to find a relatively large number of words that have been established as BFs for a long time; however, they will probably not find very many recent ones, let alone those which only exist in current communication and so have not been incorporated into dictionaries yet – the “hottest” neologisms.

Since the deliberate coining of a BF is more or less an exception and users of English normally do not recognize these formations as such, it remains the task of linguists to examine the relevant word-formation pairs, to discover which of the two items is primary and which is secondary, and to distinguish BF from affixation. The result of such research should be a list of back-formed words in which, diachronically and (where possible) also synchronically, it would be clear enough that the direction of formation has been opposite to affixation. But the question is where to start. How should the researcher proceed to be able to find the relevant pairs and to identify a BF with certainty?

The present study’s aim is to provide answers to these questions: the main task is to devise a method for the identification of back-formed words and to verify its practical application on existing vocabulary. The method is based on selected patterns derived from typical samples of BF and the study hopes to prove its general applicability, i.e. to show that it may be used for any type of BF.

3. The method

3.1 Step one: establishing formal patterns of word pairs involved in BF

In his monograph, Pennan introduced a transparent typology which is based predominantly on the formal aspect of the words, particularly on the part of speech of the source word and that of the resulting back-formed word. His system includes six types (see below). As a result of my own research another three types have been added, so the present typology includes nine categories:

Type I	Verb from agent / instrument noun
Type II	Verb from action noun
Type III	Verb from adjective
Type IV	Noun from adjective
Type V	Noun from another noun which is believed to be its derivative
Type VI	Adjective from abstract noun
Type VII	Adjective from agent noun
Type VIII	Prefixal back-formations
Type IX	Inflectional back-formations

Each of the types involves a certain recurring set of affixes. Thus, for example, the most typical suffix subtracted from agent nouns is *-er*; in the case of action nouns the most frequent suffixes are *-ing*, *-ion/-ation*. Adjectives resulting in verbs usually lose *-ed/-ing*, while when changing into nouns they frequently drop *-ic* or *-y*, etc.

When looking for the identification method, the formal approach seems the most suitable starting point, for a frequently occurring affix is something that is relatively easy to go by. Thus the process of identification of BFs will start by selecting the suitable BF patterns. Next, the potential source words will have to be found which contain one of the affixes relevant in BF.

First of all, using my previous research, I compiled a list of formal patterns providing a survey of existing BF pairs in which the following useful characteristics are indicated: affiliation with a particular type of BF (Type I – Type IX), part of speech of both words (N = noun, V = verb, A = adjective), the direction of the process, and the affix removed. These four properties of the patterns are presented in the following way:

Example:	(Type I) N > V: -er ^{N>V}
where	(Type I) is the type of BF (here verbs formed from agent nouns)
	N > V indicates the direction of BF and word class (here from noun to verb)
	-er ^{N>V} is the affix (here suffix) removed with the upper index distinguishing it from the same suffix appearing in a different type (e.g. -er ^{N>N})

As far as prefixes are concerned, the part of speech is not so relevant because the removal of the prefix does not affect the part of speech of the new formation (unlike with suffixes). The grammatical suffix in Type VIII is always the plural *-s*.

The list of formal patterns shows a set of combinations found in contemporary BF. All the affixes introduced in the list have been identified in the collection of English BFs coined in the period from 1900 until the present, the whole sample including over 700 items². Each affix is followed by an example:

Suffixes of BF source words

1. (Type I) N > V:
-ent^{N>V} (*adolescent* > *adolesce*), **-er**^{N>V} (*dealer* > *deal*), **-ian**^{N>V} (*comedian* > *comede*), **-ive**^{N>V} (*incentive* > *incent*), **-or**^{N>V} (*escalator* > *escalate*)
2. (Type II) N > V:
-ance^{N>V} (*concordance* > *concord*), **-ation**^{N>V} (*tectonization* > *tectonize*), **-ence**^{N>V} (*tumescence* > *tumescence*), **-er**^{N>V} (*demerger* > *demerge*), **-ia**^{N>V} (*ecphoria* > *ecphore*), **-ing**^{N>V} (*microcoding* > *microcode*), **-io**^{N>V} (*fellatio* > *fellate*), **-ion**^{N>V} (*proaction* > *proact*), **-is**^{N>V} (*symbiosis* > *symbiose*), **-manship**^{N>V} (*one-upmanship* > *one-up*), **-ment**^{N>V} (*drop-shipment* > *drop-ship*), **-n**^{N>V} (*wedeln* > *wedel*), **-y**^{N>V} (*holography* > *holograph*), **-ness**^{N>V} (*one-handedness* > *one-hand*)
3. (Type VI) N > A:
-(ic)s^{N>A} (*logistics* > *logistic*), **-ion**^{N>A} (*capitation* > *capitated*), **-ism**^{N>A} (*surrealism* > *surreal*), **-ity**^{N>A} (*intertextuality* > *intertextual*), **-ure**^{N>A} (*closure* > *cloze*), **-y**^{N>A} (*complicity* > *complicit*)
4. (Type VII) N > A:
-er^{N>A} (*do-gooder* > *do-good*), **-or**^{N>A} (*carburettor* > *carburetted*)
5. (Type V) N > N:
-ance^{N>N} (*grievance* > *grievant*), **-eme**^{N>N} (*morpheme* > *morph*), **-er**^{N>N} (*strip-teaser* > *striptease*), **-(graph)y**^{N>N} (*cineradiography* > *cineradiograph*), **-ia**^{N>N} (*homophobia* > *homophobe*), **-ics**^{N>N} (*aerobatics* > *aerobat*), **-ing**^{N>N} (*shrink-wrapping* > *shrink-wrap*), **-ion**^{N>N} (*retardation* > *retardate*), **-ism**^{N>N} (*cladism* > *cladist*), **-ogen**^{N>N} (*plasmalogen* > *plasmal*), **-omy**^{N>N} (*taxonomy* > *taxon*), **-ship**^{N>N} (*grantsmanship* > *grantsman*), **-(ual)ity**^{N>N} (*intertextuality* > *intertext*)
6. (Type III) A > V:
-able^{A>V} (*biodegradable* > *biodegrade*), **-ant**^{A>V} (*decongestant* > *decongest*), **-ed**^{A>V} (*hard-wired* > *hard-wire*), **-escent**^{A>V} (*luminescent* > *luminesce*), **-ic**^{A>V} (*cathectic* > *cathect*), **-ing**^{A>V} (*self-financing* > *self-finance*), **-ive**^{A>V} (*auto-destructive* > *auto-destruct*), **-ous**^{A>V} (*stupendous* > *stupend*), **-y**^{A>V} (*skeevy* > *skeeve*)
7. (Type IV) A > N:
-al^{A>N} (*paramedical* > *paramedic*), **-an**^{A>N} (*exurban* > *exurb*), **-ar**^{A>N} (*orbicular* > *orbicule*), **-ce**^{A>N} (*Rhaeto-Romance* > *Rhaeto-Roman*), **-ed**^{A>N} (*gorked* > *gork*), **-ian**^{A>N} (*archosaurian* > *archosaur*), **-ic**^{A>N} (*didactic* > *didact*), **-ous**^{A>N} (*frivolous* > *frivol*), **-y**^{A>N} (*ditz* > *ditz*)

Prefixal back-formations

8. (Type VIII):
ab-/ad- (*absorb/adsorb* > *sorb*), **an-** (*anoxic* > *oxic*), **dis-** (*concerting* > *disconcerting*), **e-** (*edentulous* > *dentulous*), **en-** (*enclitic* > *clitic*), **ex-** (*plore* > *explore*), **in-** (*inept* > *ept*), **un-** (*unflappable* > *flappable*), **re-** (*repatriate* > *patriate*), **sub-** (*suburb* > *urb*)

Inflectional back-formations

9. (Type IX):

plural -s (*gigaflops* > *gigaflop*; *giga-* + acronym from *Floating-point Operations Per Second*)

3.2 Step two: searching for potential source words with no attested BFs

Potential source words of BFs not attested in dictionaries can be looked for in several types of lexical sources, e.g. the British National Corpus, the Corpus of Contemporary American English, frequency lists of new words based on various corpora, or in existing comprehensive dictionaries. The selection of the sample of potential BF source words thus starts with the choice of the lexical source(s). For the purposes of this study I used the Concise Oxford Dictionary 11th Edition, CD-ROM (2004) and Merriam Webster's 11th Collegiate Dictionary on CD ROM, version 3.0 (2003) as the stores of potential BR source words.

The strategy of extracting the suitable BF source potentials is as follows. One of the BF patterns from the above survey is chosen, e.g. (Type I) **-er^{N>V}**, and the suffix entered in in the search engine of the selected lexical source (an electronic dictionary). Next, irrelevant items have to be eliminated from the list of all the forms ending in *-er*, such as those which have the same suffix but are not nouns (e.g. *blatter*, v., “to move or strike with a clatter”; or comparatives), or nouns which do not refer to an agent / instrument (e.g. *banter*, n. “the friendly exchange of teasing remarks”). Thereby the otherwise formal method incorporates a semantic element. Then words which fit the type but whose derivational paradigm already contains a verb have to be excluded (listed in the same dictionary or any other). This may be a verb converted from the noun (i.e. with no subtraction, e.g. *blatter* n. / v.), or the derivational base for the noun (diachronically preceding the occurrence of the noun), or even an already existing BF verb. For example, one of the first instrument nouns ending in *-er* in COD11 is *arrester* (“a devise on an aircraft carrier that slows down an aircraft after landing by means of a hook and cable”). The potential BF verb of related meaning could be *arrest*, but the verb is already entered there as the base of the noun subject to affixation. The noun *back-stabber* (“a person who criticizes someone while feigning friendship”) could be a potential BF verb, *back-stab*, and a subsequent inquiry reveals that the verb is a confirmed BF in the OED. On the other hand, examples of relevant agent nouns are *bean-counter* (“a person who works with money and who wants to keep strict control of how much a company spends”) or *fortune-hunter* (“a person seeking wealth by marriage”) for which I did not manage to find back-formed or otherwise formed verbs.

Some of the BF affixes are ambiguous, i.e. one and the same form appears in several patterns with different parts of speech involved. The source word with the suffix *-ing* can be, for example, a noun or adjective, and thus the basis of two types of BF: Type II, N > V (*microcoding* > *microcode*) and Type III, A > V (*self-financing* > *self-finance*). Sometimes an action noun exists alongside with an agent noun of the same root – both variants can be the source of one verb (e.g. *face-saving* / *face-saver* > *face-save*).

The most promising potential source words are compounds; in the sample of selected words for the investigation they absolutely prevail (which reflects the situation in attested BFs). With some compounds, an alternative process is conceivable, i.e. that the given word has been formed by compounding. In such cases the chronological sequence of the occurrence of the words and agreement with the established BF types has to be considered in order to accept or reject the operation of BF (e.g.: *fire-walker* n. OED 1895, *fire-walking* n. OED 1899, *fire-walk* n. OED 1900, *fire-walk* v. neologism 2012³).

Some of the forms of the source words are extremely frequent (e.g. *-er*, *-ing*, *-ion/-ation*, *-s*, *-i/-ity*, and others) and the search is bound to yield too large a number of hits. The use of electronic search tools makes it possible to restrict the scope of the search by specifying the strings we look for. Thus, in Type I we can insert *-p-er*, or *-s-er*, or *-w-er*, etc., instead of *-er* in order to narrow the range of potential nouns uncovered by the search and focus on strings producing likely candidates. Examples of such potential new BF pairs are: *gate-keeper* > *gate-keep*, *ambulance chaser* > *ambulance-chase* and *flame-thrower* > *flame-throw*. Such modification allows for more careful and gradual sifting through the data, exploring smaller sets of words at a time.

For the purposes of the study, I selected four BF patterns. In order to compose a typologically diverse sample, the choice of the types was such as to cover the three main word classes as the output. The types were also chosen because of their frequency and so it was necessary to restrict the number of items in the (sub) sample by extending the suffix to include the preceding consonant (*-t-er*, *-t-ing*) or morpheme (*-graph-y*, *-ic-s*). The potential BF source words were from the following types and included the respective final strings:

1. (Type I) **-ter**^{N>V} (*bean-counter* > *bean-count*)
2. (Type II) **-ting**^{N>V} (*double-knitting* > *double-knit*)
3. (Type V) **-graphy**^{N>N} (*cosmography* > *cosmograph*)
4. (Type VI) **-ics**^{N>A} (*aquarobics* > *aquarobic*)

The resulting preliminary sample of potential BF source words consisted of 1150 items, of which 739 represented the Type I pattern, 141 the Type II patterns, 86 the Type V patterns and 184 the Type VI patterns. The items in this sample then went through an elimination process to exclude those for which BFs had already been attested and recorded. This elimination narrowed the preliminary sample down to a list of 83 genuine potential BF source words which were used in step three of the study (see Table 1).

To summarize step two, its main task was to gather a pattern-based collection of potential BF source words for which no BFs occur in current dictionaries. From these words possible BFs can be derived, e.g., *bean-counter* > *bean-count* (?); *fortune-hunter* > *fortune-hunt* (?), and in the next step these hypothetical BF neologisms will be searched for.

3.3 Step three: identifying BF neologisms

When the sample of potential source words of a particular BF pattern was collected, it had to be decided which texts to use as a data source. However large the standard corpora (the BNC, the COCA, etc.) may seem, they are not big enough for the purposes of the study, and so the best choice appeared to be the biggest corpus available so far, the Internet. It is indisputably the best source of contemporary communication, almost unlimited in size, variety of text types, mode and style (i.e. including texts from all fields, by all layers of users, of various stylistic and regional markedness, from neutral to colloquial, slang, jargon, or technical), etc. For each potential BF neologism, the whole lemma, i.e. all of the forms of its inflectional paradigm were searched for (e.g. the third person sg. present simple tense, or the *-ed* past form or *to*-infinitive of the verb (*bean-counters*, *bean-counted*, *to bean-count*) using the Google search engine, in order to find any occurrence of the projected BF. Such occurrences, if found, are taken to confirm that the process of BF is productive in ordinary speech (writing). In the case of the potential BF verbs *bean-count* and *fortune-hunt*⁴, only the former was located reliably on the Internet, for example in the Washington Post: “After you get that off your chest, though, you’ll need to set aside your defensive impulses and **bean-count**” (Hax, online)

The aim of step three is thus to find as many existing BF neologisms as possible from among the final list of potential BF source words and document them by citations from the Internet. This is not to say that those which were not found do not, or will not, exist, since not even the Internet covers all the production of English in the world. The confirmed BFs can be considered neologisms in the phase of their “trial period” – they may survive and sooner or later reach the status of an attested item in a dictionary, or they will disappear as occasional and nonce words. It is almost impossible to predict which of them will win a more stable place in vocabulary – language users’ preferences are often erratic and some of the new words are really surprising.

4. Results

The verification experiment started with the preliminary sample of 1150 relevant items, out of which 83 do not have BFs recorded in the consulted dictionaries. The sample thus yielded 83 potential or projected back-formed words which were then searched for on the Internet. Of these 83 potential BFs, 48 BF neologisms were confirmed by the search as existing (57.8 %). They are presented in Table 1:

Type	Suffix	Example	Preliminary sample	BF potentials	BFs found
I	<i>-ter</i> ^{N>V}	<i>bean-counter</i> > <i>bean-count</i>	739	30 / 100 %	12 / 40.0 %
II	<i>-ting</i> ^{N>V}	<i>double-knitting</i> > <i>double-knit</i>	141	25 / 100 %	13 / 52.0 %
V	<i>-graphy</i> ^{N>N}	<i>cosmography</i> > <i>cosmograph</i>	86	17 / 100 %	12 / 70.6 %
VI	<i>-ics</i> ^{N>A}	<i>aquarobics</i> > <i>aquarobic</i>	184	11 / 100 %	11 / 100.0 %
Total			1150	83 / 100 %	48 / 57.8 %

Table 1. The results of the verification experiment

Among the selected patterns, the Type VI pattern with *-ics*^{N>A} appears to be the most productive since all the 11 projected BFs occurred in various types of the Internet texts. Although this category seems to be easily recognizable and all the projected words were confirmed, we should take into consideration the possibility of an alternative way of creating some of them – by analogy. *Aquarobics* and *aquarobic*, for example, could have been created analogically to older *aerobics* and *aerobic*. On the other hand, the BF sequence N > A is highly probable, as firstly the noun is primarily described as a blend of aqua and aerobics, and secondly the adjective *aquarobic* is not yet attested in any of the modern dictionaries, which is one of the diachronic principles of the method presented here. This particular form (*-ics* > *-ic*) is among the most frequent ones within the *-s*^{N>A}.

The same applies to the (Type V) pattern *-graphy*^{N>N}. This morpheme (considered a combining form) is subsumed under the suffix *-y*^{N>N} in the BF typology and has been selected for the same reason: it is one of the very frequent forms in this category. The idea of alternative analogical formation mentioned above is also admissible but again, the resulting newly suggested BFs do not occur in any dictionary and thus, at least seen diachronically, they must only follow the source nouns and be their BFs.

Since the patterns (Type I) *-er*^{N>V} and (Type II) *-ing*^{N>V} are traditionally extremely numerous, it was necessary to restrict the search by adding a consonant to the affix: (Type I) *-ter*^{N>V} and (Type II) *-ting*^{N>V}. Their respective productivity is not surprising; it is in compliance with the results of the preceding research on BF of the period 1900–2011, which has revealed that the suffix *-ing* is gradually becoming the most frequent BF affix, while the occurrence of the suffix *-er* has slightly decreased.

Given that only four types and only one suffix in each type were investigated, the method produced surprisingly good results. It can be expected that with more types and more affixes explored the number of actively identified BFs would be proportionately higher. This indicates not only that the method is successful, but also that the number of BFs in actual use in contemporary English is higher than appears to be the case when consulting dictionaries. More importantly, the results show that BF is, as expected, definitely a productive word-formation process. The distribution of the discovered BF neologisms may also be taken as indicating the degree of productivity to some extent.

5. Notes on the identified BF neologisms and their types

The complete list of BF neologisms found in each of the four BF type patterns is given in the Appendix. The neologisms are supplemented by definitions and citations from Internet communication, together with the reference to the web pages⁵. The most frequent sources of the new words were articles in Internet magazines (e.g. Gigaom.com), newspapers (Washingtonpost.com) or personal blogs (e.g. billayers.wordpress.com). Many technical terms appeared in learned texts presented in the blogs of scholars or physicians (e.g. drsharmadiagnostics.com). Some interviews or articles about celebrities, on the other hand, were the source of stylistically or emotionally marked items (e.g. digitalspy.co.uk).

Although the main task of this study is to present and examine a method for the identification of BFs, I find it useful to submit a brief description of the neologisms found, from the semantic, stylistic and grammatical points of view.

The semantic content of verbs in Type I (verbs from agent nouns) relates to several areas, one of the frequent ones being the area of creation: *screenwrite* (“to write TV scenarios”, *songwrite* (“to write songs”) and *trendset* (“to establish a new trend in design or fashion”). Others refer to various electronic procedures: *downconvert* (“to convert HD TV into standard definition TV”), *inkjetprint* (“to print using small ink droplets”) and *laser print* (“to print using laser”). Still others describe diverse types of states or behaviour, e.g. *bardolate* (“to idolize Shakespeare”), *self-start* (“to be able to work without needing help”) or *bounty-hunt* (“to chase outlaws or animals for the bounty offered”). *Neurotransmit* is used in medicine describing a process in the brain. *Cookie-cut* is an interesting item because of its metaphorical nature and frequent derogatory tinge (“to change someone’s character according to a given pattern”). From the stylistic point of view, only four words in this category are unequivocally part of technical terminology (*downconvert*, *inkjetprint* and *laser print*: electronics, *neurotransmit*: medicine); *bean-count* and *self-start* are informal and *cookie-cut* is an Americanism; the rest can be considered neutral. This stylistic characteristic reflects accurately the overall situation in BF over the last hundred years (as shown in my previous research).

While the vocabulary of Type I contains at least some items of technical terminology, verbs of Type II (verbs from action nouns) all belong to general language. The reason, in my opinion, consists in the fact that the source words of technical terms of Type I mostly refer to an instrument (*downconverter*, *inkjetprinter*, *laser-printer*) or substance (*neurotransmitter*) used to reach a particular (technological / medical) effect. Names of people (*screenwriter*, *songwriter*, *trendsetter*), on the other hand, result in verbs of general language, which often denote a creative activity.

This is similar with verbs of Type II, formed from action nouns: they frequently refer to activities somehow connected with leisure time: hobbies (e.g. *surfcast* “to fish from the shore by casting into the surf”), sport (e.g. *powerlift* “to participate in a contest involving three tests of strength: the bench press, squat, and two-handed lift”, *trap-shoot* “to shoot at clay pigeons hurled into the air from a trap”) or creation/art (e.g. *double-knit* “to make a type of cloth”, *underpaint* “to make the first layer in a painting in order to indicate the design and main areas of light and shade”, *method act* “to identify as closely as possible with the character played”) and they are stylistically neutral. There is only one verb that is very close to terminology (*cybersquat* “to register an Internet domain name that is likely to be wanted by another person, business or organization in the hope that it can be sold them for a profit”); however, more and more people are accepting the language of the Internet as part of general language these days.

The third category involved in the experiment, Type V (nouns from more complex nouns), is, unlike the previous ones, full of technical terms. This is predominantly due to the fact that the suffix *-graphy* is a neoclassical combining form, which typically occurs in the language of learned style. The resulting nouns are mostly names of

instruments (*arteriograph* “a diagnostic instrument used to visualize the inside of blood vessels”, *crystallograph* “an instrument used for the description of the forms and structures of crystals”, *stereolithograph* “a 3D printing machine which converts liquid plastic into solid”, *videograph* “a multimedia player, with which digitalized videos can be played and at the same time be evaluated”). Other new words in this category denote computer programs (*ethnograph* “a computer program designed to facilitate the processing of qualitatively gathered sociological data”, *stratigraph* “a Java based tool for computation and visualization of stratification graphs”) or resulting descriptions (*cosmograph* “a kind of graph resembling pie charts, usually used in order to represent finances”, *oceanograph* “a written description of the physical and biological aspects of the oceans, including their chemistry, biology, and geology”, *uranograph* “a chart of the skies”, *xerograph* “a copy produced by xerography”). Most of the terms come from natural sciences, with a few exceptions: *hagiograph* “a holy writing” and *haplograph* “omission of a repeated word”.

The resulting formations of Type VI are adjectives (formed from nouns). Similarly as was the case in Type V, they are most often related to a science from whose name they were back-formed: *combinatoric*, *fluid-mechanic*, *informatic*, *mechatronic*, *moletronic*, *soil-mechanic* and *videographic*. Several adjectives are connected with physical exercise: *aquarobic*, *callanetic* and *step-aerobic*. Only one item seems to come from a different area – linguistics: *Ebonic* “of or pertaining to Black English (= Ebonics)”. Quite a number of items in this category belong to technical terminology, sometimes very specialized. Those related to exercise may occur within general communication more frequently than the others since these activities are quite popular. They can therefore be considered stylistically neutral. *Ebonics* is clearly an Americanism.

An absolute majority of adjectives of this type occur in attributive position (*combinatoric question*, *Ebonic translations*, *fluid-mechanic experiments*, *soil-mechanic resistance*), the only exception being *informatic* (predicative position): “...the more *informatic* and *algorithmic* it becomes...”.

As regards the grammatical forms of these Internet back-formations, they rarely display a complete inflectional paradigm. Thus with verbs, for example, the most frequent grammatical form is the to-infinitive (e.g. *to laser-print*, *to neurotransmit*) and many verbs occur in the passive voice (e.g. *was bill-posted*, *is inkjetprinted*). Also, one of the finite verb forms which frequently occurs is the 3rd person plural (as in, e.g. “*people who bardolate*”, “*public schools...cookie-cut children*”), perhaps as a reflection of the users’ tendency to express general reference rather than to use a new word in a more subjective way. Presumably the limited range of inflections of these neologisms is connected with their being unusual; those of them that may happen to be gradually accepted by a growing number of language users may, as a result, become fully inflected such as the well-established back-formations like *to baby-sit*, *to brainwash*, etc.

6. Conclusion

The aim of the study was to devise and test a method of actively discovering BFs in contemporary English language production and so to demonstrate that BF is a regular productive word-formation process. The method whereby the BF neologisms were identified can be summarized by means of the following three steps:

1. Selection of a suitable set of BF patterns – types and affixes involved in the process;
2. Compilation of a list of potential source words without attested BFs by searching in suitable lexical sources (e.g. modern dictionaries or corpora-based lists);
3. Searching for these potential BF neologisms on the Internet.

The results of this study prove that the method is capable of discovering a relatively large number of BF neologisms. The experiment succeeded in finding 49 BF neologisms that have not been attested before. Considering that of the nine types of BFs only four types and only one suffix from each type were investigated, there is a good chance that with more types and more affixes the number of BF neologisms would be considerably higher. The results indicate that in contemporary English the number of BFs in actual use is certainly higher than even the most extensive and up-to-date dictionaries report.

BF is a word-formation process which, in spite of its difficult identification by ordinary language users, is still productive and has its place in the contemporary word-formation system. Any future research of this process depends on linguists having access to new vocabulary items formed in this way. The aim of the study was to provide such access by developing a simple and effective method for discovering newly formed BFs which have not yet found their way into dictionaries, although in present-day communication they seem to spring into existence at a surprisingly fast rate.

The results of the study can be used for both theoretical and practical purposes, in word-formation and lexicography. Searching for BF neologisms has a potentially useful spin-off for a lexicographer intending to compile a special dictionary of BFs. Apart from discovering specific neologisms by means of the method, I was able to identify quite a large number of words in the consulted dictionaries which are not explicitly labelled as BFs but which fulfil at least one of the basic conditions to be recognized as such. The first is the diachronic condition: the supposed back-derived form must have appeared later in the language than the complex source word. The second is a semantic condition: the dictionary definition shows that the affixless member of the derivational pair requires the prior existence of the complex member (e.g. *arm-wrestle* v. “to engage in arm-wrestling”). The same argument is used by Plag in connection with conversion: “Speaking in terms of concepts, the verb *to bottle* requires the existence of the concept of a bottle. Without a bottle there is no bottling” (109). I came across many such items during the research, and they represent another potential set of BFs that can be included in a specialized dictionary.

Although the verification experiment focused on the most frequent BF patterns and only on suffixes to demonstrate the feasibility of the method, there is no reason why it could not just as easily be applicable to all BF types, even the marginal ones, prefixal or inflectional BFs (a possible topic for further research). In addition, the method can possibly be used to study the relative degree of productivity of the BF types.

On a general level, the success of the method in locating back-formations that might otherwise escape attention provides reasonable grounds to believe that such a method, suitably adapted, could work just as well in the identification of other types of derivational neologisms (affix- or base-sharing word families, neoclassical compounds, etc.). If true, a procedure of proactive and systematic search could help, at least partially, to resolve the problem of dealing with the fast pace of new words entering the language when collecting data for word-formation analysis.

Notes

¹ Greenbaum (1996) admits that some back-formations are felt as such by at least some people (e.g. *emote* < *emotion*, *enthuse* < *enthusiasm*), and he even recommends synchronic interpretation of historically clear pairs: “Although *editor* appeared before *edit*, in a description of current English it is appropriate to analyse *editor* as derived from *edit* by the addition of the suffix –or” (466).

² The material has been gathered from a selection of dictionaries that have been substantially updated, the oldest in 1995, the latest in 2009: *Concise Oxford Dictionary 9th Edition*, *Concise Oxford Dictionary 11th Edition*, *Dictionary.com Unabridged*; *Random House, Inc.*, *Dictionary of American Regional English*, *Merriam Webster’s 11th Collegiate Dictionary*, *Merriam Webster’s Unabridged Dictionary*, *Oxford English Dictionary, 2nd edition* and *Random House Webster’s Unabridged Dictionary*. In addition, some other words have been found in monographs by contemporary authors (Pennanen and others), and several more recent items come from *The Longman Register of New Words* (Ayto 1990).

³ “Jen-Luc Piquant learned that 21 very gullible people attempted to **fire-walk** as part of a four-day motivational seminar in San Jose last weekend run by Tony Robins” (Ouellette, online).

⁴ Only one dubious instance of the verb *fortune-hunt* was discovered: “Her treasures belittle Hie glossiest dreams of Coronado when he fortune-hunted hereabouts a few centuries back.” (<http://www.newspapers.com/newspage/17484174/>)

⁵ All the Internet pages were accessed in the period of July to September 2013

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Appendix

A survey of the BF source words and the attested BF neologisms

1. (Type I) *-ter*^{N>V}

1. <i>bardolate</i> < <i>bardolater</i>	“to idolize Shakespeare” <i>It is all speculation - but people who 'bardolate' do tend to forget the theatrical context Shakespeare worked in.</i> (2008) http://shakespeareance.blogspot.cz/2008/03/hack-adaptor.html
2. <i>bean-count</i> < <i>bean-counter</i> INFORMAL	“to be involved in corporate or government financial decisions and to be reluctant to spend money” <i>After you get that off your chest, though, you'll need to set aside your defensive impulses and bean-count.</i> (2012) http://www.washingtonpost.com/lifestyle/style/carolyn-hax-a-homemaker-feels-the-sting-of-free-time-remark/2011/12/21/gIQApfXXmP_story.html?wprss=rss_linkset
3. <i>bill-post</i> < <i>bill-poster</i>	“to post bills and advertisements” <i>The personal testimony of successful farmers was bill-posted from station platform to remotest barb-wire fence.</i> (2013) http://www.oldandsold.com/articles30/canada-4.shtml
4. <i>bounty-hunt</i> < <i>bounty-hunter</i>	“to hunt outlaws or wild animals for the bounty offered for capturing or killing them” <i>Even after having been bounty-hunted, the hero regenerates over time, so at best it's a temporary reprieve, but it's enough to take the advantage.</i> (2007) http://www.insidemacgames.com/reviews/view.php?ID=828&Page=2
5. <i>Braille-write</i> < <i>Braille-writer</i> (also <i>Braille-writing</i>)	...
6. <i>brancobust</i> < <i>brancobuster</i>	...
7. <i>combine-harvest</i> < <i>combine harvester</i>	...

8. <i>cookie-cut</i> < <i>cookie-cutter</i> <i>AMERICANISM</i>	“to change someone’s (especially a child’s) character or a thing according to a given pattern” (transferred meaning, often disparaging) <i>In my experience and in the experience of millions of children forced to attend public schools – it is public schools that rubber-stamp and cookie-cut children into terrified little conformists, desperate to find a clique and dreaming of being popular, forcing them over a precipice into pits of sex, alcohol and drugs hoping to either fit in or distract themselves from the pain.</i> (2008) http://billayers.wordpress.com/2008/01/09/child-soldiersby-therese-quinn-erica-meiners-bill-ayers/
9. <i>copywrite</i> < <i>copywriter</i>	...
10. <i>downconvert</i> < <i>downconverter</i>	“to convert high-definition television video to standard-definition video that can be viewed on conventional television, receivers or computer monitors, or recorded on DVD” <i>Hook up a miglia miniHD (\$150ish) to a Mac Mini and you have an ASTC HD DVR with no DRM, plus it will automatically downconvert and export for iPod and iPhone.</i> (2008) http://gigaom.com/2008/02/22/will-the-new-apple-tv-make-the-mac-mini-obselete/
11. <i>downlight</i> < <i>downlighter</i>	...
12. <i>fire-eat</i> < <i>fire-eater</i>	...
13. <i>fire-fight</i> < <i>fire-fighter</i>	...
14. <i>fortune-hunt</i> < <i>fortune-hunter</i>	...
15. <i>freedom-fight</i> < <i>freedom-fighter</i>	...
16. <i>gang-bust</i> < <i>gang-buster</i>	...
17. <i>inkjetprint</i> < <i>inkjetprinter</i>	“to spray electrostatically small ink droplets from a nozzle onto the paper” <i>In this study, graphene-PEDOT/PSS is inkjetprinted on screen printed carbon paste electrode (SCE) to enhance the electrochemical sensitivity of the electrode.</i> (2011) http://ieeexplore.ieee.org/xpl/articleDetails.jsp?reload=true&arnumber

2. (Type II) -ting^{N>V}

1. <i>action-paint</i> < <i>action painting</i>	...
2. <i>badger-bait</i> < <i>badger-baiting</i>	...
3. <i>bear-bait</i> < <i>bear-baiting</i>	...
4. <i>computer-date</i> < <i>computer dating</i>	...
5. <i>cross-vote</i> < <i>cross-voting</i>	“to vote for a party one does not belong to, or for more than one party” <i>Congress, BJP legislators cross vote in Karnataka legislative council poll</i> (2012) http://www.ndtv.com/article/south/congress-bjp-legislators-cross-vote-in-karnataka-legislative-council-poll-230180
6. <i>cybersquat</i> < <i>cybersquatting</i>	“to register an internet domain name that is likely to be wanted by another person, business or organization in the hope that it can be sold them for a profit” <i>Pope Francis was cyber squatted more than three years ago.</i> (2013) http://www.fudzilla.com/home/item/30759-pope-francis-was-cyber-squatted-more-than-three-years-ago

7. <i>deer-hunt</i> < <i>deer-hunting</i>	“to hunt deer” <i>Eventually, my son and I would see turkeys on the land where we deer hunted near our home.</i> http://www.oakridge-archery.com/marlon_turkey_story.html
8. <i>double-knit</i> < <i>double knitting</i>	“to make a type of cloth with two sets of needles and has two connected layers” <i>You can double knit a stockinette scarf, and it will lay flat instead of curling.</i> (2009) http://community.knitpicks.com/notes/Double_Knitting
9. <i>dry-mount</i> < <i>dry mounting</i>	“to fasten a print, photograph, or the like to a board by using a heated thermoplastic tissue as an adhesive” <i>For those of you who sell your prints as art or exhibit them, do you dry mount them on the matboard or do you use archival hinges/corners/etc. on matboard?</i> (2010) http://www.thephotoforum.com/forum/general-shop-talk/195954-dry-mounting.html
10. <i>free-skate</i> < <i>free skating</i>	...
11. <i>hair-split</i> < <i>hair-splitting</i>	...
12. <i>immunoblot</i> < <i>immunoblotting</i>	...
13. <i>method act</i> < <i>method acting</i>	(of an actor) “to identify as closely as possible with the character played by correlating experiences from his/her personal life to the character” (the method was created by K. Stanislavsky) <i>How to method act successfully?</i> (2008) http://answers.yahoo.com/question/index?qid=20090416172132AANpXDP
14. <i>mirror-write</i> < <i>mirror-writing</i>	“to write backwards so that the writing resembles in slant of letters the reflection of ordinary writing in a mirror” <i>My 4 year old son sometimes mirror writes his name perfectly is it anything to worry about?</i> (2013) http://www.netmums.com/coffeehouse/children-parenting-190/primary-school-age-4-11-years-60/898337-4-year-old-mirror-writing.html
15. <i>nail-bite</i> < <i>nail-biting</i>	...
16. <i>oil-paint</i> < <i>oil painting</i>	...
17. <i>picture-write</i> < <i>picture writing</i>	...
18. <i>powerlift</i> < <i>powerlifting</i>	“to participate in a contest involving three tests of strength: the bench press, squat, and two-handed lift”

3. (Type V) -graphy^{N>N}

1. <i>arteriograph</i> < <i>arteriography</i>	“a diagnostic instrument used to visualize the inside of blood vessels and organs of the body, with particular interest in the arteries, veins and the heart chambers” <i>The Arteriograph is a diagnostic instrument which is able to measure the severity of arteriosclerosis.</i> (2013) http://www.drsharmadiagnostics.com/arteriograph.htm
2. <i>biostratigraph</i> < <i>biostratigraphy</i>	...

3. cosmograph < <i>cosmography</i>	<p>“a kind of graph resembling pie charts, usually used in order to represent finances”</p> <p>Cosmographs are often used by government agencies to represent the amount of funds they applied to various projects. (2007) http://mcconkey-johnston.com/NewPDFs/CosmographArticle.pdf</p>
4. crystallograph < <i>crystallography</i>	<p>“An instrument used for the description of the forms and structures of crystals”</p> <p><i>How did Rosalind Franklin report her x-ray crystallograph?</i> (2013) http://wiki.answers.com/Q/How_did_Rosalind_Franklin_report_her_x-ray_crystallograph</p>
5. discograph < <i>discography</i>	...
6. ethnograph < <i>ethnography</i>	<p>“a computer program designed to facilitate the processing of qualitatively gathered sociological data”</p> <p>Ethnograph is a qualitative data analysis software that allows you to create ethnographic projects. (2013) http://ethnograph.software.informer.com/</p>
7. flexograph < <i>flexography</i>	...
8. hagiograph < <i>hagiography</i>	<p>“a holy writing”</p> <p><i>Beecher was not free -- he was bound by a hagiograph riveted upon his soul; and so to a degree his whole nature was cramped and tortured in his struggles between the "natural man" and the "spiritual".</i> (2007) http://www.gutenberg.org/files/23761/23761-8.txt</p>
9. haplograph < <i>haplography</i>	<p>“omission of a repeated word”</p> <p><i>A conservative emendation would be <i>ponon</i> [on]geomor woc, and the error could be explained either as a haplograph or as the scribe's attempt to correct what he perceived as a dittograph (-onon on-)' (184-5). (2013) http://www.heorot.dk/beowulf-ms-notes.html</i></p>
10. lexicograph < <i>lexicography</i>	...
11. oceanograph < <i>oceanography</i>	<p>“a written description of the physical and biological aspects of the oceans, including their chemistry, biology, and geology”</p> <p><i>The earliest incarnation of this instrument was called an oceanograph by maker, MIT Professor Carl Rossby.</i> (2009) http://museum.mit.edu/nom150/entries/1250</p>
12. prosopograph < <i>prosopography</i>	...
13. stereolithograph < <i>stereolithography</i>	<p>“a 3D printing machine - a uniquely designed apparatus which converts liquid plastic into solid”</p> <p><i>Simulation of total hip arthroplasty revision due to infection using stereolithograph; a case report.</i> (2006) http://sciencelinks.jp/j-east/article/199917/000019991799A0397696.php</p>
14. stratigraph < <i>stratigraphy</i>	<p>“a Java based tool for computation and visualization of stratification graphs”</p> <p>Stratigraph is a software toolbox, now available in pre-release versions, to analyze and display such data. (2007) https://gsa.confex.com/gsa/2007AM/finalprogram/abstract_132674.htm</p>
15. uranograph < <i>uranography</i>	<p>“a set of classes and methods written in Java for generating printable</p>

4. (Type VI) *-ics*^{N>A}

1. <i>aquarobic</i> < <i>aquarobics</i>	(of exercise) “performed standing up in a swimming pool” <i>The aquarobic exercise program is composed of patient education and aquarobic exercise.</i> (2010) http://europepmc.org/abstract/MED/21193289/reload=0;jsessionid=n_gxxLSzuWdQYId23QjWn.20
2. <i>callanetic</i> < <i>callanetics</i>	(of exercise) “involving frequent repetition of small muscular movements and squeezes, designed to improve muscle tone” <i>Callanetic Studio is the ideal venue for exercise classes. Callanetics classes are held throughout the week.</i> (2013) http://www.activescotland.org.uk/ServiceProvider/Facility/index.html?id=f8048492-e190-49be-8111-9a4700c0e4e1
3. <i>combinatoric</i> < <i>combinatorics</i>	(of mathematics) concerned with the selection, arrangement, and combination of objects chosen from a finite set. <i>For example, you may ask, “if I have ten red balls and twenty green balls, and I randomly draw three balls, how many different combinations of red and green do I get?” That’s a combinatoric question – counting discrete things.</i> (2013) http://orgtheory.wordpress.com/2013/02/22/linear-vs-combinatoric-social-science/
4. <i>Ebonic</i> < <i>Ebonics</i> <i>AMERICANISM</i>	“of or pertaining to Black English (= Ebonics)” <i>What are some funny Ebonic translations?</i> (2013) http://www.ask.com/question/ebonics-translator
5. <i>fluid-mechanic</i> < <i>fluid mechanics</i>	“of or pertaining to fluid mechanics - a branch dealing with the properties of liquids and gases” <i>We report fluid-mechanic experiments that are designed to investigate this case, specifically treating the injection process itself, before a multilayered, convecting system develops.</i> (1995) http://link.springer.com/article/10.1007/s004100050123
6. <i>informatic</i> < <i>informatics</i>	“of or pertaining to informatics – the information /computer science” <i>However, the functionality of the game is pure software culture, suggesting that perhaps the more one tries to strip utopia of its machinic core, by cloaking it in any manner of pure fantasy or pre-modern worlds (“dungeons and dragons,” “swords and sorcery,” etc.), the more informatic and algorithmic it becomes, reverting to the software equivalent of twenty-sided dice.</i> (2008) http://gerrycanavan.wordpress.com/2008/02/11/warcraft-and-utopia/
7. <i>mechatronic</i> < <i>mechatronics</i>	“of or pertaining to mechatronics - the combination of mechanical engineering, computing, and electronics, as used in the design and development of new manufacturing techniques” <i>Mechatronic engineering is the integration of precision mechanical engineering with electronics, computer systems, and advanced controls to design and construct products and processes.</i> (2013) http://www.mt89.doodlekit.com/
8. <i>moletronic</i> < <i>moletronics</i>	“relating to moletronics – molecular electronics” <i>To make moletronic computers a reality, the devices had to do more than merely let electrons flow through them. They had to control that flow.</i> (2001) http://www.ctcase.org/bulletin/16_4.pdf

<p>9. <i>soil mechanic</i> < <i>soil mechanics</i></p>	<p>“relating to soil mechanics – the study of the physical properties of soil, especially those properties that effect its ability to bear weight, such as water, density, strength, etc.” <i>A double-factor ANOVA showed that the effect of soil mechanic resistance and work speed in NT caused significant differences in depth seed placement. (2012)</i> http://cigr.ageng2012.org/images/fotosg/tabla_137_C0937.pdf</p>
<p>10. <i>step aerobic</i> < <i>step aerobics</i></p>	<p>“of or pertaining to step aerobics – exercises and dance movements performed by stepping up onto and down from a rectangular block” <i>He says that a step aerobic exercise program will help you metabolize fat, strengthen your muscles and increase your aerobic stamina. (2013)</i></p>