The incoherence of the English adverb class

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Every description of the English language uses word classes to categorize units; word classes (or *lexical categories*, or *parts of speech*) are, according to Huddleston & Pullum (2002: 20), one of the axioms of syntactical analysis. Among these classes, the label 'adverb' is used by almost every reference grammar dealing with English (e.g. Huddleston & Pullum 2002; Quirk *et al*. 1985), although Fries (1952) is an exception.

However, there is unanimous recognition in these works that the class is an extremely heterogeneous one, because it is made up of all the units that linguists have no good reason to classify otherwise. Let us take the following example, taken from the Corpus of Contemporary American English (COCA):

[1] And they **also** believed in something **very** important — that when you've worked **hard**, and done **well**, and you **finally** walked through that doorway of opportunity, you don't slam it shut behind you. (*Applause*.) **No** — you reach **back**, and you give other folks the same chances that helped you succeed. ‹COCA 2012: BLOG›

The seven units in bold are classified as adverbs by most authors, but differ in three respects:

(i) They have different forms: some are monomorphemic (*also*, *very*, *no*, *back*), some are morphologically complex (*finally*), while others share their form with an adjective (*hard* and *well*).
(ii) They have different distributions: some only modify verbs (*hard*, *back*), some only modify adjectives and adverbs (*very*) and others can modify units that belong to all these categories (*finally*).
(iii) They have different meanings: they express manner (*hard*, *well*), time (*finally*), place (*back*), degree (*very*), addition (*also*) and negation (*no*).

According to Haspelmath (2001: 16543), "adverbs are the most problematic major word class because they are extremely heterogeneous in all languages", including English. The problem is that not only does this word class exhibit heterogeneity among its members, but its very limits are not agreed upon by all linguists. Thus, in some works (e.g. Fries 1952; Huddleston & Pullum 2002), units such as *very* and *back* would not be grouped with adverbs but would either be put in another class or attributed a distinct class altogether.

The goal of this article is to assess the validity of the adverb class and its limits by comparing different arguments and classification methods. After briefly reviewing the place of adverbs in various accounts of the English language (§1), I will describe different ways of establishing word classes and argue for an approach in which word classes are used only if some units are sufficiently similar (§2). Following these guidelines, I will put forward a multivariate analysis of the 200 most frequently used units that are classified as adverbs (§3). The results show that the class is indeed very heterogeneous, and a comparison with other word classes calls for a recategorization of a considerable number of those units (§4).

1 Adverbs in grammatical descriptions of English

As mentioned earlier, adverbs have been renowned for being an extremely heterogeneous class. At least since the *Art of Grammar* in the 2nd century BCE, attributed to Dionysus Thrax (Davidson 1874: 14–15), adverbs (*ἐπίῤῥημα*, literally 'on a verb') have been defined as invariable units that modify verbs. This extremely broad definition essentially makes adverbs "a miscellaneous or residual category – the category to which words are assigned if they do not satisfy the more specific criteria for nouns, verbs, adjectives, prepositions, and conjunctions" (Huddleston & Pullum 2002: 563). This led several linguists to try to reduce the extension of the category so as to make it more coherent. Some accounts of the adverb category thus depart, sometimes greatly, from traditional description, but linguists disagree over which units should be recategorized.

Table 1 below shows how some invariable units are classified by various linguists in reference grammar books. Note that some authors (like Eastwood 2002) were not included because most of them exactly follow Quirk *et al.*'s (1985) classification.

	very	*slowly*	*abroad*
Jespersen (1924)	particle		
Fries (1952)	group D	class 4	
Quirk *et al.* (1985)	adverb		
Huddleston & Pullum (2002)	adverb		preposition
Kolln & Funk (2012)	qualifier	adverb	

Table 1. Classification of degree, manner and place elements in grammatical descriptions of English.

Among units that are traditionally classified as adverbs are also the deictic time elements *today*, *tomorrow*, *yesterday* and *tonight*. Most authors consider them adverbs because they are invariable and express time. On the other hand, Payne & Huddleston (2002: 429) rather classify them as pronouns, since they can appear in subject function, have a genitive form and are unable to take determiners.

As Table 1 shows, three cases may be distinguished according to whether manner elements (*slowly*) are grouped with degree elements (*very*), place elements (*abroad*), or both. Adverbs in traditional accounts of English grammar, such as Quirk *et al*. (1985), tend to constitute a very large category comprising invariable elements that do not have any complement. This broad classification was questioned in at least two ways.

Fries (1952)[1] and Kolln & Funk (2012) choose to place degree elements in a distinct category (*intensifiers* or *qualifiers*). They do so on distributional grounds: units like *very* and *rather* cannot modify verbs, only adjectives and adverbs. On the other hand, manner and place elements can modify verbs, which is enough to put them in the same category.

Conversely, Huddleston & Pullum (2002) choose to remove from the adverb class many units traditionally called *place adverbs* and *time adverbs* and to group them together with prepositions. They argue that these units have the same distribution as prepositions and preposition phrases, as shown in [2].

[2] i Economists **abroad** ⟨outside the country / *externally⟩ will continue to demand austerity and further unemployment. [modifier in NP]
‹COCA 1990: SPOK›

[1] Fries (1952) makes a distinction between *classes*, i.e. open word classes, and *groups*, i.e. closed word classes. They are differentiated with numbers and letters, respectively.

ii Someone else put it **there** ⟨near the entrance / *adjacently⟩. [complement of *put*]
‹COCA 2015: TV›

iii I need to talk to Kyle right **now** ⟨after the show / *immediately⟩. [modification by *right*]
‹COCA 2010: TV›

Their only difference resides in their complementation, which is not a good argument in favor of a separate category, according to Huddleston & Pullum[2]. In this respect, they follow Burton-Roberts (1991) and Lee (1998), who coined the term *intransitive preposition* for such cases. As a consequence, they leave within the adverb category all the units that can fill the function of units formed from adjectives by adding *·ly*.

What can be learned from these different accounts is that linguists almost always use a distinct category of units that can modify verbs, and this category always includes elements that express the way an action is carried out. If one accepts to call this category 'adverbs' (or another term like 'class 4', *à la* Fries), then adverbs seem to have those manner elements as central members. However, apart from those prototypical elements, the boundaries of this class are far from consensual, which is mainly due to the way word classes are established in general.

2 Word classes and their delimitation

2.1 Top-down and bottom-up approaches

As far as I know, all syntactic analyses of the English language posit the existence of word classes. Along with constituents and syntactic functions, word classes are part of the axioms of syntax (Huddleston & Pullum 2002: 20): if these three concepts are not accepted, then no syntactic analysis is apparently possible.

Even within theoretical approaches which argue that syntax is not distinct from morphology or the lexicon, like constructionist approaches, word classes are used. Langacker (2008: 93–103) uses them because they have a conceptual foundation, while other constructionists like Goldberg (2006: 51) consider them essential to explain why constructional slots accept some kinds of units but not others.

These classes are generally needed in linguistic analysis to predict the morphosyntactic behavior of specific units and are probably somehow interiorized by speakers (cf. Berko 1958 and the "*wug* test"[3]). However, the way those units should be grouped together is not agreed upon among linguists.

Word classes have traditionally been inherited from Greek and Latin grammatical description. Since then, they have barely changed, apart from the substantive class, which was divided into nouns and adjectives, and the determinative[4] class, which was expanded or created altogether. Most grammatical works use between 8 and 10 classes and assume that all words must fall into one of them (Huddleston & Pullum 2002: 21–22).

In this sort of "top-down" approach, the linguist thus establishes a set of limited, pre-defined categories. The inventory of the linguistic units of a given language is divided *a priori* and every

[2] The authors argue, for instance, that *know* can be complemented by a noun phrase, a clause or nothing but is not thought to belong to three different classes, whereas *before* has the same possibilities of complementation and is traditionally treated as a preposition, a conjunction and an adverb, respectively.

[3] In this test, children are presented with a nonsense word, *wug*, in a nominal context. Older children spontaneously use a plural suffix (*wugs*) when faced with a plural syntactic context (*there are two* ___). This shows that speakers can spontaneously apply a certain number of grammatical processes to a word once they have identified it as a noun, for instance.

[4] I follow Huddleston & Pullum (2002: 24–25), who clearly distinguish *determinatives* (a word class) and *determiners* (a syntactic function). These two concepts mainly overlap, but some determinatives can be used as heads of NPs (***this** is it*) while some determiners are not determinatives (***Sandra's** car*).

linguistic unit is then assigned to (preferably) one category. The problem with the top-down approach is that it cannot account for non-prototypical members of a class, or unclassifiable units:

[3] i Brothers and sisters, our Lord Jesus Himself warned us, "Beware of false prophets who come in sheep's clothing," for inwardly, they are ravenous wolves. ‹COCA 2017: MOV›

ii I'm a nice person! And anyone who doesn't think so can have a sock in the eye. ‹COCA 2012: BLOG›

The unit *beware* is usually classified as a verb (Huddleston & Pullum 2002: 1186; Quirk et al. 1985: 152) despite the fact that it is highly defective synchronically; indeed, it can only be encountered in a plain form and in directive contexts (i.e. in imperative constructions and after strong deontic modals):

[4] i I can only warn you, not teach you. **Beware** of what you dream for. ‹COCA 2004: MOV›

ii Santorum (and most of the Rs from top to bottom as well) should **beware** of squirrels and chipmunks. ‹COCA 2012: WEB›

iii *He has **bewared** of pickpockets.

Verbs are the only category whose members can enter into those syntactic contexts as well, hence the classification of *beware*; but if one chooses to follow it, then one has to admit that *beware* is at best a highly non-prototypical verb. Because word classes help predict the morphosyntactic behavior of a given unit, it will be necessary to add a large set of exceptions for *beware* so as to explain why it lacks some typical verbal forms.

In example [3ii], *so* functions as a complement of *think* and replaces a clause whose propositional content is identical to a previous clause; it is the equivalent of *anyone who doesn't think [(that) I'm a nice person]*. This prompted Quirk *et al*. (1985: 880–881) to call it "pro-clause *so*". It is difficult to assign pro-clause *so* a word class: other adverbs cannot be used as complements of epistemic verbs, and pronouns can function as subjects, which is not the case of pro-clause *so*. This prompts Huddleston & Pullum (2002: 1536) to state that it would be unproductive to artificially assign a word class to this unit.

Therefore, working with a limited number of pre-established word classes can be problematic, because a few exceptional units might not be subject to the rules applying to the category they are assigned to by default, and because some units may have a unique syntactic behavior.

Conversely, one could classify units not by using predefined categories, but by observing recurrent behavior among linguistic units — a "bottom-up" approach. In this case, such units are compared according to the grammatical properties they exhibit and are only grouped together if they manifest the same set of (morphological, syntactic or semantic) properties in full or in a non-negligible part. In that case a small word class is created and if the same conditions apply, it can further integrate other units or fuse with other classes to create a larger category.

This approach thus leaves the door open for unclassified units, like pro-clause *so*. It makes it also possible for a unit to be gradient (Aarts 2007), i.e. to exhibit properties from several categories. The unit *near*, for instance, has both adjectival and prepositional properties:

- Like other adjectives, it has a comparative and superlative form (*near**er***, *near**est***), it can be derived into an adverb (*near**ly***) and it can be modified by degree units (***very*** *near*, *near* ***enough***, ***as*** *near* ***as possible***);

- Like other prepositions, it is complemented by NPs (*near **the building***), it can function as a complement of motion verbs (***put** it / **go** near the door*) and it can be modified by *right* (***right** near the entrance*).

The bottom-up approach also relies on generalization (Crystal 1967: 26–27): a word class is created and used only if it is powerful enough to account for the morphosyntactic behavior or the semantic content of a given linguistic unit.

Because of this, I think it preferable to adopt a bottom-up approach when studying word classes. Such categories are not objective or directly observable: they are abstract constructs used by linguists to facilitate grammatical description. Since they are merely the result of an operation of categorization based on analogy, they should be used not as an end in itself, but to describe a language more efficiently when a number of units exhibit certain properties that are relevant to grammatical description.

2.2 Lumpers and splitters

As mentioned earlier, small classes can be fused together if the resulting category is believed to be relevant enough for grammatical description. Systematic fusion of classes may therefore result in a limited number of categories. There is a great deal of variation among classifications, however; Table 2 below expands on Table 1 and shows how linguists classify various invariable units of English.

<table>
<tr><th></th><th>very</th><th>slowly</th><th>abroad</th><th>from</th><th>while</th><th>whether</th><th>and</th><th>oh</th></tr>
<tr><td>Jespersen (1924)</td><td colspan="8">particle</td></tr>
<tr><td>Fries (1952)</td><td>group D</td><td colspan="2">class 4</td><td>group F</td><td colspan="2">group J</td><td>group E</td><td>group K</td></tr>
<tr><td>Quirk et al. (1985)</td><td colspan="3">adverb</td><td>preposition</td><td colspan="3">conjunction</td><td>interjection</td></tr>
<tr><td>Biber et al. (2002)</td><td colspan="3">adverb</td><td>preposition</td><td colspan="2">subordinator</td><td>coordinator</td><td>insert</td></tr>
<tr><td>Huddleston & Pullum (2002)</td><td colspan="2">adverb</td><td colspan="3">preposition</td><td>subordinator</td><td>coordinator</td><td>interjection</td></tr>
<tr><td>Kolln & Funk (2012)</td><td>qualifier</td><td colspan="2">adverb</td><td>preposition</td><td>conjunction</td><td>expletive</td><td>conjunction</td><td>interjection</td></tr>
</table>

Table 2. Invariable word classes in grammatical descriptions of English.

As Table 2 shows, there is no consensus on the way English invariable units should be classified. Linguists use from one (Jespersen) to six categories (Fries and Kolln & Funk) to describe them. Although these linguists presumably have access to the same data, i.e. how linguistic units behave and combine with other units, they chose different classifications.

In scientific disciplines involving classification, a distinction is often made between *lumpers* and *splitters*. The former tend to establish very large categories, while the latter prefer smaller and more numerous classes; in Table 2, Jespersen and Fries could be seen as typical examples of a lumper and a splitter, respectively. Both approaches have their advantages and drawbacks.

Lumping tends to emphasize common characteristics between units. By taking into account only a small number of criteria to classify units (only less than a dozen), lumpers allow for less cumbersome grammatical systems. The problem with lumping is that the classes are so large that they become almost useless. Knowing that a unit is a particle (in Jespersen's terms) only gives an indication on its morphological behavior, not its syntactic behavior. In order to account for specific properties, a lumper will have to rely heavily on subclasses.

Conversely, splitting consists in translating any difference in behavior into a distinct class. For instance, the fact that some degree elements cannot modify verbs is a sufficient reason to create a specific class for splitters. This allows for a more precise system in which each class is homogeneous because its members exhibit the same morphosyntactic behavior. However, there is theoretically no limit to how many distinct classes one can create. Any difference might trigger the partition of a category, leading to a very complex descriptive system that might be hard to handle, especially for learners.

Choosing one approach over the other therefore depends on whether one wants to draw attention to the similarities or the differences between units. In the former case, the system will achieve generality; in the latter, it will achieve accuracy.

At first sight, one could just say that the choice between broad and narrow categories is not a real one. For instance, despite their differences, lexical verbs and auxiliary verbs are often ultimately thought to belong to the same class because they have properties that distinguish them quite sharply from other classes. Therefore, there is no contradiction in saying that adverbs, prepositions, conjunctions and interjections are subclasses of "invariable units" or "particles" (or that "invariable units" is the superclass encompassing adverbs, prepositions, conjunctions and interjections). After all, this choice is only about what one's preferred scale of analysis is.

Yet another problem arises with linguists who choose an intermediate number of categories. Indeed, a similar number of classes does not ensure that these classes will include the exact same members. For instance, Biber et al. (2002) and Huddleston & Pullum (2002) have opted for five classes of invariable units, but the authors give those classes different boundaries. In particular, Huddleston & Pullum's preposition class is more extensive than Biber et al.'s because they gave priority to a different set of grammatical properties.

Variation in classification results from the fact that linguists choose to weigh their criteria of classification differently. In the end, the boundaries of the word classes one uses depend on the properties that are deemed more relevant than others; they are therefore the result of a completely subjective choice.

2.3 A third way of classifying

There is probably no right answer to how far one should split or lump word classes, because it depends on the scale of analysis that a linguist will choose. What can be solved in a less subjective way is which units one should group together in priority.

In line with the theoretical principles exposed in §2.1, I propose a third way of classifying units, which is often called *clustering*. Under this approach, the categorization of units is done step by step. If units A and B have more in common than do A and C or B and C, then any group that one might want to create will include A and B before anything else. This means that no priority is given to any property: they all equally participate in determining how close or far two units are. Thus a common way to mark a complement (e.g. with a specified preposition like *of*) is given the same weight as a common inflectional suffix (e.g. a plural marker). Any weighting of a property would have been a necessarily subjective choice, hence a debatable one.

Note that this approach does not dictate HOW MANY common characteristics are needed for several units to be considered part of the same class. This is up to the linguist and the way they conceptualize categories. What this approach allows for is ending up having the same subcategories when breaking down large categories.

With this method, a word class will be a set of units which will be close enough to each other and/or far enough away from other groups. This means that there will be potential isolates, i.e. units that will be so far from others that they cannot be readily categorized (e.g. pro-clause *so*), and potential hybrids, i.e. units that will lie between classes (e.g. *near*).

Since one may potentially compare a large number of units according to a large number of grammatical properties, it is preferable to use an automated way of establishing word classes that follows the principles exposed above. I will now present a statistical method of clustering linguistic units that I will apply to English units traditionally classified as adverbs.

3 A multivariate analysis of English adverbs

3.1 Criteria of distinction

As mentioned earlier, adverbs are extremely heterogeneous and linguists choose to classify them very differently. My goal here is to try to minimize the subjectivity of such classifications and to group together units that behave in an identical or very similar way.

To do so, I listed as many criteria of variation as possible that are displayed by units traditionally called 'adverbs' in English. I used three main types of criteria:

- The morphology of the units, i.e. their internal structure and their potential (inflectional or derivational) affixes;
- Their syntactic distribution (Creissels 2006: 16), also known as their passive valence (Iordanskaja & Mel'čuk 2009), i.e. the syntactic contexts they can be put into;
- The range of their dependents, also known as their active valence, i.e. their potential complements and modifiers.

The decision to exclude the semantic category of adverbs as a criterion of distinction was based on two observations.

(i) There is no right answer as to what level of precision is needed. Speed adverbs (*fast*, *rapidly*, *slowly*) are for instance classified as manner adverbs by Mittwoch et al. (2002: 670); one can either annotate them as manner adverbs, which denies their semantic and syntactic specificity, or as speed adverbs, which involves trying to find a semantic subcategory for all manner adverbs.
(ii) More often than not, adverbs can have several interpretations: *truly*, for instance, can express manner (*I will speak truly*), degree (*I do not truly understand what this is about*), modality (*this is truly a miracle*) and illocution (*I truly do not expect you to come*), which makes it hard to assign a definite category to this adverb.

Although semantic categories will not be used as criteria of distinction, a semantic classification will be applied at the end of the analysis to see whether morphosyntactic subcategories of adverbs have a semantic basis.

If two criteria yielded the same results for all units (see §3.2), then they were fused together or one of them was removed. Initially, for instance, *too* ~ and *very* ~ were used as criteria (where ~ replaces the adverb under consideration), but any adverb that could be used in one of these contexts could be used in the other. The former was removed in favor of the latter. Another case was the initial position of adverbs in the sentence: a distinction was initially drawn between integrated and detached initial adverbs. However, those criteria virtually yielded the same results, probably because usage fluctuates in written corpora as to whether a comma should be inserted or not.

This resulted in 39 criteria of distinction, which are listed below:

MORPHOLOGY

Internal structure:	structure ‹X·*ly*›, where X is an existing adjective
	structure ‹X·Y›, where X and Y are any identifiable elements
Inflected forms:	comparative (*~er than*)
Derived forms:	privative (*iN~*[5], *un~*)
	adverb (*~ly*)

SYNTACTIC DISTRIBUTION

Can function as complement of[6]:	*be*	
	become	
	behave	
	go and *put*	
	*last*V	
	until	
Can be a particle (i.e. can occur between a verb and its NP object or after the NP object)		
Can function as a modifier or supplement of[7]:	▪ verbs:	initial position, prosodic detachment (~, S V X)
		initial position, compulsory subject–auxiliary inversion (~ Aux S V)[8]
		central position (S Aux ~ V)
		final position (S V X ~)
		final position, prosodic detachment (S V X, ~)
	▪ adjectives:	attributive position (*the ~ good thing*)
		predeterminer position (*~ good a thing*)
	▪ prepositions	
	▪ nouns:	post-head position (*the room ~ is large*)
		pre-head position[9] (*the very ~ thing*)

[5] The criterion *iN~* covers cases in which the nasal consonant assimilates with the first consonant of the base, thus becoming /m/, /ŋ/ or /ɹ/ (as in the pair *regularly~irregularly*).

[6] These units are the only ones in English that accept adverbs as complements. More specifically, *behave* and *last* are one of the few English verbs that accept manner adverbs and time adverbs as complements, respectively.

[7] Note that "modifier of adverbs" was not used as a criterion. Most of the time, when two adverbs occur in a row, the first one (the modifier) will be a degree adverb, so there will not be much variation. Moreover, the modification of an adverb by another adverb is already covered by several criteria in the second category (*dependents*). Maintaining a similar criterion in the third category would have resulted in a duplicate.

[8] In some cases, preposed adverbs can trigger **optional** subject–auxiliary inversion (e.g. *Thus did he break with a family tradition*). This kind of construction is however very formal and subject to a lot of variation among speakers.

[9] The pre-head position is typical of adjectives. This criterion is concerned with adverbs which have the same form as adjectives, also called *flat adverbs*.

DEPENDENTS	Can have as complements:	NPs
		PPs headed by a specified preposition (*for*, *from*, *of*, *to*, *with*)
		that and bare content clauses
		to-infinitive clauses
		gerund-participial (·*ing*) clauses
	Can have as modifiers:	degree modifiers (*as ~ as possible*, *more ~ than*, *very ~*)
		typical modifiers of prepositions (*right ~*)
		NPs (*3 days ~*)

3.2 Corpus and method

Once the various criteria of distinction were established, I selected the 200 units labeled as adverbs that appear most frequently in the COCA. In some cases, the tagging was erroneous (*for*, *of*) but the historical preposition is actually part of a polylexemic adverb (*for_example*, *kind_of*, *of_course*, *sort_of*); those four polylexemic adverbs were included in the list[10].

Among those 200 units, a distinction was made between homonyms, i.e. units which have the exact same form but whose senses are unrelated (at least synchronically) in a way that allows them to be analyzed as several linguistic units. To do so, Blank's (2003: 270–271) typology of polysemy was used: if two senses of a unit are not related by one of the seven polysemy links (metaphoric, co-hyponymous, taxonomic, metonymic, auto-converse, antiphrastic, antilogic), then they can be considered homonyms, even if they have a common etymology[11]. Based on these criteria, I found four potentially homonymous units: *so* (expressing degree or result), *still* (expressing aspect or concession), *too* (expressing degree or addition) and *yet* (expressing aspect or concession).

The COCA was then checked for every morphosyntactic context given in §3.1. In a spreadsheet, the adverbs (rows) were then annotated according to whether they could appear in each of these contexts (columns).

The spreadsheet was imported to R and the *daisy* function was used to automatically calculate the Gower distance between each unit. If two units have the exact same properties, they are at a distance of zero; if they differ according to 4 properties, they are at a distance of 4, and so on. The result is a large matrix that shows these distances, like a table of distances between cities on a map — with the difference that these are not physical distances, but abstract ones.

Following the bottom-up approach that was advocated in §2.1, clusters of adverbs were created through agglomerative hierarchical clustering. Each adverb was initially considered as a cluster (i.e., a class); an algorithm then combined, step by step, the two clusters (adverbs or groups of adverbs) that were the most similar into a new, larger cluster. The operation was repeated until all points formed one single cluster, thus forming a dendrogram (average linkage clustering, cophenetic

[10] One argument in favor of analyzing those as polylexemic units is the fact that they will often undergo phonetic reduction: [fɹɪgˈzæ̃mpɬ], [ˈkʰaɪm(d)ə], [ˈfkʰɔːɹs], [ˈsɔːɹɾə].

[11] The noun *box*, for instance, has two senses that are etymologically related, as in *box$_1$ tree* and *a box$_2$ of chocolate*. Historically, containers were typically made out of box wood: *box$_2$* was therefore metonymically derived from *box$_1$*. Nowadays, boxes (containers) are far more frequently made out of other materials, so that the original link that existed between those two senses has disappeared, making them homonyms.

coefficient 0.85). The elbow method was used to determine that the optimal number of classes for the adverbs under consideration was 4.

Those distances were then modeled using a multidimensional scaling process: this is a method that makes it possible to represent the distance between each point (i.e. each unit) on a two- or three-dimensional space in order to better visualize it. Since the distances are not physical, the representation is necessarily imperfect and some data will not be represented on a two-dimensional plane. The SMACOF (*scaling by majorizing a convex function*) algorithm is used to minimize this loss of information.

The result is a map composed of 200 points that represent the 200 units. These points are more or less close to one another and this spatial proximity conveys a proximity in the properties of these units. This representation can therefore help determine whether adverbs are a homogeneous class or not, whether there are clear groups and whether some adverbs can be considered hybrids or isolates.

4 Results and discussion

4.1 Adverbs as a heterogeneous category

The result of the analysis carried out is the two-dimensional space in **Erreur ! Source du renvoi introuvable.** below:

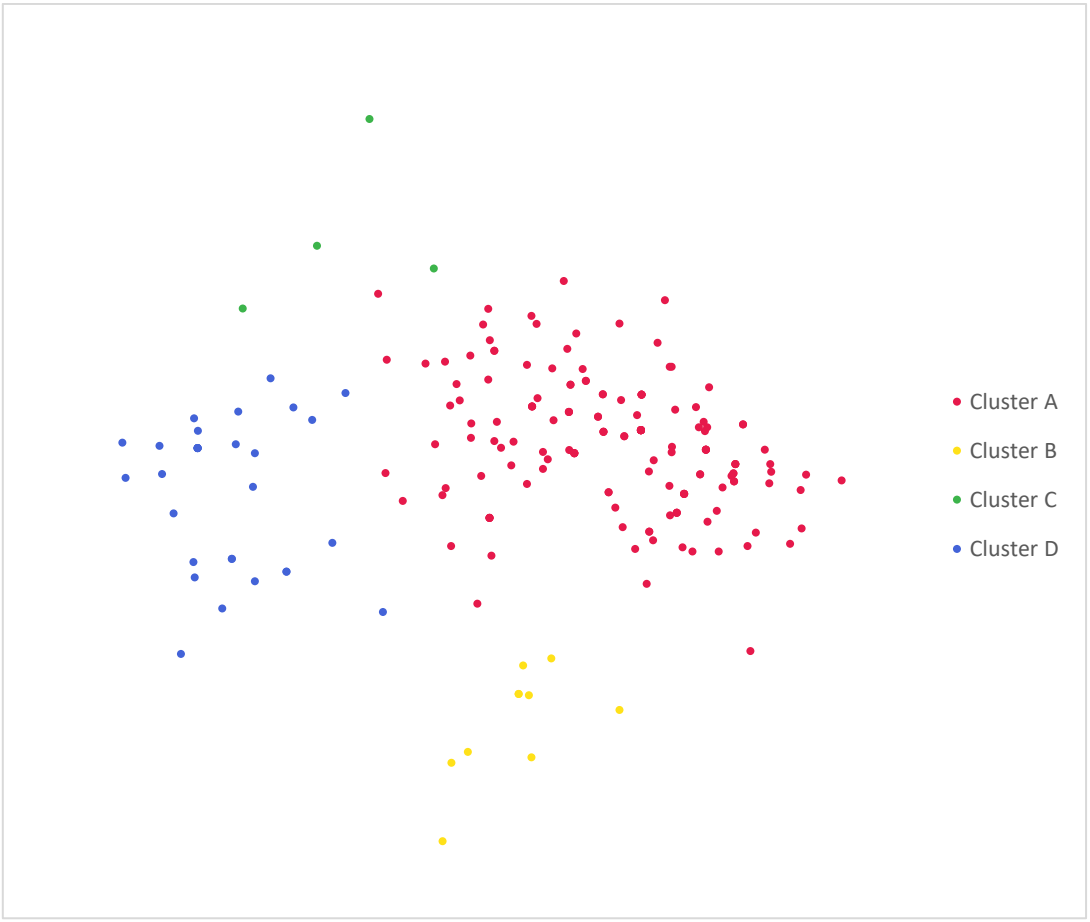

Figure 1. Two-dimensional scaling of adverb units, using SMACOF algorithm, colored by cluster.

As mentioned earlier, since multidimensional scaling consists in representing a certain number of dimensions of variations with only two dimensions, this representation is necessarily imperfect. The proportion of information thus lost is called the *stress*. Here the stress is 11,07%, which means that

to accurately represent the remaining 11,07% information, more than two dimensions would be needed.

In this representation, each dot represents a single unit, but some dots may be overlapping and appear as a single one. This is the case, for instance, of the dots representing the units *today*, *tomorrow*, *tonight* and *yesterday*; this means that these units are at a distance of zero, because they have the same grammatical properties.

Erreur ! Source du renvoi introuvable. also shows adverbs colored according to the cluster they belong to, as determined by the agglomerative hierarchical clustering presented in §3.2:

- Cluster A includes most of the units of the list, notably all units in *·ly*;
- Cluster B is made up of 10 units: *early*, *far*, *fast*, *hard*, *late*, *little*, *long*, *much*, *soon* and *well*;
- Cluster C is composed of the four traditional *wh·* adverbs: *how*, *when*, *where* and *why*;
- Cluster D consists of traditional place adverbs and the unit *before*, most of which are also classified as prepositions when they have an NP complement.

Most of these adverbs were annotated according to their semantic category, using Mittwoch et al.'s (2002) typology. Represented below in **Erreur ! Source du renvoi introuvable.** are the most common categories: connective, degree, frequency, manner, modality, place and time adverbs.

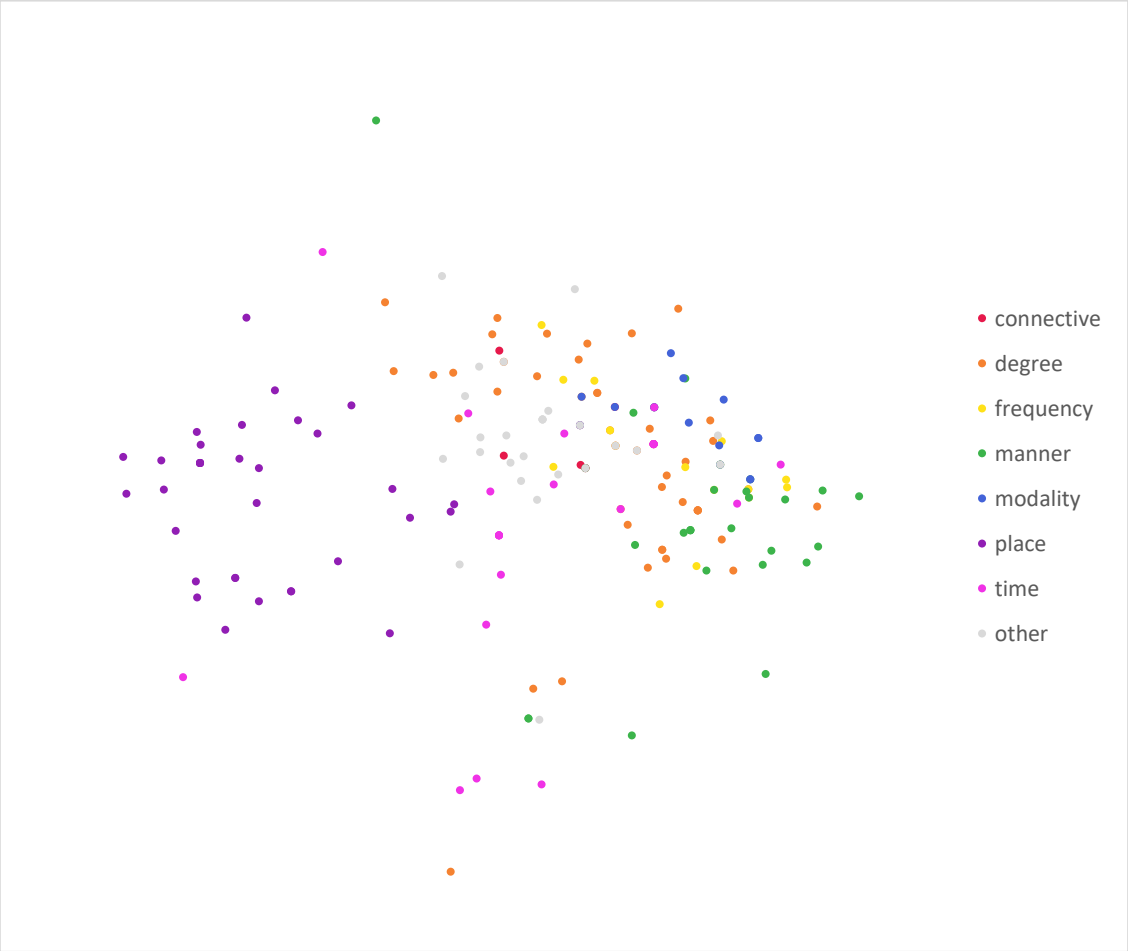

Figure 2. Two-dimensional scaling of adverb units, colored by semantic category.

Erreur ! Source du renvoi introuvable. clearly shows that Cluster D, which was already morphosyntactically coherent, is also semantically coherent, as it is almost exclusively composed of traditional adverbs expressing location. Clusters A and B are semantically far more heterogeneous,

but the rightmost elements of Cluster A are mainly units primarily expressing manner, as well as frequency and modality.

In multidimensional scaling, the first dimension of variation (represented by the abscissa) is the most relevant one. This means that within the traditional category of adverbs (as defined for instance in Quirk *et al.* 1985), place elements on the one hand and manner, frequency and modality elements on the other act as two attracting poles. Other adverbs are scattered along the continuum that lies between these two poles.

The fact that these categories constitute opposite poles is no coincidence, given the fact that they have very different morphosyntactic properties. As seen in the examples in [2], place elements (but not manner elements, for instance) mostly accept NPs as complements, can be modified by *right* or *straight* and can function as complements of *be*, *go* and *put*. Unlike place elements, on the other hand, manner, frequency and modality elements are mostly morphologically complex, are gradable (they can be modified by degree adverbs and can enter into the scalar equality comparative construction) and can modify verbs in all linear positions as well as adjectives, as can be seen in [5] below:

[5] i I am talking to you as **frankly** ⟨*outside⟩ as I can. ‹COCA 1993: NEWS›

ii She **frankly** ⟨*outside⟩ confessed that all efforts to change his views were futile. ‹COCA 2012: WEB›

iii I can't believe what I'm hearing, **frankly** ⟨*outside⟩. ‹COCA 1996: SPOK›

iv I reminded him that for me to say such a thing in his presence would have been a **frankly** ⟨*outside⟩ stupid thing to do. ‹COCA 2012: BLOG›

The plot also shows that degree elements are neither concentrated in one area nor clearly distinct from other adverbs. It therefore appears that Fries's and Biber *et al.*'s distinct class of "intensifiers" is not the most relevant one, despite their convincing arguments. This is most probably due to the fact that there are very few units that only express degree, like *quite*, *rather*, *too* or *very*. Most adverbs expressing degree can also express other semantic categories, mostly manner (e.g. *entirely*, *perfectly*, *roughly*, *strongly*); in that case, the semantic category is generally determined by the linear position of the adverb and the word it modifies. Yet, precisely because degree adverbs can have many linear positions, they do not have properties that distinguish them sharply from other units, and are therefore scattered across the plot.

The second dimension of variation (represented by the ordinate) is less significant but is still important. The plot shows that most traditional adverbs lie around the center of the vertical axis. More interesting are the topmost dot and the scattered group of dots at the bottom forming Cluster B.

The topmost dot represents the unit *how*, which indeed has special properties compared with most other adverbs: as a *wh·* word, it will be mostly restricted to front position (except for *in-situ* questions) and will always trigger subject–auxiliary inversion; as a potential manner element it can replace the complements of *behave* and *treat*; and as a degree element that modifies an adjective within an NP, it will impose a predeterminer position for the adjective phrase (e.g. *how bad a situation is it?*). More generally, the fact that *wh·* words form a distinct cluster shows that they might constitute a micro-class of units that is distinct from the adverb word class. Note, however, that in Figure 1 the unit *where* is not far from Cluster D, presumably because it can function as a complement to the same verbs as place adverbs.

The units in Cluster B are few and semantically different; these are *early*, *far*, *fast*, *hard*, *late*, *little*, *long*, *much*, *soon* and *well*. Despite their semantic diversity, they still bear a few similarities: all of

them are monomorphemic[12], all of them have an inflectional comparative form (sometimes an irregular one) and most of them can also be analyzed as adjectives or determinatives, which would make them adjective–adverb hybrids (*early*, *far*, *fast*, *hard*, *late*, *long*, *well*) or determinative–adverb hybrids (*little*, *much*).

Semantic categories do therefore influence how traditional adverbs can be divided into subclasses, but purely morphosyntactic properties are still the main criterion.

4.2 Adverbs and other word classes

If the analysis carried out so far established that there are clear subclasses of traditional adverbs, it did not establish whether this traditional class is relevant in the description of English. That is, one of these apparent subclasses might well belong with another word class. The second and final step of the analysis is therefore to compare traditional adverbs with other units and to see whether one or several of the subclasses that were established rather belongs with another word class.

To do so, the most frequent units traditionally classified as adjectives, (subordinating) conjunctions and prepositions in the COCA were selected:

Adjectives		**Conjunctions**	**Prepositions**	
able	*large*	*because*	*across*	*in_case*
alive	*national*	*although*	*after*	*in_front*
American	*new*	*if*	*against*	*into*
bad	*old*	*in_order*	*among*	*like*
big	*other*	*lest*	*as*	*near*
black	*political*	*unless*	*at*	*of*
different	*public*	*whereas*	*between*	*since*
good	*real*	*whether*	*beyond*	*toward*
great	*small*	*while*	*despite*	*until*
happy	*social*		*during*	*with*
high	*sure*		*for*	*without*
important	*young*		*from*	

Table 3. Units from other traditional word classes.

Some of the units in Table 3 exhibit a few properties that are not among the original 39 presented in §3.1. Five criteria therefore had to be added to go on with the analysis:

- The unit can have no complement[13];
- The unit can be complemented by PPs headed by the specified prepositions *about*, *at* and *than*;
- The unit can be complemented by a subjunctive bare content clause.

The same statistical analysis was run as the one described in §3.2. A new two-dimensional representation of the distance between all those units is given below in Figure 3:

[12] *Early* is diachronically analyzable as *ere* + ·*ly*, but it is not in synchrony, notably because it is not pronounced /ɛɪli/.
[13] This property was not distinctive with traditional adverbs, as all of them can occur without a complement.

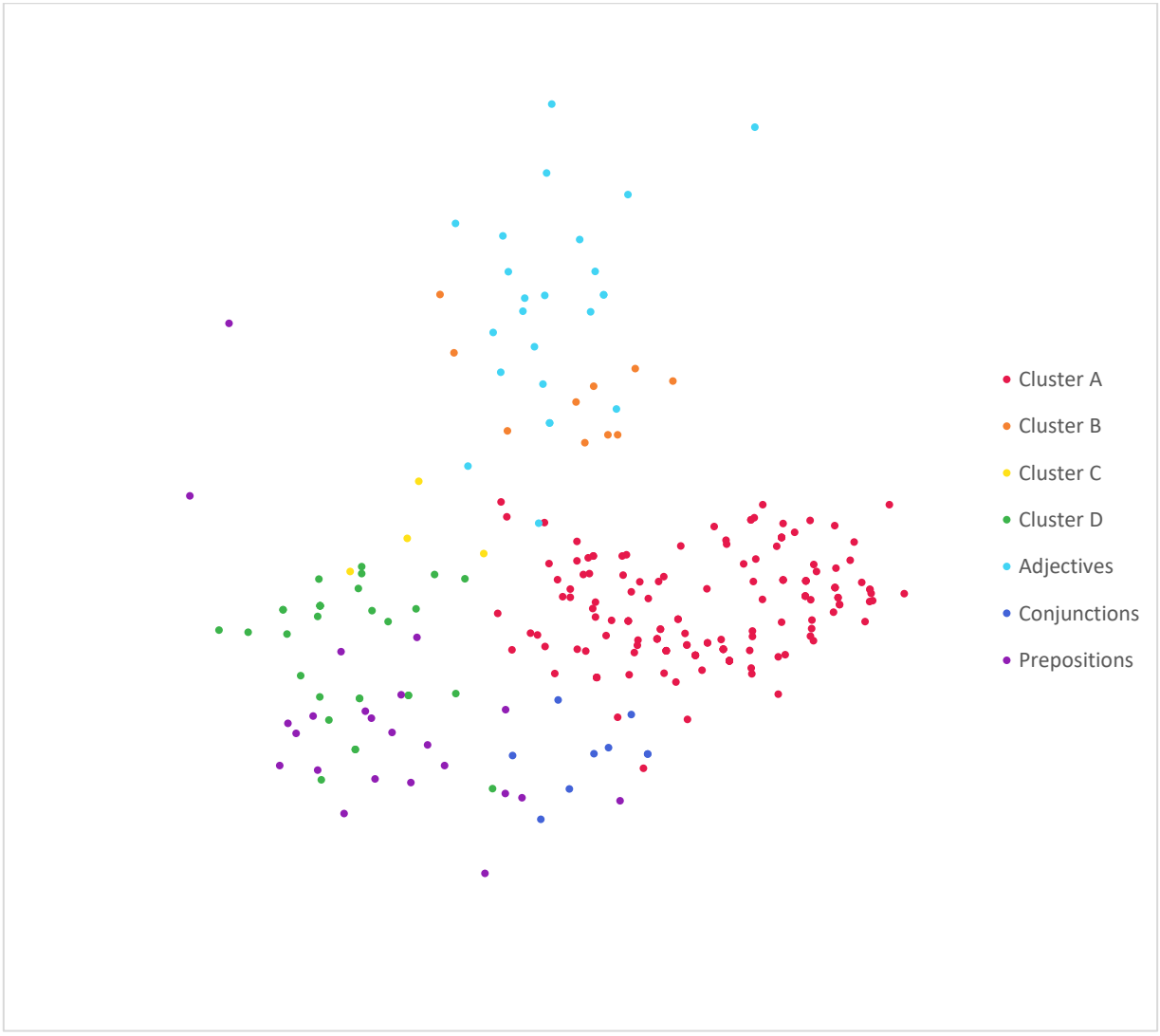

Figure 3. Two-dimensional representation of adverbs, prepositions, conjunctions and adjectives.

Several conclusions can be drawn from this new representation.

If prepositions are to be considered a distinct word class, which is what almost all linguists seem to believe, then most units traditionally called "place adverbs" (cluster D) should be part of that word class as well. Indeed, the plot shows that these two groups are almost blended, which indicates a large set of common grammatical properties. These results seem to confirm Huddleston & Pullum's (2002) analysis of prepositions and adverbs presented in §1, according to which all place elements (and some time elements) should be reassigned to the preposition class, whether they have a complement or not. Units such as *here*, *there*, *abroad*, *ahead*, *home*, *downstairs* or *forward* should therefore move from the class of adverbs to that of prepositions.

My analysis, however, failed to show that *now* and *then* should be grouped with prepositions, unlike what Pullum & Huddleston (2002: 615–616) assume. Although they are indeed the temporal equivalents of *here* and *there* and although they can be modified by *right*, they cannot appear in the same complement slots as prepositions and they can modify verbs in central position (*the show has* ***now*** *begun*). Compounds in *·where* are not clearly part of the preposition class either; Payne & Huddleston (2002: 423) rather analyze them as compound determinatives.

Another case of class blending arises with so-called "flat adverbs" (most of cluster B), i.e. adverbs that have the same form as an adjective (*early*, *far*, *fast*, *hard*, *late*, *long*). The representation indicates that these units should rather be grouped with units such as *big*, *important*, *large* or *old*. This would

suggest that “flat adverbs” are actually full adjectives (hence their comparative form) that can occur in adjunct function without the need to be derived into adverbs. A surprising fact is that *soon* can also be considered part of this group, due to its simple form and its inflectional comparative. All this will have to be confirmed by another study that takes into account a larger set of properties and a larger set of adjectives, notably non-prototypical ones, like non-gradable adjectives or adjectives limited to the attributive or predicative position.

Some units traditionally described as subordinating conjunctions, like *after*, *before*, *since* or *until*, should probably be analyzed as prepositions (see Delhem 2018). If those units are reassigned to the category of prepositions, the remaining conjunctions form a small group. Since they seem to have similar properties, especially in terms of complementation, they might be considered a micro-class. If they were to be grouped with another class, agglomerative hierarchical clustering suggests that they should be fused with adverbs rather than prepositions. This is probably due to the fact that, like most adverbs, subordinating conjunctions do not have many positive properties: they can be described as being UNable to enter into a certain number of syntactic contexts.

From the traditional class of adverbs, one can therefore establish at least three distinct word classes, two of which belong with other established classes: adverbs, intransitive prepositions and “adverbial” adjectives. Most traditional adverbs can be assigned to one of these classes, even as peripheral members, except for two cases:

- The units *like*, and less importantly *near*, seem to be at best adjective–preposition hybrids, exhibiting grammatical properties of these two classes, or even isolated units that should not be assigned to any class (especially *like*);
- *Wh·* units (*where*, *when*, *why*, *how*) seem to constitute a micro-class of units with common syntactic and semantic features, although they also exhibit strong individual behaviors, especially *where* and *how*.

However, in accordance with what Lee (1998: 135) found, the multidimensional scaling analysis showed that there is no sharp distinction between adverbs and prepositions. Some elements (*now* and *then*, compounds in *·where*) lie in the middle, somewhere between these two poles. It would therefore seem either that prepositions and adverbs exhibit intersective gradience (Aarts 2007: 124), i.e. that some elements have properties of both categories, or that adverbs (Cluster A) exhibit heavy subsective gradience (Aarts 2007: 97), i.e. that the adverb class constitutes a gradient between core and peripheral members.

5 Conclusion

The fact that traditional adverbs are considered a residual category is mainly due to classification problems rather than to the nature of adverbs itself. A statistical analysis that took into account a large number of criteria showed that adverbs could be subdivided into three major groups which should preferably be considered three distinct classes. More precisely, it would probably be better to consider the group of “place adverbs” as intransitive prepositions, and the group of “flat adverbs” as full-fledged adjectives that can have the same syntactic functions as most adverbs.

This does not solve the heterogeneity of the remaining adverb class: its members still express manner, frequency, time, modality, degree and other smaller semantic categories. Yet this mainly results from the fact that many adverbs can have several interpretations (and hence belong to several semantic categories) depending on their linear position in the sentence or the verb they depend on. Greater coherence is brought by the fact that adverbs either are formed by the suffixation of *·ly* to an existing adjective, or have the same function as such units.

The resulting adverb class was not made more homogeneous, however. Another study that would take more units into account may yield different results, as less frequent lexemes tend to be less polysemous (Pawley 2006). Moreover, no criterion was given more weight than the others; refining this study will therefore involve adding criteria of distinction. A greater number of properties and units might therefore shine a new light on this analysis.

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