Light Verbs and the Lexical Category Bias of Their Complements

Mémoire de DEA

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Abstract

Light verb constructions are periphrastic paraphrases of verbs. For example, English expressions *put the blame on, give someone a kick, take a walk* are instances of such paraphrases for the verbs *blame, kick, and walk*. The verbs that head these phrases are called “light” verbs because they are considered as semantically empty or impoverished. Their complements are headed by deverbal nouns, which are considered as a mixed category, showing some nominal and some verbal properties. Light verb constructions present a problem for natural language processing because their meaning is considerably idiosyncratic and non-compositional and they cannot be translated to other languages literally. On the other hand, they are not conventionalized enough to be treated as idioms or collocations. They require a special approach, distinguishing them from regular verb phrases, but at the same time, taking into account their underlying regularities. The aim of this study is to quantify the lexical category bias of the nominal complements of light verbs and to determine in an experiment if the degree to which the nominal complement in a construction is close to the category of verb is related to the degree to which the meaning of the light verb is impoverished. The lexical category bias of complements is assessed on the bases of corpus counts. The degree of semantic impoverishment of light verbs is assessed on the basis of human judgements collected through a questionnaire. These two values are correlated for a sample of constructions. The results show that they do not correlate, except in the case where the complement as well as the particular verb-noun combination are not frequent, i.e. in the case of the least conventionalized light verb constructions.
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## Contents

1 Introduction 4

2 Linguistic analyses of light verb constructions 9
   2.1 Light verb .................................................. 10
       2.1.1 Light verbs as syntactic argument structure .... 11
       2.1.2 The meaning of light verbs ..................... 12
   2.2 The complement of light verbs as a mixed category ... 15
   2.3 True light verbs and vague action verbs ............ 18

3 Automatic identification of light verb constructions 21
   3.1 Identifying light verb constructions ................. 22
   3.2 Measuring semantic compositionality and productivity ... 24

4 Lexical category bias of the complements of light verbs 29
   4.1 Measuring lexical category bias ...................... 31
   4.2 Experiment ................................................. 33

5 Materials and methods 34
   5.1 Corpus data ................................................ 34
       5.1.1 Extracting verb-noun pairs ..................... 35
       5.1.2 Lemmatised frequencies for verbs and nouns ... 37
   5.2 Human judgements ......................................... 38
       5.2.1 Sampling ............................................. 38
       5.2.2 Questionnaire ..................................... 40
Chapter 1

Introduction

Light verb constructions are typically identified as periphrastic paraphrases of verbs. English expressions *put the blame on*, *give someone a kick*, *take a walk* are instances of such paraphrases for the verbs *blame*, *kick*, and *walk*. These constructions are attested in many different languages, representing a widespread linguistic phenomenon, interesting both for theoretical and applied research. They are characterized by a special relation between the syntax and semantics of their constituents. The verbs that head these phrases are usually said to be semantically “empty” or “impoverished”. Their semantic contribution to the overall meaning of the phrase does not correspond to their syntactic position of a head. The main meaning of the phrase is provided by the complement, in fact, which does not correspond to its syntactic position either.

(1) Mary \[VP \text{ had } [NP \text{ a yacht}]\].
(2) Mary \[VP \text{ had } [NP \text{ a laugh}]\].
(3) Mary \[VP \text{ laughed}\].

The verb phrases in (1) and (2) represent two different usages of the verb *have*, although they have the same syntactic structure. The verb *have* is the head of the phrase in both examples, taking the nouns *yacht* and *laugh* as complements. The difference is that the meaning of the phrase
in (1) corresponds to the meaning of its head (it refers to “having”), while
the meaning of the verb phrase in (2) corresponds to the meaning of its
complement (it refers to "laughing"). Figure 1.1 illustrates the difference.
Unlike the the phrase in (1), the phrase in (2) can be transformed into a
single verb, as in (3), without changing the meaning of the sentence.

![Diagram of light verb construction](image)

Figure 1.1: Light verb construction: a special case of projection.

The case in (1) is a typical verb phrase, formed by the general rules of
phrase structure. On the contrary, the verb phrase in (2) is a light verb
construction — a special verb phrase that need to be distinguished from
regular phrases.

Light verb constructions require a special treatment in natural language
processing. The meaning of these phrases is considerably idiosyncratic and
non-compositional and they cannot be translated to other languages literally,
which is why they need to be treated as multiword expressions. Since their
representation cannot be obtained by an analysis based on general rules, they
need to be identified in an automatic analysis so that they can be correctly
interpreted.

Some of these constructions, such as those in (3-4), are similar to collo-
cations. They are frequent and conventionalized expressions and they can
be processed applying methods developed for other multiword expressions.
Other light verb constructions, however, such as those in (5-6), are not con-
ventionalized, but rather formed according to a common, relatively produc-
tive pattern. This pattern can determine, for example, the type of the complement of the construction (deverbal nouns), or the kind of meaning that can be attributed to the light verbs that head the constructions. Thus, light verb constructions require a special approach, distinguishing them from regular verb phrases, but at the same time, taking into account their underlying regularities, as well as potential differences between them.\footnote{The problem is somewhat similar to the one posed by English phrasal verbs. Some of these constructions are more opaque, e.g. look up, give up, while others are more compositional, e.g. fly up, go up. The need to distinguish between the two cases, extracting the underlying regularities, is emphasized in McCarthy, Keller and Carrol (2003).}

(3) Mary took a shower.
(4) Mary took a walk.
(5) Mary had a jog this morning.
(6) Mary gave the show a miss.

Another problem that light verb constructions pose for natural language processing involves their semantic representation. As we can see in the examples above, English light verbs take nominal complements that are, morphologically and semantically, related with verbs. This means that both constituents of light verb constructions, the heading verb and its nominal complement, are argument-taking words. It is not clear, however, how their arguments are distributed. For example, Mary is clearly an argument of had and not of yacht in (1), but it can be an argument of both had and laugh in (2). For applications that involve any kind of semantic analysis it is important to determine the predicate-argument relations between constituents in a sentence. Again, the argument structure of light verb constructions needs a special representation.

The fact that nominal complements of light verbs have some verbal features at the same time is a specific property of light verb constructions. It has already been used in developing statistical measures for their automatic identification. (Grefenstette and Teufel 1995, Stevenson, Fazly and North...
In our study, this property is further explored. The aim of this research is to determine in an experiment if the degree to which the nominal complement in a construction is close to the category of verb is related to the degree to which the meaning of the light verb is impoverished. A correlation between these two properties would mean that an indicator of a light usage of a verb can be the similarity of its complement with the corresponding verb.

Considering each complement as a word ambiguous between two categories, noun and verb, we assess its lexical category bias on the basis of corpus data. We assume that this measure reflects whether the word is close to one or the other category. The degree to which the meaning of a light verb is impoverished is assessed on the basis of native speakers’ judgements. This includes the assumption that native speakers have certain intuition about the level of specification of words’ meaning.

On the basis of some linguistic analyses (Butt and Geuder 2001, Brugman 2001, Grimshaw and Mester 1988) and in line with the previous work on automatic identification of light verb constructions (Fazly 2007), we consider light verbs as non-literal uses of ordinary verbs. The meaning of light verbs can differ from their literal meaning to a different degree, depending on the extent to which their meaning is impoverished. The instances with lighter verbs, as in (7), are further from their literal meaning. The instances where the meaning of the light verb is more specified are closer to the literal meaning (8).

(7) John gave the table a wipe.
(8) John gave a talk yesterday.

In the following chapter, we present linguistic analyses of light verb constructions. The properties of light verbs are discussed in Section 2.1. The nominal and verbal characteristics of the complements of light verbs are described in Section 2.2. The last section of the chapter presents the differences between two types of light constructions. In Chapter 3, we review the pre-
vious work on automatic identification of light verb constructions (Section 3.1), as well as on measuring their semantic compositionality and productivity (Section 3.2). In Chapter 4, we propose the lexical category bias score as an indicator of compositionality of light verb constructions. Chapter 5 describes procedures used in collecting data and the results of the experiment. We first describe collecting the corpus data: extracting verb phrases (Section 5.1.1) and obtaining lemmatised frequency lists for verbs and nouns (Section 5.1.2). The second part of this chapter deals with eliciting human judgements. In Section 5.2.1, we describe the sample of phrases for which human judgements were provided. In Section 5.2.2, we describe developing the questionnaire used for eliciting the judgments. In Section 5.2.3, we discuss the agreement between the judges. Finally, in Section 5.3, we present and discuss the results of comparing human judgements with the lexical category bias score. In Chapter 6, the contributions of the research are summarized (Section 6.1). We close this chapter indicating some directions of potential future research (Section 6.2).
Chapter 2

Linguistic analyses of light verb constructions

Light verb constructions are discussed from different points of view in linguistic theory. They raise several questions concerning the interface between the lexicon and syntax: What are the special lexical properties of light verbs and their complements? How are lexical entries for these words organized? How do these properties fit into phrase structure rules? The questions discussed from the point of view of semantics are: How can be the meaning of light verbs described? Are they related to their “heavy” counterparts and how? Is there a particular meaning common to all light verb constructions? Are the complements of light verbs characterized by some particular meaning? It has also been noted that light verb constructions have a specific role in discourse organization and that they can be analyzed from this point of view too.\(^1\)

\(^1\)Brugman (2001) gives the following examples to illustrate the participation of light verb constructions in establishing co-reference and discourse coherence (emphasis are original): i. “However, although I find this ontological question relevant in making claims about polysemy, I cannot directly use my present empirical methodology to test them.” ii. “#However, although I find this ontological question relevant in claiming things about polysemy, I cannot directly use my present empirical methodology to test them / those claims.”
In this chapter, we present different analyses concerning the notions of semantic impoverishment of light verbs and the mixed, nominal and verbal, properties of their complements, introducing a classification of light verb constructions based on these notions.

### 2.1 Light verb

The metaphorical opposition “light — heavy” is used in linguistics to denote a general difference between the words and constituents that have an actual meaning and those that are semantically empty. Words such as verbs, nouns, adjectives, and adverbs generally have semantic content since they refer to an event, situation, object, or a property that can be imagined. Words such as prepositions, articles, and conjunctions do not refer to any entity that can be imagined. They are formal constituents of sentences, used to put the other words in different relations. The former are considered as heavy, and the latter as light. The term light verb is used to refer to the verbs that do not have semantic content, i.e., that do not refer to any imaginable event or situation.

The concept of a verb that does not have semantic content plays an important role in explaining lexical alternations and lexical derivations in the framework proposed by Hale and Keyser (1993) and based on Baker (1988). They argue for a separate level of lexical representation of verbs — lexical relational structure (LRS) — that contains a specification of the relations in which a particular verb can participate. This is the light verb. It is present in the lexical representations of all verbs. This part of lexical representation is the same for the verbs get in (9) and bottle in (10). The difference between these two verbs is explained by two different incorporations — lexical transformations involved in deriving lexical items. In the first case, the light verb incorporates the verb get, while in the second case, it incorporates the noun bottle through a series of head movements.²

²A detailed formalization of head movement is presented in (Baker 1988).
2.1.1 Light verbs as syntactic argument structure

Kearns (2002) assumes the notion of complex lexical entry introduced by Hale and Keyser (1993) in distinguishing between two parts of the lexical entry of verbs: the lexical conceptual structure (LCS) and syntactic argument structure (SAS). The former represents the semantic content of verbs, including the specification of the participants of the event denoted by the verb. The latter specifies the open syntactic positions to be filled by the constituents of a sentence (such as subject or object). For example, the LCS of the verb cut defines that this verb denotes “linear separation in the material integrity”, as well as that there are two participants in this event: the one that cuts and the one that is cut. Its SAS defines that the sentence formed with this verb will contain a subject and an object.

Light verb constructions are generated in the cases where the two components of the verb’s lexical entry are separated, so that only the SAS is active in syntactic derivation. In a conjunction with a predicating nominal, a light verb gives up its LCS, turning into a functional word with no semantic content. It takes the content of its complement and distributes it to its syntactic positions. As a result, the subject of (11) John will be semantically related with sweep and not with give.

(11) John gave the floor a sweep.

Kearns (2002) identifies three syntactic transformations that cannot be applied to light verb constructions: passivization (12), WH movement (13), and pronominalization (14).

(12) * A groan was given by the man on the right.
(13) * Which groan did John give?
These restrictions are explained by the fact that the syntactic constituents of the sentence are not semantic arguments of the verb. All the three transformations involve shifting syntactic constituents which are semantic arguments of the verb at the same time. Since light verbs do not have semantic arguments, these transformations are not possible.

### 2.1.2 The meaning of light verbs

Other authors tend to consider light verbs as having some semantic content, especially in the case of English. Grimshaw and Mester (1988) argue that there are different kinds of light verbs, with argument structure less or more specified. They point to the morphological markers that show the difference between the complements of the Japanese verbs *suru* and *saseru*. The arguments of *suru* are unspecified, while *saseru* has “a more fully specified argument structure: incomplete, but with some arguments specified” (Grimshaw and Mester 1988: 229). English light verbs are claimed to be like Japanese *saseru*.

Butt and Geuder (2001) compare different constructions with English verb *give* and its Urdu counterpart *de*. Both light *give* and light *de* are seen as instances of lexical polysemy. The gradual extension of the prototypical meaning of *give* is illustrated with the following sequence of expressions:

(15)  
* give him the ball  
* give the dog a bone  
* give the costumer a receipt

(16)  
* Tom gave the children their inheritance money before he died  
* The king gave the settlers land

(17)  
* give advice

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*Verbal meaning is often described in terms of a predicate and its arguments.*
*give someone the right to do something*

*give someone information*

(18) *give someone emotional support*

*give someone one’s regards*

(19) a. *give someone a kiss / a push / a punch / a nudge / a hug*

b. *give the car a wash, give the soup a stir*

The change in the meaning of *give* depends on the sort of the complement. The most prototypical variant in (15) involves a change in possession of the object together with a change of its location. Having a more abstract object, or an object that does not move, excludes the component of moving from *give* in (16). The possession is excluded with objects that are not actually possessed, such as *advice* or *right* in (17), and replaced with a more abstract component of resultant state. The action of “giving” in (18) is realized without “giver’s” control over the recipient’s state. Finally, the light *give* in (19) does not denote a transfer at all, but just “the exertion of some effect on the recipient”. The difference between the two groups of expressions is made by the presence of the component of moving in (19a), while in (19b), even this is gone.

The presence of an agent (the participant that performs or causes the action denoted by the verb), completion of the action, and its “directedness” are the components of meaning present in all the realizations. These are also the components that the English *give* and the Urdu *de* have in common.

Brugman (2001) focuses on the English verbs *give, take, and have*. In this analysis, an abstract layer of verbal meaning is identified as the semantic content that light verbs preserve and systematically contribute to light verb constructions. This meaning is described in terms of force-dynamic schemata — a theoretical framework for representing interactions between entities. Within this framework, semantic properties such as aspect and argument
structure of a verb are seen as a consequence of a particular energy flow involved in the event denoted by the verb. If a verb denotes an event were some energy is applied, it will be an action verb, otherwise it will denote a state. In the domain of argument structure, the participant that is the source of energy will have the role of agent and the one that is the sink of the energy will have the role of patient. The meaning of a light verb retains the pattern of force dynamics (or a part of it) of its heavy (i.e. semantically specified) counterpart. Two different senses of a verb have different patterns.

(20) Sandy took the book \{ from Ashley / off the table \}.

(21) a. Sandy took the book to Ashley.
    b. Sandy took Ashley (to the movies).

The action in (20) is self-oriented, with Sandy being the energy source and sink at the same time. In (21), another participant (Ashley / to the movies) is more important, since it denotes the direction of energy. These are two different senses of the verb take.\(^4\)

Light take keeps only the pattern represented in (20). It can have two different senses itself, depending on what part of the pattern it preserves. The bomber, denoting a person who initiated a reading, is the energy source in (22), while it is the energy sink in (23), denoting an aeroplane that was hit.

(22) The bomber took a reading.
(23) The bomber took a hit.

The differences in meaning between light verbs such as take in (24) and give in (25) are also explained in terms of different force-dynamics patterns.

\(^4\)The difference is reflected in the fact that this argument can be omitted in sentences like (20) whenever it is indefinite or indeterminate, while in sentences like (21), it can only be omitted if it can be interpreted from the context.
(24) Take a {sniff / taste} of the sauce, will you?
(25) Give the sauce a {sniff / taste}, will you?

In (24) it is the opinion of the addressee that is asked for. So, the energy is directed towards the agent, which corresponds to the force-dynamic pattern of the verb take. The question in (25) is about the sauce. One wants to know whether it had spoiled. This direction corresponds to the pattern of the verb give.

The linguistic analyses presented above suggest that the meaning of light verb constructions is compositional. They differ, though, in explaining how it is composed. If light verbs were considered as syntactic realizations of abstract light verbs, with no semantic content, as it is suggested in (Kearns 2002), the meaning of light verb constructions could be calculated from the meaning of their complements alone. In this case, light verbs and their heavy counterparts would be homonyms. However, other analyses show that light verbs do contribute to the meaning of their phrases. Their meaning is related to the meaning of their heavy counterparts and it can be more or less specified in different constructions. A number of semantic properties (e.g. agentivity, completion)\(^5\) of light verbs are proposed, but this is far from a systematized inventory.

### 2.2 The complement of light verbs as a mixed category

As already pointed out in the previous section, the distinctive property of light verb constructions is the fact that they take a complement headed by a deverbal noun. These nouns combine the features that characterize nouns

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\(^5\)Some of the components are suggested by Wierzbicka (1982): “The have a V construction is agentive, experiencer-oriented, antidurative, atelic, and reiterative”. 

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and verbs. For example, we can compare *look* in (27) both with *cup* in (26) and *look* in (28).

(26) Mary took a cup of coffee.
(27) Mary took a look at her daughter.
(28) Mary looked at her daughter.

Both *look* in (27) and *cup* in (26) are nouns. Together with the article that precedes them, they constitute the direct object of the sentence. At the semantic level, they are both arguments of the verb *take*. On the other hand, *look* in (28) is a verb. It bears the past tense ending and it is the syntactic predicate in the sentence. Nevertheless, the meaning of *look* in (27) is almost the same as the meaning of *look* in (28). They can be seen as two realizations, verbal and nominal, of the same lexical concept.

Much of the work in linguistics has been done on explaining semantic and syntactic relations between these nouns and verbs. Hale and Keyser (1993) propose a regular lexical derivation that transforms nouns into verbs. According to their approach, the noun *laugh* will be incorporated in an abstract light verb to form the verb *laugh* (see also Section 2.1). Other authors (Comrie and Thompson 1985, Rappaport 1983) consider this relation as nominalization, a derivation that transforms verbs into nouns.

The noun that heads a light verb complement in English can be more or less similar to the corresponding verb. Its form can be identical to the verb form, as it is the case in (27), or it can be derived from a verb with a suffix, as in (30). Although certain parallelism in their meaning is reflected in the fact that they take the same argument (*at her daughter* in (27) and (28)), the syntactic realization of this relation can be different. In some cases, the same argument is realized as the same complement at the syntactic level, as in (27) and (28). In other cases, the argument can be differently realized in syntax (*his brother* vs. *to his brother* in (29)) or it can be left unspecified.

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6In some languages such as Urdu (Butt and Geuder 2001), light verbs can take both verbs and nouns as complements. In English, they only take nouns.
(the project site vs. no complement in (30)).

(29)  a. John visited his brother.
     b. John paid a visit to his brother.

(30)  a. They inspected the project site last week.
     b. They made an inspection last week.

The meaning of a deverbal noun can be more or less similar to the meaning of the corresponding verb. Grimshaw (1990) distinguishes between event nominals (31) and result nominals (32), arguing that only event nominals actually denote an action and can take arguments.

(31)    the examination of the papers
(32)    * the exam of the papers

Since one of the characteristics of the event nominals is that they cannot be modified by the indefinite article, most of light verb complements would be classified as result nominals according to this analysis. On the contrary, Wierzbicka (1982), underlines the difference in meaning of the complements of the verb have in (33) and (34). The nouns like swim in (33) are claimed to be verbs “despite the fact that they combine with an indefinite article” and should be distinguished from deverbal nouns. All the derived forms are considered to be nouns, together with some nouns that have the same form as verbs, but whose meaning is clearly that of a noun, such as smile in (34a), cough in (34b), or quarrel in (34c).

(33)    He had a swim.
(34)  a. She has a nice smile.
     b. He has a nasty cough.
     c. They had a quarrel.

Kearns (2002) notices that the complements of light verbs are not “real nouns”, but that they are coined for the constructions and do not occur freely
in other nominal environments. Similarly, Grimshaw and Mester (1988) make a difference between the nominal phrases that are complements of the verb suru and those of the verb soseru (see Section 2.1).

According to the presented analysis, complements of light verbs can be seen as a mixed category, showing some nominal and some verbal properties. Their meaning is closer to a typical verbal meaning when they denote an action, and closer to a typical nominal meaning when they denote a result of an action. However, it is difficult to establish formal criteria to distinguish between these two meanings.

2.3 True light verbs and vague action verbs

The variety of phrases that can be considered as light verb constructions includes different types of constructions. The distinctions between the types can be made in different ways, but they always depend on the degree to which the complement is verbal or nominal (cf. Grimshaw and Mester 1988, Wierzbicka 1982, Kearns 2002).

If the complement is more verbal, the construction will have a specific, more fixed syntactic structure. The complement in these constructions is always a noun that is identical in form with the corresponding verb. It cannot be modified by the definite article and it does not participate in transformations such as passivization, WH movement, and pronominalization (35-38a). These are constructions with true light verbs (Kearns 2002). If the complement is more nominal, the syntax of the construction will be less specific. The complement can be a noun derived with a suffix. It can have different modifiers and it can move more freely (35-38b). These are constructions with vague action verbs (Kearns 2002), i.e. not light verb constructions at all. Other authors (Grimshaw and Mester 1988, Brugman 2001) do not distinguish between the two types, considering all the constructions in (35-38) as light verb constructions.
(35)  a. * Who gave the groan just now?  
     b. I don’t know who made the inspection.

(36)  a. * A groan was given by the man on the right.  
     b. An inspection was made some time last week.

(37)  a. * Which groan did John give?  
     b. Which offer did the finance company make?

(38)  a. * I gave the soup a heat and then Bill gave it one too.  
     b. The Health Department made an inspection on Monday and 
        may make another one before prosecuting.

Being obviously different in some respects, both of these groups are char-
acterized by the features that make them problematic for automatic treat-
ment. Even if a verb is just a vague action verb, some kind of semantic re-
arrangement is involved (Argument Transfer (Grimshaw and Mester 1988)),
which needs to be interpreted. The selection of the complement is conven-
tionalized to a certain extent in both cases, which means that different types
of complements will be selected in different languages.

On the other hand, it is useful to make a distinction between the different
types, since they might need different interpretations. For example, the
constructions with true light verbs could be considered as simple predicates,
with all the arguments belonging to the complement, while the constructions
with vague action verbs could be seen as complex predicates, where some
arguments belong to the verb and some to the complement.

In a multilingual context, the two types of constructions in English can
have different translation equivalents in other languages. For example, con-
structions with true light verbs can only be translated with one single verb in
Serbian, as in (39). This verb is perfective\(^7\) and, in most cases, has a prefix.

\(^7\)In Serbian, like all the other Slavic languages, verbs are divided into perfective and
imperfective, according to the aspect.
In contrast to this, constructions with vague action verbs can be translated with a perfective or imperfective verb, but also with a corresponding light verb construction (40) (Samardžić 2007).

(39)  
\[a. \quad \text{Mary took a look at her daughter.}\]
\[b. \quad \text{Marija je pogledala kćerku.}\]
\[\text{Mary AUX PREF-looked daughter-ACC}\]

(40)  
\[a. \quad \text{Mary has finally made a decision.}\]
\[b. \quad \text{Marija je konačno donela odluku.}\]
\[\text{Mary AUX finally brought decision-ACC}\]

All the constructions with deverbal nouns as complements are considered as potential light verb constructions in this study. They are ranked according to the degree to which they exhibit one of the properties of light verb constructions — the similarity of their nominal complement to a verb.
Chapter 3

Automatic identification of light verb constructions

Light verb constructions require a special treatment in natural language processing. The meaning of these phrases is considerably idiosyncratic and non-compositional and they cannot be translated to other languages literally (examples (39) and (40) in Section 2.3). This is why they need to be treated as multiword expressions. Since their representation cannot be obtained by an analysis based on general rules, they need to be identified in an automatic analysis so that they can be correctly interpreted. However, what distinguishes these phrases from other multiword expressions is the fact that they are formed according to a common, relatively productive pattern. This pattern can determine, for example, the type of the complement of the construction (deverbal nouns), or the kind of meaning that can be attributed to the light verbs that head the constructions (see Section 2.2 and 2.1). This is why these constructions require a special approach, distinguishing them from regular verb phrases, but at the same time, taking into account their underlying regularities.

Another problem that light verb constructions pose for natural language processing involves their semantic representation. As we can see in Section 2.2, English light verbs take nominal complements that are, morphologically
and semantically, related with verbs. This means that both constituents of light verb constructions, the heading verb and its nominal complement, are argument-taking words. However, the distribution of the arguments in the constructions is not straightforward. Some of the arguments are not represented in the syntactic structure or they overlap with other arguments, which is why the argument structure of light verb constructions requires a special representation.

It is also useful to distinguish between different types of light verb constructions, such as those with true light verbs and those with vague action verbs (see Section 2.3), since they might require different interpretations and since their realizations might differ systematically across languages.

In this chapter, we review the work on automatic extraction and classification of light verb constructions and similar collocations of the type V-N.\(^1\) We first present the work on their identification. Then we review the means developed for measuring their semantic compositionality and productivity.

### 3.1 Identifying light verb constructions

Grefenstette and Teufel (1995) present a method for automatic identification of an appropriate light verb for a derived nominal (e. g. *make a proposal*) on the basis of corpus data. Making a difference between the cases where these nouns can be ambiguous between more verb-like (41) and more noun-like (42) usages, Grefenstette and Teufel extract only those usages where the noun occurs in a context similar to a typical context of the corresponding verb. The most frequent governing verbs for these noun occurrences are their light verbs.

\[(41) \quad \text{He made his formal proposal to the full committee.}\]
\[(42) \quad \text{He put the proposal in the drawer.}\]

Sentences containing a given verb and its nominalized form are extracted

\(^1\)Most of the collocations of the type V-N are, in fact, light verb constructions.
from a corpus first. Syntactic patterns for the verbs and their corresponding nouns are then extracted using a surface parser. The verb-like occurrences of the nominal forms are selected by comparing the syntactic patterns and choosing those cases where the patterns were parallel to the patterns of the corresponding verbs (e.g. where they are followed by the same preposition as the corresponding verb). Finally, all the verbs governing these nouns are extracted as candidates for the appropriate light verb and the most frequent one is chosen.

As noted by the authors, this technique proves to be insufficient on its own for identifying light verbs. It does not differentiate between the light verb and other frequent verbal collocates for a given nominalization (e.g. reject a proposal vs. make a proposal). But it can be used as a step in automatic processing of corpora, since light verbs do occur in the lists of the most frequent collocates.

The method for extracting verb-noun collocations proposed by Tapanainen, Piitulaine and Jarvinen (1998) seems to be particularly suitable for detecting light verb constructions. It is based on the assumption that collocations of the type verb-noun are asymmetric in such a way that it is the object (i.e. the noun) that is more indicative of the construction being a collocation. If a noun occurs as the object of only few verbs in a big corpus, its usage is idiomatical. For example, the noun toll occurs mainly with the verb take. It can be used with other verbs too (e.g. charge, collect), but not with many.

The measure that is proposed in this study is the distributed frequency of the object ($DF(o)$ in 3.1). It is calculated as the sum of the number of occurrences of an object with different verbs in a corpus divided by the number of verbs it occurs with:

$$DF(o) = \sum_{k=1}^{n} \frac{F_k}{n^b}$$

(3.1)

In this equation, $F_k =$ the number of occurrences of an object with the verb $k$; $n =$ the number of different verbs the object occurs with; $a$ and $b$ are constants that can be determined to favour the cases where there are
fewer exceptions. The constant $a$ gives preference to the cases where the occurrences of the object are not equally distributed between the verbs and $b$ to the cases where there are fewer different verbs. Those nouns that occur frequently and that are always objects of the same verb will get the highest score.

This measure is better suited for extracting light verb constructions than some symmetric measures of association such as mutual information (see Section 3.2). Since it is based on the distribution of the objects, it provides high scores even for the constructions that include very frequent verbs, which is usually the case with light verbs. However, this approach does not provide a means to distinguish light verb constructions from the other collocations of the same type.

### 3.2 Measuring semantic compositionality and productivity

Fazly (2007) proposes a statistical measure that quantifies the degree of figurativeness of the light verb in conjunction with a predicating noun. The degree of figurativeness of a verb considered as the degree to which its meaning is different from its literal meaning in a certain realization. It is assumed that constructions of the type verb-noun can be placed on a continuum of figurativeness of meaning, including literal combinations (e. g. *give a present*), abstract combinations (e. g. *give confidence*), light verb constructions (e. g. *give a groan*), and idiomatic expressions (e. g. *give a whirl*). More figurative meanings of the verb are considered closer to true light verbs, while more literal meanings are closer to vague action verbs (i.e. to the abstract combinations on the presented continuum).

The measure of figurativeness is based on indicators of conventionalized use of the constructions: the more the two words occur together and the more they occur within a particular syntactic pattern the more figurative the meaning of the verb. Thus, the figurativeness score is composed of two
measures of association: association of the two words and association of the verb \((lv\) in 3.2) + noun \((n\) in 3.2) combination with a particular syntactic pattern:

\[
\text{FIGNESS}_{LV}(lv, n) = \text{ASSOC}(lv, n) + \text{DIFF}(\text{ASSOC}_{pos}, \text{ASSOC}_{neg}) \quad (3.2)
\]

The syntactic pattern that is expected for figurative combinations is defined in terms of three formal properties associated with typical light verb constructions (see Section 2.3): active voice, indefinite (or no) article, and singular form of the noun. The association of a verb-noun combination with the expected syntactic pattern is expressed as the difference between the association of the combination with this pattern (positive association) and the association of the combination with any of the patterns where any of the features has the opposite value (passive voice, definite article, plural noun).

The strength of all the associations is calculated using point-wise mutual information. This measure is widely used to estimate the strength of association between two words. It expresses a relation between the probability that two units \((x,y\) in 3.3) occur together and the probability that occur each of them occurs independently:

\[
\text{PMI}(x,y) = \log \frac{P(x,y)}{P(x)P(y)} \quad (3.3)
\]

Counts from a parsed corpus were used to estimate the probabilities.

For a sample of expressions, the scores assigned by the measure of figurativeness are compared with the ratings assigned by human judges. The results show that the scores obtained by the proposed measure correlate better with human ratings than the scores calculated using mutual information alone. This means that a measure that includes linguistic information about expressions performs better in measuring the degree of their figurativeness than a simple measure of association between the words in the expressions.
The research of Stevenson, Fazly, and North (2004) deals with semantic constraints on light verb complements. They focus on true light verb constructions trying to identify the classes of complements that would be preferred by a given light verb. Light verb constructions are first identified automatically and then the relations between light verbs and some classes of complements are examined.

Similarly to the method used by Fazly (2007), formal properties of light verb constructions are used for their automatic detection. For each pair \((\text{light verb}, \text{noun})\) a score that indicates whether the pair is a light verb construction is calculated. Two measures of association are calculated to obtain the score. The first is the measure of association between the light verb on the one hand and the sequence indefinite article + noun on the other \((\text{e.g. 'give' and 'a cry'}\)\). The second is the association of the light verb and the sequence definite article / demonstrative / possessive + noun \((\text{e.g. 'give' and 'the/that/his cry'}\)\). Their strength is calculated using point-wise mutual information \((\text{PMI})\). The score combines the first value with the difference between the first and the second:

\[
2 \times \text{PMI}(lv; aV) - \text{PMI}(lv; detV)
\]  

Following the analysis of Wierzbicka (1982) (see Section 2.2), the nominal complements of light verbs are identified with their corresponding verbs. With this, it was possible to use Levin’s lexical semantic classification of verbs to divide the complements into semantic classes and to examine if certain light verbs prefer certain classes of complements.\(^2\)

Research shows that light verbs have some degree of systematic and predictable behaviour with respect to the class of their complement. For example, light \textit{give} tend to combine with deverbal nouns derived from the \textit{Sound Emission} verbs, while light \textit{take} combines better with the nouns derived from the \textit{Motion (non-vehicle)} verbs. As the light verb construction score

\(^2\)Levin’s classification of English verbs (Levin 1993) is a comprehensive resource often referred to. There are no similar resources for nouns.
gets higher, the pattern gets clearer. It shows as well that some of the verbs (e. g. *give* and *take*) behave in a more consistent way than others (e. g. *make*).

In measuring the relative compositionality of different verb-noun collocations, Venkatapathy and Joshi (2005) define a six-point scale of compositionality. The verb-noun combinations are described as vectors of seven features and ranked on the scale using an automatically learnt ranking function based on support vector machine. These ranks are compared with human judgements.

Five of the features are based on measures of association between words:

- the frequency of the combinations;
- the point-wise mutual information (see above);
- the distributed frequency of the object (see Section 3.1);
- the distributed frequency of the object using the verb information — an extension of the previous measure introducing the information on the semantic distance between the verbs that occur with the same object;
- the least mutual information difference with similar collocations — a measure that provides higher scores for the combinations for which there are no similar combinations with similar mutual information values.

Two features are based on measures of context similarity:

- dissimilarity of the collocation with its constituent verb using latent-semantic analysis — a measure based on the idea that non-compositional combinations occur in contexts that are different form the contexts of the verb constituent alone;
• similarity of the collocation to the verb-form of the object using latent semantic analysis — a measure based on the idea that if a verb-noun combination occurs in contexts similar to the contexts of the verb that is the counterpart of the nominal complement, the combination is likely to be non-compositional.

The research shows that the ranking with vectors of features correlates better with human judgements then any ranking based on just one feature. The context based features are good indicators of non-compositionality on their own, but their contribution to the ranking function is not very large.

All the methods presented in this chapter treat light verb constructions as a kind of multi-word expressions. The automatic identification of these constructions is mainly based on different measures of association between their components. However, the compositionality of their meaning does not correspond directly to the strength of the association of their components. Adding specific linguistic information improves the correlation between human judgements and automatic rankings.
Chapter 4

Lexical category bias of the complements of light verbs

One feature that distinguishes light verb constructions from the other collocations of the type verb-noun, as well as from the regular constructions of the same type, is their specific complement — a noun which is morphologically and semantically related to a verb (see Section 2.2). The fact that the nominal complement of a light verb construction can occur as a verb elsewhere has already been noted and made use of in automatic identification of these constructions. Grefenstette and Teufel (1995) compare their syntactic patterns (see Section 3.1). Fazly (2007) and Stevenson, Fazly, and North (2004) consider as potential light verb complements only those nouns for which there is a corresponding verb.

Assuming the notion of complex lexicon (see Section 2.2 and 2.1), we consider these nouns and verbs as two realizations of a single lexical unit. For this unit of the lexicon, no lexical category is specified, but it can be biased towards either verbal or nominal realization. We propose a measure of the lexical bias of the complement of light verb constructions towards one of the possible realizations. We use this measure to examine the relation between the degree of semantic impoverishment of light verbs and the lexical category bias of their complement.
The hypothesis that is tested in this research is that the lexical category bias of the complement of a light verb construction and the degree to which the meaning of the governing verb is impoverished are correlated: the more the complement is biased towards verbal use, the more impoverished the meaning of the governing verb.

There are two assumptions that underly this hypothesis. The first is that the complements that are biased towards verbal use correspond to the more specific complements of true light verbs as they are described in Section 2.3. The complements that are biased towards nominal use correspond to the less specific complements of vague action verbs. The second assumption is that the same verb can be used both as a true light verb and as a vague action verb, depending on the nature of its complement. Used as a true light verb, it is more semantically impoverished than when it is used as a vague action verb.

In other approaches (Fazly 2007, Stevenson, Fazly, and North 2004) light verb constructions are seen as collocations that occur with more or less fixed syntactic pattern. Measures of fixedness of their syntactic pattern are developed to identify these constructions, as well as to distinguish between the constructions with true light verbs and those with vague action verbs.

Our approach is based on the lexical properties of the complements of light verb constructions. We use a measure of their bias towards the category of a verb or to the category of a noun to identify light verb constructions as well as to distinguish between the two types. This measure does not rely on the collocational properties of the constructions, such as co-occurrence of the words and rigidity of their syntax. This is important for two reasons. First, the syntactic pattern in which these constructions occur appears to be more flexible than it is suggested by linguistic analyses (Kearns 2002, Wierzbicka 1982). For example, Stevenson, Fazly, and North (2004) find, “contrary to the linguistic claim, that the is not always rare in ‘LV a V’ constructions.”¹ Moreover, the fixed syntactic pattern is only relevant for

¹The nominal complement is identified with a verb in this study following Wierzbicka
the constructions with *true light verbs*, while the syntax of the constructions with *vague action verbs* is much more flexible. Second, given the relative productivity of these constructions, it can be expected that some of them are formed only occasionally and that are not characterized by the collocational properties at all.

Exploiting the lexical properties of the complements of light verb constructions, our approach is expected to identify not just frequent, co-occurring combinations of verbs and nouns used with a fixed syntactic pattern, but also the infrequent combinations with more flexible syntactic patterns that can also be interpreted as light verb constructions.

### 4.1 Measuring lexical category bias

The issue of measuring lexical biases of words is addressed by Merlo (1994). The study deals with measuring the preferences of ambiguously subcategorized verbs for a particular subcategorization frame. Verbs’ bias is defined as their tendency to co-occur most frequently with a given continuation. A corpus-based measure of this tendency is proposed. A correlation of this method with other methods of measuring lexical bias (such as sentence completion and sentence production), showed that the corpus counts and the experimental counts correlate in an inconsistent way. The sentence production counts are better correlated than the sentence completion counts, the NP continuation is better correlated than the clausal continuation. Correlation is also better for the counts related to the verbs with higher frequency in the corpus.

Under the assumption that corpus-based counts are relevant for psycholinguistics, they are used to investigate the relation between processing times and verb completions with complementizers. It is argued that the parser is sensitive to the frequency of the lexical items that occur as complementizers. The reaction times correlate with the count of the declarative complementizer (1982).
(that), but not with a count that includes other complementizers too.

In our study, the lexical category bias of a complement of a light verb construction is defined as the tendency of its corresponding lexical unit to be realized with one of the two categories, as a verb or as a noun. For example, if take a walk is a light verb construction, the lexical unit that corresponds to the complement of the construction is the word “walk” that can be realized as a verb (walk\textsubscript{V}) or as a noun (walk\textsubscript{N}). The same applies to derived nouns. For example, in make an inspection, the lexical unit that corresponds to the complement is the word “inspect” that can be realized as a verb (inspect\textsubscript{V}) or as a derived noun (inspection\textsubscript{N}).

The tendency of a lexical unit to be realized as a verb or as a noun is quantified as the ratio between two conditional probabilities: the probability that a given lexical unit is realized as a verb and the probability that the same unit is realized as a noun:

\[
LCB = \frac{P(V|L)}{P(N|L)}
\]  

In this equation, LCB = Lexical category bias, L = Lexical unit, V = Verbal realization of a lexical unit, N = Nominal realization of a lexical unit.

The two probabilities are estimated by the frequency of the nouns and the verbs, determined on the basis of the number of their occurrences in a corpus. A lexical unit is identified as a potential light verb complement if its nominal realization occurs as the direct object of a verb and if it occurs as a verb elsewhere in the corpus. The number of occurrences of a given lexical unit is calculated as the sum of all its nominal and verbal occurrences.

The lexical category bias will have high values for words that are very frequent and that are almost always realized as verbs and only exceptionally as nouns. The values will be low for words that are very frequent and that are only exceptionally realized as verbs.

This measure is intended to capture the fact that different types of complements of light verbs have different distributions, already underlined in linguistic analyses (Section 2.2). The complements of true light verbs can
be expected to occur as nouns only within light verb constructions, while the complements of *vague action verbs* can be expected to occur in other syntactic positions too.

### 4.2 Experiment

The hypothesis that the lexical category bias of a complement of a light verb construction is related to the degree of semantic impoverishment of its governing verb is tested in an experiment. A sample of potential light verb constructions is automatically extracted from a corpus. Each of the constructions is rated according to the calculated value of the lexical category bias of its complement. The degree of semantic impoverishment of the governing verbs is measured for a sub-sample of these constructions. These ratings are obtained from human judges through a questionnaire. To determine if these two ratings are correlated, we perform a correlation test. The procedures used for collecting the data and the results of the experiment are described in detail in the following chapter.
Chapter 5

Materials and methods

The experiment consists of two parts. In the first part, we create a sample of potential light verb constructions and measure the lexical category bias for their complements using corpus data. In the second part, we collect human judgements of the degree to which the meaning of light verbs is specified for a sub-sample of the potential light verb constructions.

We limit the research to the constructions headed by three verbs: have, take, make. These verbs are chosen as the three most widely discussed light verbs that take only one complement (direct object) in their literal meaning. Another verb that is often analyzed as a light verb is give, but it is not included in the experiment, since it is a ditransitive verb.

5.1 Corpus data

The potential light verb constructions are extracted automatically from the British National Corpus. They are represented as verb-noun combinations, where verb is any morphological form of any of the verbs included in the sample (have, take, make) and noun is the noun which is the head of its direct object and for which a morphologically corresponding verb could be found in the corpus.

The lexical category bias is calculated for all the nouns that are extracted.
The data needed for this calculation are the lemmatised frequency for all the verbs occurring in the corpus and the lemmatised frequency of all the nouns occurring in the corpus. Collecting these counts is described in detail in Section 5.1.2.

Although it was not needed for calculating the lexical bias, the frequency of the verb-noun pairs is counted too. This information was used in composing a sub-sample of data for which human judgement were provided. (see Section 5.2.1 for more details).

### 5.1.1 Extracting verb-noun pairs

A total of 12610 verb-noun pairs is extracted, 5853 representing the constructions with *have*, 3827 with *make*, and 2930 with *take*. The pairs are extracted as an approximation of the verb-direct object grammatical relation. A noun that occurs after a verb, but is not preceded by another verb, a preposition, an adverb, or a conjunction is considered to be the object of that verb. If there is a sequence of two or more nouns, the second noun is considered to be the object.

Not using a more sophisticated parser for extracting the pairs simplifies considerably the procedure of collecting corpus data, but it results in recall and precision errors that need to be taken into consideration. First, there could be more than one nominal modifier of a noun. A look at a sample of the sequences of more than two nouns showed that these are, for the most part, names of organizations and institutions. Since these objects are not relevant for this research, taking the second noun as the object seemed adequate. Second, this technique was unable to distinguish between the objects of potential light verb constructions and the objects of some other specific constructions, such as causative use of verbs (e.g. *make an inspection* vs. *make an inspection difficult*). Third, looking only in the right context of the verbs, the fronted objects of relative clauses (e.g. *the inspection that they made*) could not be identified, so these usages are not extracted. Finally, no pronominal objects are extracted, even if they could potentially provide a
relevant piece of information about the object used (as resolved anaphors).

We keep the simplified method of extracting the verb-noun pairs despite the expected errors because the number of occurrences of the pairs is not needed for calculating the lexical category bias. The extracted pairs are used as a sample of phrases that is considered in the experiment. Even with the expected errors, this method extracts enough different cases. As for the pairs extracted due to the precision errors (e.g. the causative constructions mentioned above), they are removed manually from the sub-sample for which human judgements are provided. However, a more elaborated study would require a more sophisticated parser.

In order to select only those verb-noun pairs in which the noun is morphologically related to some verb, i.e. potential light verb constructions, each object is checked. If the noun could be found in the list of all verbs occurring in the corpus, the pair was selected. If not, a number of transformations is performed removing derivational suffixes\(^1\). The list of verbs was searched after each transformation. If the transformed object could be found, the pair was selected.

It should be noted that this technique does not take into account the direction of category changing between verbs and nouns. Thus, if a verb-noun pair contains a noun such as hand (e.g. take my hand) it will be selected, because the verb hand will be found in the list of verbs. Although it is clear that the phrase take my hand is not a light verb construction, this does not pose a problem, since hand is expected to be strongly biased towards nominal use, which would give the phrase a low score.

Since this technique of selection relies only on the part-of-speech tag found in the corpus, it is very sensitive to mistakes in tagging. If a verb-noun pair contains a noun that is marked as a verb anywhere in the corpus, the pair will be selected. It is enough to have one wrong tag to decide to select a wrong pair.

\(^1\)The list of covered derivations, based on Quirk et al. 1985, can be found in Appendix B.
The part-of-speech annotation in the British National Corpus is done automatically with estimated overall precision of 96.25%, which is why a number of wrong tags is expected. In addition, the tagger allows “ambiguity tags”, such as “NN1-VVB”, denoting “singular noun or bare verb form”, for instance. These double tags needed to be resolved for counting frequencies. This is done by taking the first tag as the correct one, which necessarily increased the number of mistakes. (Only 76.84% of tags having “NN1” in the first place, for example, were actually singular nouns (Burnard 2007).) The pairs selected due to some of these mistakes were manually removed from the sub-sample used for the comparison.

5.1.2 Lemmatised frequencies for verbs and nouns

Occurrences of all verb and noun forms are counted. Non-basic forms, including a number of irregular verbs\(^2\), are transformed into basic forms and then stored in two lists of lemmatized frequencies, one for verbs and one for nouns.\(^3\) These counts can also be influenced by the errors in tagging described in the previous subsection. The list of expected errors for verb and noun tags is given in Table 5.1, according to Burnard (2007).\(^4\)

For the purpose of this study, we assume that all the tags are correct. However, given the importance of correct part-of-speech tagging for calculating the lexical category bias, applying a more efficient tagger should be considered for a more elaborate study.

\(^2\)The list of included irregular verbs can be found in Appendix C.

\(^3\)A list of lemmatised frequencies of words in the British National Corpus has already been composed by A. Kilgarriff. It is available at http://www.kilgarriff.co.uk. We do not use this list because it does not include words that have less than 800 occurrences, which are also needed for our research.

\(^4\)Separate tags are used for the forms of the verbs be, do, and have, but there are either no errors for these tags, or they are smaller than 1%, so they are omitted from the table.
Table 5.1: Tag error rates for noun and verb categories in the British National Corpus.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Description</th>
<th>Error rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>NN0</td>
<td>Common noun, neutral for number</td>
<td>3.70%</td>
</tr>
<tr>
<td>NN1</td>
<td>Singular common noun</td>
<td>1.19%</td>
</tr>
<tr>
<td>NN2</td>
<td>Plural common noun</td>
<td>1.10%</td>
</tr>
<tr>
<td>VVB</td>
<td>The finite base form of lexical verbs</td>
<td>15.00%</td>
</tr>
<tr>
<td>VVD</td>
<td>The past tense form of lexical verbs</td>
<td>5.15%</td>
</tr>
<tr>
<td>VVG</td>
<td>The -ing form of lexical verbs</td>
<td>1.51%</td>
</tr>
<tr>
<td>VVI</td>
<td>The infinitive form of lexical verbs</td>
<td>0.58%</td>
</tr>
<tr>
<td>VVN</td>
<td>The past participle form of lexical verbs</td>
<td>2.49%</td>
</tr>
<tr>
<td>VVZ</td>
<td>The -s form of lexical verbs</td>
<td>3.73%</td>
</tr>
</tbody>
</table>

5.2 Human judgements

To establish whether the meaning of a light verb is impoverished proportionally to how much its complement is biased towards verbal use, we rely on human judgements of semantic lightness of the verbs. The judgements are provided for a sub-sample of the automatically extracted verb-noun pairs. They are collected from four native speakers through a questionnaire. In this section, we describe the composition of the sub-sample used for the comparison and the design of the questionnaire. We also analyze and discuss the agreement between the judges.

5.2.1 Sampling

The sub-sample of examples for comparing the ratings is balanced with respect to three factors. The first is the score for lexical category bias of the complement. An equal number of pairs with high and low score are included in the sub-sample. Secondly, since native speakers’ judgements of the degree to which the meaning of a verb is impoverished can be influenced by the collocational association of the verb and its complement, an equal number of
more and less associated pairs is taken. To quantify this association, we use the point-wise mutual information, as a well established measure of strength of association between words (see Section 3.2). Finally, although the lexical category bias does not depend on the differences in the range of frequency between different lexical units, frequency might influences native speakers’ judgements. The meaning of highly frequent words can be felt as less specified than the meaning of infrequent words. In conjunction with these nouns, the verbs’ meaning can be felt as different from its typical meaning. Thus, the sample includes an equal number of more frequent and less frequent lexical units, their frequency being calculated as a sum of frequencies of its verbal and nominal occurrences.

In determining the thresholds for high and low values for the three factors, two issues were taken into consideration: the skewed distributions of data (there were many more examples with low values than with high values) and the need for a balanced sample. As a result, the thresholds were set so that the proportion between the number of examples with high and low values was roughly 1 : 3 for all the factors. (See Table 5.2 for the details.)

<table>
<thead>
<tr>
<th></th>
<th>LCB</th>
<th>MI</th>
<th>LFq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>0.21</td>
<td>1.91 \cdot 10^{-8}</td>
<td>1277</td>
</tr>
<tr>
<td>High values</td>
<td>&gt; 3</td>
<td>&gt; 9 \cdot 10^{-8}</td>
<td>&gt; 10000</td>
</tr>
<tr>
<td>No of pairs</td>
<td>1951</td>
<td>1981</td>
<td>1908</td>
</tr>
<tr>
<td>Low values</td>
<td>&lt; 0.3</td>
<td>&lt; 1.89 \cdot 10^{-8}</td>
<td>&lt; 1300</td>
</tr>
<tr>
<td>No of pairs</td>
<td>6579</td>
<td>6257</td>
<td>6338</td>
</tr>
</tbody>
</table>

Table 5.2: Data divisions. LCB = Lexical category bias, MI = Mutual information, LFq = Lexical unit frequency.

The examples were then divided into eight groups, each group containing pairs with a different combination of values for the three variables (Table 5.3). Ten examples were randomly selected from each group. More precisely, twenty examples were taken randomly first, then a number of them were eliminated as wrong pairs (see section 5.1). If there were more than ten
remaining examples, the number would be reduced by cutting off the end of the list.

<table>
<thead>
<tr>
<th>Group</th>
<th>LCB</th>
<th>MI</th>
<th>LFq</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>101</td>
</tr>
<tr>
<td>II</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>271</td>
</tr>
<tr>
<td>III</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>52</td>
</tr>
<tr>
<td>IV</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>675</td>
</tr>
<tr>
<td>V</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>363</td>
</tr>
<tr>
<td>VI</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>84</td>
</tr>
<tr>
<td>VII</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>566</td>
</tr>
<tr>
<td>VIII</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>1486</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>3598</td>
</tr>
</tbody>
</table>

Table 5.3: Data groups. LCB = Lexical category bias, MI = Mutual information, LFq = Lexical unit frequency, N = Number of pairs.

To these eighty pairs one more group of ten pairs were added (Group IX). These were randomly chosen from the group of pairs that had medium values for lexical category bias. In this way we got a sample of ninety verb-noun pairs for which the lexical category bias score was compared with native speakers’ judgements.5

5.2.2 Questionnaire

The questionnaire was completed by four native speakers of English coming from different regions of the United States of America, not trained in linguistics, but holding a university degree in another field. They were asked to assess the extent to which light verbs lose their meaning in conjunction with a particular complement, in other words, the extent to which the meaning of light verbs is impoverished in these contexts.

Eighty-nine examples were evaluated in the end, since one example proved to be wrong at a later stage.

5
A similar task was given to native speakers in the experiment conducted by Fazly (2007), where they were asked to assess the degree of figurativeness of verbs’ meaning. The participants were asked to answer a number of yes/no questions regarding presence or absence of some indicative components of meaning for each verb usage (e.g. Does “SUBJ emit something (non-physical)”?) (Fazly 2007: 26). Different combinations of answers were transformed into numerical values. Differently from that approach, we ask for more direct judgements, thus not including any assumptions of any particular semantic decomposition of the meaning of the verbs.

Verb-noun pairs were presented to the participants in a sentence context. The task was to assess the verbs’ meaning on a seven point scale, where 1 represented literal meaning of the verb and 7 its light usage.6 The instructions for the judges can be found in Appendix D.

The sentences used in the questionnaire represent examples of real usages of the verb-noun pairs. They are all found on web sites. The selection of the examples was done so that the context itself did not suggest a more verb-like or a more noun-like use of the complement. All the examples have a uniform syntactic pattern with respect to the syntactic features used to distinguish between literal and figurative meanings of the constructions in Fazly (2007) (See Section 3.2): the verb is in active voice, the complement is preceded by an indefinite or by no article, and its form is singular (41-43). Some exceptions were made to the last two criteria in the cases where there would be no examples that satisfied the criteria, two exceptions for the former (44) and five for the latter (45). In addition to this, the complement of the selected constructions is not modified (with just one exception (46)) and it is not followed by a relative clause, which eliminates two more indicators of its more nominal use. Finally, two sentences were originally titles or headlines. They were slightly modified to be used as ordinary sentences (47). All the sentences

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6Using magnitude estimation technique as it is presented in (Sorace and Keller 2005) instead of traditional seven point scale might have yielded more reliable judgements. However, the scale is chosen for this research in order to keep the task as simple as possible for the native speakers.
were checked for grammaticality and acceptability by a native speaker before they were presented to the judges. The list of the sentences is given in Appendix A.

(43) They seemed to make a stagger back.
(44) We headed upstairs first and had a browse.
(45) The rock made a smack as it fell in the stream.
(46) We don’t take the trouble any more in getting to know the person.
(47) We all have regrets.
(48) Mental health findings make depressing reading.
(49) Scientists make a find in a S. African Cave.

To control for potential effects of the order in which the examples are presented, three different random orders were generated. Judge 1 and Judge 2 completed the questionnaires with two different orders of examples. Judge 3 and Judge 4 completed the questionnaires with the same order of examples but different from the other two.

5.2.3 Agreement between judges

To estimate the reliability of human ratings an analysis of agreement between the four judges is performed. As it can be seen in Figure 5.1, there are some differences in which the judges use different points of the scale, but some trends in the distribution of the ratings can also be identified. It can be noted that all of the judges are biased towards low scores. The ratings of Judge 2 can be seen as an exception to this, since they are mostly concentrated on point 4. On the other hand, we can see that this judge does not use any rating below 4, which is why this rating can be interpreted as low. This means that the ratings of Judge 2 are balanced towards low scores too. Ratings 1 and 2 are used more frequently than ratings 3, 4, and 5 by all the judges (again, with the exception of Judge 2). A higher frequency can be seen for rating 6, and then it falls again for rating 7.
The distribution of the ratings represented in Figure 5.1 suggests that there are three typical ratings, 1, 2, and 6, indicating three possible categories used by the judges for rating the examples.

To see how much the judges agree in assessing each particular item, we compare each judge with every other judge. The measure we use is the kappa statistics. This measure takes into account the fact that a number of agreements can occur just by chance, due to a limited possible ratings for a limited number of cases. However, since this measure is not adequate for the cases where judges do not use the same number of categories, the data were rescaled to three categories before calculating the score. Table 5.4 shows how the categories were merged.

Since the categories that were used in our questionnaire are ordered cat-
categories, we use the version of the score with linear weighting. This version takes into account the fact that a difference between two adjacent ratings (e. g. 1 and 2) is smaller than a difference between two distant ratings (e. g. 1 and 3). The scores are presented in Table 5.5.\(^7\) The corresponding 0.95 intervals denote that it is 95% certain that the score falls somewhere within the given interval. The bigger the interval the less precise the measure.

We apply one more measure, which expresses how related the different ratings are and which can be used without rescaling the data. This is the Spearman rank correlation coefficient (Woods, Fletcher, and Hughes 1991), for which the results are presented in Table 5.6. The \(p\)-values, showing how probable the score is under the hypothesis that there are no correlations, for all the scores are \(< 0.02\), so they are omitted from the table.

<table>
<thead>
<tr>
<th>Original category</th>
<th>Rescaled category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Judge 1, Judge 3, Judge 4</td>
<td>Judge 2</td>
</tr>
<tr>
<td>1, 2</td>
<td>4</td>
</tr>
<tr>
<td>3, 4, 5</td>
<td>5</td>
</tr>
<tr>
<td>6, 7</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 5.4: Rescaled categories

<table>
<thead>
<tr>
<th>Judge 1</th>
<th>Judge 2</th>
<th>Judge 3</th>
<th>Judge 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\kappa) (Int.)</td>
<td>(\kappa) (Int.)</td>
<td>(\kappa) (Int.)</td>
<td>(\kappa) (Int.)</td>
</tr>
<tr>
<td>Judge 1</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Judge 2</td>
<td>0.25 (0.10-0.40)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Judge 3</td>
<td>0.42 (0.27-0.57)</td>
<td>0.11 (0-0.26)</td>
<td>—</td>
</tr>
<tr>
<td>Judge 4</td>
<td>0.24 (0.07-0.41)</td>
<td>0.15 (0-0.32)</td>
<td>0.36 (0.20-0.51)</td>
</tr>
</tbody>
</table>

Table 5.5: The linearly weighted kappa score (\(\kappa\)) with 0.95 confidence interval (Int.) for all pairs of judges.

---

\(^7\)The online calculator used for these calculations is available at http://faculty.vassar.edu/lowry/kappa.html.
Table 5.6: The Spearman rank correlation coefficient ($r$) for all pairs of judges ($p < 0.02$).

<table>
<thead>
<tr>
<th></th>
<th>Judge 1</th>
<th>Judge 2</th>
<th>Judge 3</th>
<th>Judge 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Judge 1</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Judge 2</td>
<td>0.40</td>
<td>—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Judge 3</td>
<td>0.62</td>
<td>0.25</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Judge 4</td>
<td>0.47</td>
<td>0.27</td>
<td>0.45</td>
<td>—</td>
</tr>
</tbody>
</table>

Both tables show that the agreement varies from quite low values representing weak agreement between ratings provided by Judge 2 and other ratings ($r = 0.25, \kappa = 0.11; r = 0.27, \kappa = 0.15$) and good values ($r = 0.62, \kappa = 0.42$) for the ratings given by Judge 1 and Judge 3, with average values ($r = 0.40, \kappa = 0.25; r = 0.45, \kappa = 0.36; r = 0.47, \kappa = 0.24$) for the other pairs. This means that the judges generally agree on the ratings, but that there are still some factors which influence their decisions in different ways.

Apart from different use of the categories, especially between Judge 2 and the other judges, a possible source of disagreement could be the fact that the criterion for assessing how specified the meaning of a verb is, which was suggested in the questionnaire (Appendix D), can be composed of different factors. For example, in assessing the possibility of substitution between the phrase and the corresponding verb, a question could be whether a sentence “sounds better” with one verb or with the corresponding paraphrase, whether this is important and how much, and so on. The judges could give different weights for some of them. Moreover, this criterion might have been overridden by some other criteria in certain cases. This could be expected to occur in collocations, for example, since a verb used in a collocation should be felt like less specified than an ordinary verb, even if the construction is not a paraphrase of a verb. The judges could differ between each other with respect to the degree to which they try to keep the suggested criterion. A more elaborated questionnaire, with more precise tasks and a more adequate scaling, could be developed for improving the agreement between judges in
a broader study. For the purpose of this research, mean values of the ratings of all four judges are considered as human judgments.

5.3 Results and discussion

To assess if the lexical category bias of the complement of a construction is related with native speakers’ opinions on the level of semantic lightness of the governing verb, we compare two ratings of the constructions on the basis of the two criteria. A high lexical category bias score indicates that the complement is biased toward verbal use. A high score for the lightness of the governing verb indicates that the verb is used as a light verb in a given context. Thus, on the basis of our hypothesis that verbs used with complements which are biased towards verbal use are light verbs, we expect a positive correlation between these two ratings. As a measure of relatedness, we use the Spearman rank correlation coefficient $r$ (see Section 5.2.3).

5.3.1 Correlations between human judgements and lexical category bias score

The overall correlation coefficient for the whole sample is $r = 0.22$ with $p = 0.04$ (Figure 5.2). This is a result that shows that there is a statistically significant relation between these two ratings, but that it is rather weak.

There were two factors that were expected to influence human judgements, resulting in ratings different from the automatic ratings. The first factor is collocational association between a light verb and its complement. In frequently co-occurring combinations of verbs and nouns, the meaning of the verb can be perceived as unspecified even if its complement is not biased towards verbal use. The second factor is high frequency of the lexical units that occur as complements of light verbs. The meaning of highly frequent words can be perceived as less specified than the meaning of infrequent words. In conjunction with these nouns, the verbs’ meaning can be perceived
as different from its typical meaning.

To verify these factors, we divide the examples into four types. Each type is defined with a different combination of controlled values for the two factors (see Section 5.2.1). For example, verb-noun combinations for which the values both for point-wise mutual information and for lexical unit frequency are high represent one type. These pairs belong to the groups I and V in Table 5.3. Another type are the combinations for which the values for point-wise mutual information are high, but the values for lexical unit frequency are low (groups II and VI in Table 5.3). The correlations between automatic rating of

Figure 5.2: Rank correlation between LCB score and human ratings for the whole sample
the constructions based on the lexical category bias score and human ratings are measured for each type separately to see if there are differences between particular types of constructions. The results are presented in Table 5.7.

<table>
<thead>
<tr>
<th>Part of the sample</th>
<th>Correlation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole sample</td>
<td>$r$ (p)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.22 (0.04)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>With controlled factors</th>
<th>Correlation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlled factors</td>
<td>$r$ (p)</td>
<td></td>
</tr>
<tr>
<td>High MI, high LFq</td>
<td>0.12 (0.61)</td>
<td></td>
</tr>
<tr>
<td>High MI, low LFq</td>
<td>0.31 (0.23)</td>
<td></td>
</tr>
<tr>
<td>Low MI, high LFq</td>
<td>0.23 (0.33)</td>
<td></td>
</tr>
<tr>
<td>Low MI, low LFq</td>
<td>0.46 (0.04)</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.7: Correlations (Spearman rank correlation coefficient $r$) with $p$-values between the lexical category bias score and human ratings. MI = Mutual information score, LFq = Lexical unit frequency.

It can be noted that the correlation score is good, better than the overall score, only for the cases where both of the factors have controlled low values ($r = 0.46$ with $p = 0.04$). Figure 5.3 shows the plot representing this case. On the other hand, there are no significant correlations for the other three types. This means that these two factors influence indeed the relation between the two ratings and that their influence can be eliminated by manipulating their values.

Since these two factors do have an impact on human ratings, we examine the relation between the ratings in the cases where the lexical bias score is controlled while one or the other factor varies. This should show in what way each of the factors affects the relation. As it can be seen in Table 5.8, there are no significant correlations for any of the examined factors.

However, by examining the cases where judges tended to give higher ratings to the constructions for which the values for the lexical bias score
Figure 5.3: Rank correlation between LCB score and human ratings, for the constructions with low mutual information scores and low lexical unit frequency score.

were low, i.e. where the constructions got the opposite ratings, it could be noted that this happened when the values for one or the other of the factors were high, which suggest that these factors caused the difference between the ratings.

Examining differences between the two ratings in the cases where the lexical bias score was high and human ratings low, we could note that this mostly happened when the complements were deverbal nouns derived with a suffix, including the suffix -ing. On the other hand, the derived nouns
Table 5.8: Correlations (Spearman rank correlation coefficient $r$) with $p$-values between the lexical category bias score and human ratings with controlled values for the lexical category bias score. LCB = Lexical category bias score, MI = Mutual information score, LFq = Lexical unit frequency.

<table>
<thead>
<tr>
<th>Varying factor</th>
<th>Controlled factors</th>
<th>Correlations $r$ ($p$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MI</td>
<td>High LCB, high LFq</td>
<td>0.30 (0.19)</td>
</tr>
<tr>
<td></td>
<td>High LCB, low LFq</td>
<td>−0.01 (0.96)</td>
</tr>
<tr>
<td></td>
<td>Low LCB, high LFq</td>
<td>−0.03 (0.90)</td>
</tr>
<tr>
<td></td>
<td>Low LCB, low LFq</td>
<td>−0.36 (0.13)</td>
</tr>
<tr>
<td>LFq</td>
<td>High LCB, high MI</td>
<td>−0.01 (0.95)</td>
</tr>
<tr>
<td></td>
<td>High LCB, low MI</td>
<td>0.12 (0.62)</td>
</tr>
<tr>
<td></td>
<td>Low LCB, high MI</td>
<td>−0.39 (0.11)</td>
</tr>
<tr>
<td></td>
<td>Low LCB, low MI</td>
<td>−0.36 (0.13)</td>
</tr>
</tbody>
</table>

Due to the influences of the two identified factors on human judgements, these results support our initial hypothesis only for one type of light verb constructions — the constructions which are not collocations and in which the complement is not frequent. This means that the lexical category bias of the complement is an indicator of a light use of the verb only for this type of constructions. They are still useful since they address exactly those light verb usages that do not occur frequently, but that still need to be identified because of the semantic opacity that characterize them.

Including derived noun complements into the experiments showed that, as lexical units, they can be biased both towards verbal and towards nominal use, which means that the derivation itself does not determine the category bias.

The lexical category bias of a complement could be an indicator of a light
usage of a verb in other cases as well, distinguishing light verb constructions from the other collocations of the same type, for example. This would need to be examined in another experiment.
Chapter 6

Conclusion

In our research, we examine the lexical bias of the complements of light verbs towards verbal or nominal realization as a means of automatic identification of light verb constructions. We show in an experiment that the lexical category bias of the complement of a light verb construction assessed by means of a frequency-based measure does not correlate with the degree of semantic impoverishment of the light verb, except in the case where the complement as well as the verb-noun combination are not frequent. In this chapter, we summarize the contributions of the research and we indicate some directions for future research.

6.1 Summary of contributions

This research shows that the lexical category bias of the complement of a light verb construction and the semantic lightness of its governing verb can be related if the complement as well as the verb-noun combination are not frequent. The more the complement is biased towards verbal use, the more impoverished the meaning of the governing verb can be expected to be. The more the complement is biased towards nominal use the more specified the meaning of the governing verb. On the basis of this relation, the lexical category bias can be used as a measure for automatic distinguishing between
light and ordinary usages of verbs. It can also be used as a measure of the
degree of lightness of the verb for distinguishing between two types of light
verb constructions: those with true light verbs and those with vague action
verbs.

While the other measures developed for identifying light verb construc-
tions are based on the strength of association between light verbs and their
complements and on the fixedness of their syntactic pattern (Fazly 2004,
Stevenson, Fazly, and North 2004, Grefenstette and Teufel 1995), the fre-
quency based measure of the lexical category bias that we use relies on the
lexical character of the complement only. This makes it particularly suitable
for identifying those light verb constructions that are not conventionalized
but rather occasionally formed according to the productive patterns and
which are not realized with a fixed syntactic pattern.

In assessing semantic impoverishment of the verbs used as light verbs,
we rely on human judgements. We construct a questionnaire for eliciting
these judgements so that the verbs are presented in sentences. In this way,
we provide a context for the verb usages similar to the context that would
occur naturally in language use i. e. as realized lexical units. We ask for
the judgements of semantic impoverishment of the verbs directly, without
decomposing the question into questions that are related to some indicators
of the impoverishment. A questionnaire constructed in this way allow us to
make fewer assumptions on the way in which speakers use their intuition in
judging the examples.

The statistically significant correlation coefficient ($r = 0.22$) that repre-
sents the relation between the lexical category bias and human judgements
seems encouraging, but it also shows that there are some limitations to the
method and that it should be improved in order to provide more reliable
results.
6.2 Future work

In our experiment, we included three different verbs but the measure that we use does not take into account the difference between the verbs. For example, the noun *turn* occurs with all three verbs (*have a turn, make a turn, take a turn*). The score that we calculate gives the same rating to all three constructions. In future work, potential differences between the verbs can be examined. The verbs could be compared to see if some of them tend to be used with complements that are biased towards verbal realization, while others tend to be used with a complement biased towards nominal realizations. Some other verbs could be included in the experiments too.

We compared our automatic ratings of the constructions only with human ratings. A comparison between our ratings and the other automatic ratings could result in a clearer picture of the potential of our approach. It could also show if and how the approach could be combined with other approaches.

We used the lexical category bias of their complement for distinguishing between the different usages of a given set of verbs. This measure can also be used for automatic identification of verbs that have potential light or abstract usages. In an approach such as that of Grefenstette and Teufel (1995) verbs that occur with complements that are bias towards verbal realization can be identified as light verbs.

In this study we treated only English light verb constructions, but these constructions are present in many different languages. Our approach should be easily adaptable for all languages in which light verbs take nominal complements. Further work on it should take a multi-lingual perspective.

Eliciting human judgements on semantic relations between words could be improved too. The judgements of semantic differences between different verb usages that are needed for evaluating their automatic identification and classification can be seen as tasks of magnitude estimation (Sorace and Keller 2005). The methods already developed in experimental psychology for this kind of tasks can be applied in developing instruments for obtaining more accurate and more reliable human judgements.
Finally, a comparison of light verb constructions in a number of different languages through a systematic analysis of translation equivalents in parallel corpora could provide a means of their automatic identification and classification. The translation equivalents in different languages could provide some information about the types of light verb constructions. Those that are translated with single words in other languages can be considered as less semantically compositional than those that are translated with other constructions. Similarly, light verbs that are translated with many different light verbs can be considered as less semantically specified than those that are translated with only few different verbs in other languages.
Appendix A

List of sentences

This appendix contains the list of the constructions rated by judges. The fields of the table contain the following information: Pair — automatically extracted verb-noun pairs which represent potential light verb constructions; Sentence — Examples of usages of the construction presented to the judges in the questionnaire. LCB — high, medium, or low values for the lexical category bias score; MI — high or low values for the mutual information score; LFq — high or low values for the lexical unit frequency — the frequency of the object of the construction occurring as a noun and as a verb; Human ratings.
<table>
<thead>
<tr>
<th>No</th>
<th>Pair</th>
<th>Sentence</th>
<th>LCB</th>
<th>MI</th>
<th>LFq</th>
<th>Average Human rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>have say</td>
<td>In 3 elections, voters will have a say on Europe.</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>2.50</td>
</tr>
<tr>
<td>2</td>
<td>have earmark</td>
<td>He had an earmark of $500,000 to beautify a metro station in Washington.</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>3.75</td>
</tr>
<tr>
<td>3</td>
<td>make find</td>
<td>Scientists make a find in a S. African Cave.</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>4.25</td>
</tr>
<tr>
<td>4</td>
<td>take liking</td>
<td>A dragonfly took a liking to my freshly washed jeans.</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>2.25</td>
</tr>
<tr>
<td>5</td>
<td>have forcing</td>
<td>Other significant greenhouse gases together have a &quot;forcing&quot; on climate change approximately equal to that of carbon dioxide.</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>5.25</td>
</tr>
<tr>
<td>6</td>
<td>make join</td>
<td>When you make a join between two different colored proteins, those shapes will try to make chains with nearby shapes.</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>5.25</td>
</tr>
<tr>
<td>7</td>
<td>have recheck</td>
<td>They can also have a recheck at no charge within the next 7 days.</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>5.50</td>
</tr>
<tr>
<td>8</td>
<td>have continuation</td>
<td>It is my hope that we will have a continuation of that very strong friendship.</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>3.00</td>
</tr>
<tr>
<td>9</td>
<td>make munch</td>
<td>The ladies are going to make a munch too.</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>6.25</td>
</tr>
<tr>
<td>10</td>
<td>have suffusion</td>
<td>Creamy white blooms have suffusions of salmon pink.</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>2.25</td>
</tr>
<tr>
<td>11</td>
<td>make trekking</td>
<td>I bought a fresh coconut and made a trekking to a traditional village up the mountains.</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>6.25</td>
</tr>
<tr>
<td>No</td>
<td>Pair</td>
<td>Sentence</td>
<td>LCB</td>
<td>MI</td>
<td>LFq</td>
<td>Average Human rating</td>
</tr>
<tr>
<td>----</td>
<td>----------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-----</td>
<td>----</td>
<td>-----</td>
<td>----------------------</td>
</tr>
<tr>
<td>12</td>
<td>take allowance</td>
<td>The report was slightly modified to take allowance of comments made during the last meeting.</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>5.50</td>
</tr>
<tr>
<td>13</td>
<td>have browse</td>
<td>We headed upstairs first and had a browse.</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>3.75</td>
</tr>
<tr>
<td>14</td>
<td>have bearing</td>
<td>Race must not have a bearing in sports.</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>2.75</td>
</tr>
<tr>
<td>15</td>
<td>have prolongation</td>
<td>If the heat continues they will have a prolongation of their season.</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>4.50</td>
</tr>
<tr>
<td>16</td>
<td>have dependence</td>
<td>Use this to determine if two affine loop indices have a dependence.</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>3.75</td>
</tr>
<tr>
<td>17</td>
<td>have attendance</td>
<td>Those shows which have an attendance of 10000 or less pay a minimum nominal sum.</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>4.00</td>
</tr>
<tr>
<td>18</td>
<td>make mention</td>
<td>The Boston Globe does not make mention of Wade Wide.</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>2.50</td>
</tr>
<tr>
<td>19</td>
<td>take regard</td>
<td>The plan takes regard for rural and urban development.</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>5.25</td>
</tr>
<tr>
<td>20</td>
<td>have muster</td>
<td>It is usual in most schools to have a muster at a particular hour.</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>5.25</td>
</tr>
<tr>
<td>21</td>
<td>have stop</td>
<td>We also had a stop where the train pulled up.</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>4.50</td>
</tr>
<tr>
<td>22</td>
<td>make suggestion</td>
<td>I want to make a suggestion to the Ubuntu team.</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>2.25</td>
</tr>
<tr>
<td>23</td>
<td>have jog</td>
<td>The best you can do is to have a jog in the park.</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>4.25</td>
</tr>
<tr>
<td>24</td>
<td>have reappearance</td>
<td>Perhaps the movie will give incentive for her to have a reappearance.</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>4.00</td>
</tr>
<tr>
<td>25</td>
<td>make reading</td>
<td>Mental health findings make depressing reading.</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>2.75</td>
</tr>
<tr>
<td>26</td>
<td>have turn</td>
<td>You must allow others to have a turn at giving their input too.</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>3.00</td>
</tr>
<tr>
<td>No</td>
<td>Pair</td>
<td>Sentence</td>
<td>LCB</td>
<td>MI</td>
<td>LFq</td>
<td>Average Human rating</td>
</tr>
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<td>--------------------------------------------------------------------------</td>
<td>-----</td>
<td>----</td>
<td>-----</td>
<td>-----------------------</td>
</tr>
<tr>
<td>27</td>
<td>make appearance</td>
<td>Did Mohammad Ali ever make an appearance in Coney Island in 1980?</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>1.75</td>
</tr>
<tr>
<td>28</td>
<td>make abjuration</td>
<td>Being suspected, he made abjuration of Protestantism.</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>4.25</td>
</tr>
<tr>
<td>29</td>
<td>have play</td>
<td>With this free service you can have a play with the WordPress software.</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>6.25</td>
</tr>
<tr>
<td>30</td>
<td>have sprinkling</td>
<td>We had a sprinkling of snow this morning.</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>3.00</td>
</tr>
<tr>
<td>31</td>
<td>make stagger</td>
<td>They seemed to make a stagger back.</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>6.25</td>
</tr>
<tr>
<td>32</td>
<td>have opening</td>
<td>This double layer front pouch has an opening on the right side.</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>2.00</td>
</tr>
<tr>
<td>33</td>
<td>have flick</td>
<td>I wasn’t sure, so I had a flick through the maps and atlases we have.</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>4.75</td>
</tr>
<tr>
<td>34</td>
<td>make payment</td>
<td>I made a payment via PayPal but I have not received the files.</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>1.75</td>
</tr>
<tr>
<td>35</td>
<td>have refutation</td>
<td>Among other things, they have a refutation of McIntyre and McK-</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>5.75</td>
</tr>
<tr>
<td></td>
<td></td>
<td>itrick’s work.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>have yawn</td>
<td>Excuse us if we have a yawn.</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>6.00</td>
</tr>
<tr>
<td>37</td>
<td>make peck</td>
<td>The pigeon had been trained to make a peck at every person it saw in a photograph.</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>5.00</td>
</tr>
<tr>
<td>38</td>
<td>have dissipation</td>
<td>Instead of a climax where everything works out, we just have a dissipation of tension without any loss of incipient disaster.</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>2.50</td>
</tr>
<tr>
<td>No</td>
<td>Pair</td>
<td>Sentence</td>
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<td>MI</td>
<td>LFq</td>
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<td>----------------------</td>
</tr>
<tr>
<td>39</td>
<td>have effacement</td>
<td>Every patient that has proteinuria has effacement of the foot processes.</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>6.00</td>
</tr>
<tr>
<td>40</td>
<td>have adjournment</td>
<td>He also wished to have an adjournment in order to produce a witness.</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>3.75</td>
</tr>
<tr>
<td>41</td>
<td>take bite</td>
<td>You can take a bite of an orange and obtain ascorbic acid.</td>
<td>M</td>
<td>-</td>
<td>-</td>
<td>2.25</td>
</tr>
<tr>
<td>42</td>
<td>take preparation</td>
<td>In order to perform a colonoscopy, you must take a preparation.</td>
<td>M</td>
<td>-</td>
<td>-</td>
<td>4.75</td>
</tr>
<tr>
<td>43</td>
<td>take spin</td>
<td>This evening we will take a spin in the Jerusalem time elevator.</td>
<td>M</td>
<td>-</td>
<td>-</td>
<td>3.00</td>
</tr>
<tr>
<td>44</td>
<td>make smack</td>
<td>The rock made a smack as it fell in the stream.</td>
<td>M</td>
<td>-</td>
<td>-</td>
<td>3.25</td>
</tr>
<tr>
<td>45</td>
<td>have regret</td>
<td>We all have regrets.</td>
<td>M</td>
<td>-</td>
<td>-</td>
<td>1.75</td>
</tr>
<tr>
<td>46</td>
<td>have claim</td>
<td>Only a creditor can have a claim in a bankruptcy proceeding.</td>
<td>M</td>
<td>-</td>
<td>-</td>
<td>2.00</td>
</tr>
<tr>
<td>47</td>
<td>have distrust</td>
<td>The Sumatran people have a distrust of the sea.</td>
<td>M</td>
<td>-</td>
<td>-</td>
<td>2.00</td>
</tr>
<tr>
<td>48</td>
<td>take briefing</td>
<td>PSC staff takes a briefing and then work to develop the best training solution for the client.</td>
<td>M</td>
<td>-</td>
<td>-</td>
<td>5.25</td>
</tr>
<tr>
<td>49</td>
<td>have acquaintance</td>
<td>You should have an acquaintance with the relevant scholarship and display originality in the formulation of your arguments.</td>
<td>M</td>
<td>-</td>
<td>-</td>
<td>4.25</td>
</tr>
<tr>
<td>50</td>
<td>make experiment</td>
<td>You should make an experiment showing why ipods are dangerous.</td>
<td>M</td>
<td>-</td>
<td>-</td>
<td>3.75</td>
</tr>
<tr>
<td>No</td>
<td>Pair</td>
<td>Sentence</td>
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<td>MI</td>
<td>LFq</td>
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<td>----------------------</td>
</tr>
<tr>
<td>51</td>
<td>have reference</td>
<td>A dependency is created when one object has a reference to another object.</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>4.00</td>
</tr>
<tr>
<td>52</td>
<td>have competition</td>
<td>If you are going to have a competition, it should be fair to all customers.</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>2.00</td>
</tr>
<tr>
<td>53</td>
<td>have defence</td>
<td>Employers will have a defence if they can objectively justify age-discriminatory treatment or practices.</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>3.25</td>
</tr>
<tr>
<td>54</td>
<td>take account</td>
<td>The sub-panel will take account of the standard and non-standard data analyses.</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>2.25</td>
</tr>
<tr>
<td>55</td>
<td>have account</td>
<td>It is valuable to have an account of a tribe like the Batetela.</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>4.25</td>
</tr>
<tr>
<td>56</td>
<td>have hallucination</td>
<td>Someone who travels in the desert might have a hallucination of a swimming pool.</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>2.50</td>
</tr>
<tr>
<td>57</td>
<td>make casing</td>
<td>I sewed 2 sheets together and then made a casing.</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>2.50</td>
</tr>
<tr>
<td>58</td>
<td>take shape</td>
<td>Some new diversity strategies are taking shape.</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>2.50</td>
</tr>
<tr>
<td>59</td>
<td>have balance</td>
<td>On top of having balance between work and life, make sure you have fun.</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>2.25</td>
</tr>
<tr>
<td>60</td>
<td>take balance</td>
<td>We are trying to take a balance between science and engineering classes.</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>4.75</td>
</tr>
<tr>
<td>No</td>
<td>Pair</td>
<td>Sentence</td>
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<td>MI</td>
<td>LFq</td>
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<td>----</td>
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<td>----------------------</td>
</tr>
<tr>
<td>61</td>
<td>have procreation</td>
<td>Not all species have procreation the way we do.</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>4.50</td>
</tr>
<tr>
<td>62</td>
<td>take rein</td>
<td>He seemed to think that actually feeling and letting his emotions</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>take rein were the same thing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>make copy</td>
<td>I find it useful to make a copy of the original database table.</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>1.75</td>
</tr>
<tr>
<td>64</td>
<td>have veil</td>
<td>China always seems to have a veil of mystery around it.</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>2.00</td>
</tr>
<tr>
<td>65</td>
<td>make dedication</td>
<td>I’m not even going to make a dedication this time.</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>2.25</td>
</tr>
<tr>
<td>66</td>
<td>make exchange</td>
<td>If for any reason you are not satisfied, I will make an exchange.</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>3.00</td>
</tr>
<tr>
<td>67</td>
<td>take overdose</td>
<td>Many people take an overdose because of an emotional turmoil.</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>4.25</td>
</tr>
<tr>
<td>68</td>
<td>have bifurcation</td>
<td>The tree must have a bifurcation at the root.</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>3.25</td>
</tr>
<tr>
<td>69</td>
<td>take action</td>
<td>Good things happen when students take action.</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>4.25</td>
</tr>
<tr>
<td>70</td>
<td>have holster</td>
<td>He never actually carried the gun on him, although he had a holster.</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>1.75</td>
</tr>
<tr>
<td>71</td>
<td>have risk</td>
<td>Populations with a high total fat intake have a risk of nutritionally</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>linked cancers.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>make barbecue</td>
<td>After everything was prepared for the next day, we made a barbecue.</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>4.75</td>
</tr>
<tr>
<td>73</td>
<td>make misstatement</td>
<td>I’ll never knowingly make a misstatement of fact.</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>2.25</td>
</tr>
<tr>
<td>74</td>
<td>have trouble</td>
<td>I’m having troubles watching the video tutorials.</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>3.50</td>
</tr>
<tr>
<td>No</td>
<td>Pair</td>
<td>Sentence</td>
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<td>MI</td>
<td>LFq</td>
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</tr>
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<td>--------------------------------------------------------------------------</td>
<td>-----</td>
<td>----</td>
<td>-----</td>
<td>----------------------</td>
</tr>
<tr>
<td>75</td>
<td>take trouble</td>
<td>We don’t take the trouble any more in getting to know the person.</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>3.25</td>
</tr>
<tr>
<td>76</td>
<td>make cloak</td>
<td>Only a very skilled wizard would be able to make a cloak.</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>2.00</td>
</tr>
<tr>
<td>77</td>
<td>make bar</td>
<td>The restrictions made a bar to their enjoyment of civil and political</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>4.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rights.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>78</td>
<td>have mutation</td>
<td>One in 500 people has a mutation in at least one of their LDLR genes.</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>3.50</td>
</tr>
<tr>
<td>79</td>
<td>take hand</td>
<td>During the evenings Erhard played the piano or took a hand at Doppelkopf.</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>5.50</td>
</tr>
<tr>
<td>80</td>
<td>have footnote</td>
<td>Each author can have a footnote.</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>2.50</td>
</tr>
<tr>
<td>81</td>
<td>make disposition</td>
<td>The board may make a disposition at any request for reinstatement of a</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>4.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>medical license.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>82</td>
<td>take picture</td>
<td>Researchers have taken pictures of the face of Altair.</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>1.75</td>
</tr>
<tr>
<td>83</td>
<td>take arm</td>
<td>Finally, they took arms against the Government.</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>3.25</td>
</tr>
<tr>
<td>84</td>
<td>make effect</td>
<td>It takes a couple of years, but we will definitely make an effect.</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>4.25</td>
</tr>
<tr>
<td>85</td>
<td>take towel</td>
<td>Just let me take a towel.</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>3.00</td>
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<tr>
<td>86</td>
<td>have romance</td>
<td>I doubt if Creed will have a romance.</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>4.25</td>
</tr>
<tr>
<td>87</td>
<td>take time</td>
<td>The Brooklyn bishop takes the time to listen.</td>
<td>L</td>
<td>H</td>
<td>H</td>
<td>2.00</td>
</tr>
<tr>
<td>No</td>
<td>Pair</td>
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</tr>
<tr>
<td>88</td>
<td>make outcast</td>
<td>The traditional and the modern conspire in our culture to make an outcast of the disabled.</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>4.50</td>
</tr>
<tr>
<td>89</td>
<td>make hay</td>
<td>Mid-career is your prime time and it’s the best time to make hay of this type.</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>4.50</td>
</tr>
</tbody>
</table>
Appendix B

Morphological transformations

This appendix contains the details of the transformations that are performed for extracting verb-noun pairs with derived nouns.
<table>
<thead>
<tr>
<th>Nominal ending</th>
<th>Removed nominal ending</th>
<th>Added verb ending</th>
<th>Example (Noun)</th>
<th>Example (Verb)</th>
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<tr>
<td>-ence/-ance</td>
<td>-ence</td>
<td>-e</td>
<td>preced-ence</td>
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<td>-e</td>
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<td>argu-e</td>
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Appendix C

Irregular verbs

This appendix contains the list of all irregular verbs that are included in lemmatisation of verbs and extraction of verb-noun pairs. The list is available at http://www2.gsu.edu/~wwwesl/egw/verbs.htm

awake, be, bear, beat, become, begin, bend, beset, bet, bid, bind, bite, bleed, blow, break, breed, bring, broadcast, build, burn, burst, buy, cast, catch, choose, cling, come, cost, creep, cut, deal, dig, dive, do, draw, dream, drive, drink, eat, fall, feed, feel, fight, find, fit, flee, fling, fly, forbid, forget, forego (forgo), forgive, forsake, freeze, get, give, go, grind, grow, hang, hear, hide, hit, hold, hurt, keep, kneel, knit, know, lay, lead, leap, learn, leave, lend, let, lie, light, lose, make, mean, meet, misspell, mistake, mow, overcome, overdo, overtake, overthrow, pay, plead, prove, put, quit, read, rid, ride, ring, rise, run, saw, say, see, seek, sell, send, set, sew, shake, shave, shear, shed, shine, shoe, shoot, show, shrink, shut, sing, sink, sit, sleep, slay, slide, sling, slit, smite, sow, speak, speed, spend, spill, spin, spit, split, spread, spring, stand, steal, stick, sting, stink, stride, strike, string, strive, swear, sweep, swell, swim, swing, take, teach, tear, tell, think, thrive, throw, thrust, tread, understand, uphold, upset, wake, wear, weave, wed, weep, wind, win, withhold, withstand, wring, write
Appendix D

Instructions for judges

In this task you are asked to assess different usages of the verbs *take*, *make*, and *have* in given examples.

These verbs are extremely polysemous. The range of variation of their meaning and use could be seen as a continuum, starting with the primary, prototypical meaning (like in *She took a cup of coffee*, *She made a cake*, *She had a yacht*) and ending with usages where these verbs practically lose their meaning (like in *She took a look*, *She made an offer*, *She had a laugh*). In the latter case, the verb phrase (verb + object) can usually be replaced by a related verb (*She took a look* > *She looked at something*, *She made an offer* > *She offered something*, *She had a laugh* > *She laughed*).

Please assign a single value to each of the following examples denoting where the verb is on this continuum according to your intuition. The value can be any number from 1 to 7, where 1 represents primary, prototypical meaning and 7 represents no or almost no meaning at all, like in the following instance:

1 2 3 4 5 6 7

*She took a cup of coffee.*

*She made a cake.*

*She had a yacht.*

*She took a look.*

*She made an offer.*

*She had a laugh.*
As we are dealing with very fine and subtle differences in meaning, it is usually not easy to decide what value should be assigned to a particular example. Please try to be consistent as much as you can. If you find an example particularly difficult to assess put a question mark just in front of the assigned value.

Thank you for your participation!
Bibliography


