

# Are English prepositions simply degenerate verbs?

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## Abstract

*Prepositions share properties with verbs. They act as operators that often relate subject and object noun phrases, and they assign theta roles and case to their nominal objects. I explore syntactic parallels in the English language between verbs and prepositions, while noting significant areas where they differ. Mathematical degeneracy denotes a limiting case in which a class of objects changes its nature to become simpler. Degenerate structure is discussed, using two-dimensional geometrical examples, and ways are identified in which degeneracy gradience might apply to lexical categorization. The syntactic role of prepositions is examined. Prepositions and verbs are compared, to identify significant similarities and critical differences. The treatments of prepositions in Chomsky's and Jackendoff's competing theories of syntactic feature sets are reviewed. The available syntactic evidence indicates English prepositions could well be subsumed as a degenerate form of verbs. This potential simplification may have implications for computational linguistics and artificial intelligence.*

## 1. Introduction

Prepositions share a number of properties with verbs. They act as operators that often relate subject and object noun phrases, and they assign theta roles and case to their nominal objects. I explore syntactic parallels in the English language between verbs and

prepositions, but also note certain significant areas where they differ. In mathematics, degeneracy denotes a limiting case in which a class of objects changes its nature so as to belong to another, usually simpler, class. Are prepositions then simply degenerate verbs?

Degenerate structure is first discussed, using two-dimensional geometrical examples, and ways are identified in which degeneracy gradience might apply to lexical categorization. The syntactic role of prepositions is examined. Prepositions and verbs are compared, firstly to identify significant similarities they exhibit; and secondly to identify critical differences that differentiate them. The treatments of prepositions in Chomsky's and Jackendoff's competing theories of syntactic feature sets are reviewed. Finally, I seek to determine whether the available syntactic evidence indicates prepositions should be subsumed as a degenerate form of verbs.

## 2. Degeneracy

Degenerate cases are well known in mathematics, and readily accessible in Geometry. Typically, examination of a sequence of related forms suggests that the sequence be extended to include particular cases that do not exhibit the full behaviour of the class of forms, but which appear as limiting cases that satisfy some, but not all, of the identifying constraints.

The sequence of regular polygons of equal edge length (here illustrated with constant circumcircle radii) is normally considered to commence from the regular triangle (3-gon), and to continue indefinitely:

{triangle, square, pentagon, hexagon, heptagon, octagon, nonagon, decagon, ...}

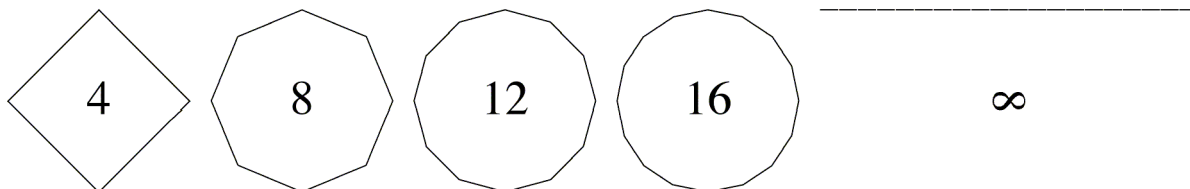


Figure 1: Sequence of regular polygons of equal edge length (here with constant circumcircle radii)

The limiting case at infinity can then be considered a degenerate case. The infinite regular polygon ( $\infty$ -gon) is centered at infinity, is of infinite frequency and extent, and can be represented as a straight line of unit segments. Note that the degenerate polygon exhibits new properties not shared by those of the finite case; firstly all of the line segments are parallel, and secondly they are collinear.

An interesting extension also applies if the sequence is extended in the reverse direction, i.e.:

{... < triangle < square < pentagon < ...}.

The polygon of frequency 2 can then be identified as in Fig. 2. This **2-gon** shares many properties of normal regular n-gons; like its regular counterparts, it consists of n points, connected by n edges, with a perimeter of n units, and has an interior angle sum of  $(n-2)\pi$ , where  $n = 2$ . But in this instance the edges are

now superimposed, being identical in location but opposite in direction; and they define an area of finite extent (in one direction) but of zero size. This 2-gon can therefore be recognized as a degenerate case of the class of finite regular polygons. It shares certain of the identifying properties of the normal class; but it does not exhibit the full range of properties that normal elements of the class exhibit, e.g. it is not of finite area. Further, it now exhibits other significant properties: all (both) the edges now occupy the same space, and all (both) the edges are now collinear.

Arguably, the sequence can be further extended to include the **1-gon**, consisting of a single point. The only evident property that remains is the single vertex. The single edge of unit length is not accounted for; the singular point is of undefined extent, and now the area, perimeter, and sum of internal angles are problematic.

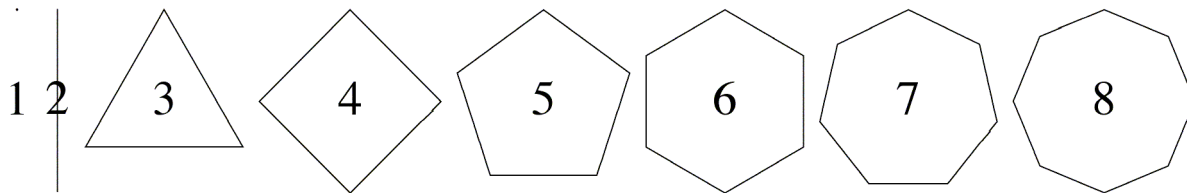


Figure 2: Extended sequence of regular polygons of equal edge length (with constant circumcircle radii)

Taking the 1-gon as shown in Fig. 2, together with the degenerate 2-gon, and the regular sequence of finite elements {..., 5-gon, 4-gon, 3-gon, ...}, a degeneracy gradient can be identified:

{..., 5-gon, 4-gon, 3-gon, **2-gon**, **1-gon**}

which extends from regular forms - through forms of

lesser degeneracy (the 2-gon) - to forms of greater degeneracy (the 1-gon). Further, this singular vertex exhibits significant behaviour that other members of the polygonal sequence do not share: it no longer has a unique circumcircle, but instead has an infinite sheath of circumcircles tangential to the vertex.

Table 1: Extended sequence of regular polygons of equal edge length: data

Frequency	<b>1</b>	<b>2</b>	3	4	5	6	7	8	...	n	...	$\infty$
Number of Vertices	<b>1</b>	<b>2</b>	3	4	5	6	7	8	...	n	...	$\infty$
Number of Sides	-	<b>2</b>	3	4	5	6	7	8	...	n	...	$\infty$
Perimeter	-	<b>2</b>	3	4	5	6	7	8	...	n	...	$\infty$
Sum Interior Angles	-	<b>0<math>\pi</math></b>	1 $\pi$	2 $\pi$	3 $\pi$	4 $\pi$	5 $\pi$	6 $\pi$	...	(n-2) $\pi$	...	$\infty$

These various examples { $\infty$ -gon, 2-gon, 1-gon} suggest that degeneracy, while it can be identified as the property of elements that exhibit a subset of the identifiable behaviour of the elements of a normal class, need not be bound to those properties, i.e. degenerate cases may also exhibit other behaviour that the normal members of the class do not share.

How then might degeneracy be applied to lexical categorization? In general, the lexis does not exhibit

convenient linear sequences of elements that might then be extended into limiting cases (notwithstanding gradable adjectives). However, it is widely recognized that word categories are not clear-cut, because of the irregularity that obtains in language; and traditionally differentiation is made between core elements and more peripheral elements, which might share some of the properties of other classes. For example, Crystal [1, p. 92] identifies 'gradience' as the movement from

a central core of stable grammatical behaviour to a more irregular periphery; while Stowell, in his celebrated PhD thesis [2, p. 25], observes that it is probable that the abstract principles that determine grammatical knowledge are not formulated in disjunctive sets.

It is therefore likely that if degeneracy occurs in word categorization, it will be more pronounced in those elements that occur more towards the periphery of categories: i.e. degeneracy gradience may occur. Furthermore, the categorization schema itself might be subject to such revision, if it can be shown that certain secondary categories, previously considered as discrete classes, are recognizable as peripheral subsets of more fundamental categories. This lends credibility to the fundamental intuition that word categories are essentially nominal or verbal. A similar intuition is explored by Stowell [2, p. 21] in his discussion of Chomsky's (1974) proposal of an explicit theory of syntactic features, from which major lexical categories can be derived.

### 3. Prepositions

Following Huddleston and Pullum [3], prepositions are traditionally considered to be words that govern, and normally precede a noun or pronoun, expressing the latter's relation to another word. In governing, P determines the case of N or PN. But in extending the definition of P to allow it to head a prepositional phrase, a good number of words not traditionally considered to be P need to be included, including certain subordinating conjunctions, and a subset of traditional adverbs.

There are a number of difficulties with the traditional definition. P is not uniquely defined, as V can also govern and precede a nominal, and express that object's relation to another word (or phrase), the subject. V, like P, also determines the case of its nominal object. A non-NP constituent can often follow P, e.g. another PP, or an AdvP, Interrogative Clause, or AdjP:

*I climbed [from out of the clouds] [PP]*  
*You climbed [up quite leisurely] [AdvP]*  
*He climbed*  
*[from which saddle did you say?] [Interrogative clause]*  
*They climbed [for deadly earnest] [AdjP]*

P need not immediately precede its complement, as P-stranding occurs in non-canonical constructions:

*Where<sub>i</sub> was she climbing up \_\_\_\_<sub>i</sub>?*  
*That is the mountain<sub>i</sub>, she skied to \_\_\_\_<sub>i</sub>.*

P need not even precede its complement:

*[The weather notwithstanding], we climbed on*  
*[Avalanches aside], conditions were awesome*

In any event, P preceding its complement is not a distinguishing feature, as it is a feature shared by V, Adv, and Adj:

*Mallory was clearly visible [beyond the serac] [PP]*  
*Irvine nearly collapsed on [seeing the crevasse] [VP]*  
*[Unfortunately for Irvine], Mallory fell [AdvP]*  
*[Fraught with danger], the descent looked hard [AdjP]*

Furthermore, while some P never take complements:

*Mallory slid [downhill] [Shortly afterwards],*  
*Irvine collapsed*

some P optionally take a complement:

*Neither has been seen [since]*      *Neither has been seen*  
*[since then]*

and some P take an obligatory complement:

*They found their resting place [amid the snowy peaks]*

Huddleston and Pullum note that the most central members of P have meanings to do with static or dynamic relations in space, at least in origin. For example the most frequent P, [of], derives from a word meaning 'away' or 'away from'. They suggest distinctive properties of P in English, which distinguish it from lexemes of other categories, are:

#### 3.1. Complements

Most P license a complement, and most central P take an NP complement; but note these are properties shared by V. A non-expandable content clause is generally a P complement:

*They rappelled [before the weather broke]*

#### 3.2. Functions

All P can head a PP functioning as a non-predicative adjunct, while many P can also head a complementary PP.

#### 3.3. Modifiers

A subset of P accept Adv as modifiers, such as 'clear', 'right' and 'straight':

*The ice-axe fell [clear into the crevasse]*

#### 4. Similarities between Prepositions and Verbs

As already noted, both P and V can govern and precede a nominal, express that object's relation to another word (or phrase), and determine the theta role and case of their nominal object. With rare exceptions, only V and P can take complement NP. P allows a wide range of complement types, a large subset of those that V licenses.

The contrast of transitive versus intransitive can be applied to P as well as to V:

Transitive	<i>Shipton stayed</i>	Transitive	<i>Shipton</i>
P:	<i>[in</i> <i>the house]</i>	V:	<i>[stayed</i> <i>home]</i>
Intransitive	<i>Shipton stayed</i>	Intransitive	<i>Shipton</i>
P:	<i>[in]</i>	V:	<i>[stayed]</i>

Obvious similarities exist between prepositional objects and verbal indirect objects, where P and V respectively assign theta role (recipient) and case (accusative) to NP:

<i>Tilman gave the crampons</i> <i>[to her]</i>	<i>Tilman [gave her]</i> <i>the crampons</i>
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Literal-Minded [4] discusses prepositional passives, where an intransitive V plus a P acts like a quasi-transitive V, and the object of P is promoted to the subject:

*You left out [the jumars]* > *[The jumars] were left out*

Traditionally, phrasal verb analysis associates particles with verbs, which might lend support to my argument, though Jackendoff [5] argues that the syntactic uniformity of English particle constructions provides evidence of a flat VP.

Like V, some P can take a predicative complement. 'As', the main P to do so, analogues the V 'be':

<i>Hillary regarded Tenzing's achievement</i> <i>[as outstanding]</i>	<i>[P]</i>
<i>Tenzing's achievement</i> <i>[is outstanding] in Hillary's regard</i>	<i>[V]</i>

While P can take complement PP, Auxiliary T takes complement VP. A similar situation also obtains with multiple auxiliaries, and in verb chaining, where V may take complement VP.

Huddleston and Pullum observe that a number of the most frequent and central P (e.g. 'by', 'of', 'with') have grammaticized uses, where P has no identifiable meaning independent of the grammatical construction

within which it occurs. These might be considered to correspond to grammaticized V, namely auxiliary verbs, particularly the auxiliary supportive 'do', (though grammaticization also applies to pronouns and nominal expletives).

#### 5. Differences between Prepositions and Verbs

An obvious difference is that V is open, while P is a finite closed class, there being no freely productive morphological formation process. But in the geometrical example above, the regular class is infinite, whilst only a finite few cases of degeneracy are recognizable. By analogy, a finite closed subset of an infinite open set could consist of degenerate elements. Therefore in principle an open word class could contain a closed subset, so V could contain P.

Another obvious difference is that P is invariant, even where there is a homonymous verb that inflects, while V (or T<sub>AUX</sub>) always inflects for person and for tense:

<i>Simpson continues</i> <i>[up the mountain]</i>	<i>Chouinard</i> <i>[up-s the ante]</i>
<i>Yates lowered the rope</i> <i>[down the chimney]</i>	<i>Messner</i> <i>[down-ed his drink]</i>

However Huddleston and Pullum note that some P have arisen from the conversion of secondary non-tensed forms of verbs, and have no understood subject:

*[Given the worst case scenario], the ice caps will melt*  
*[Barring heavy snowfall], we will survive*

Allowing V to contain members that do not inflect for person or for tense could satisfy this constraint; certain other languages do not exhibit verb inflection.

Although P can modify T<sub>AUX</sub>, there is no equivalent of auxiliary T that conditions P. This constraint could be met by allowing V to contain certain members that do not take auxiliaries.

<i>I will search</i> <i>[as well]</i>	* <i>The carabiner is</i> <i>[might under the packs]</i>
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A third obvious difference is that V can head a clause, while P cannot.

<i>I [go] to the movies</i>	*	<i>I [to] the movies</i>
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This constraint could be met by allowing V to contain members that cannot head a clause; or alternatively recognizing that a PP together with its subject constitute a degenerate clause that cannot stand alone, akin to a small clause.

## 6. Prepositions in competing Syntactic Feature Set theories

Stowell [2] discusses Chomsky's Categorical Distinctive Features, which propose an explicit theory of syntactic features. From these, major lexical categories can then be derived. Chomsky assigns  $[\pm N]$  and  $[\pm V]$  features. Stowell, while apparently failing to define these, contrasts them with the syntactic features of Jackendoff's competing theory, of which he is critical. Jackendoff eliminates  $[\pm N]$  and  $[\pm V]$  in favor of  $[\pm OBJ]$  and  $[\pm SUBJ]$  features, which I abbreviate as  $[\pm O]$  and  $[\pm S]$  respectively.

According to Stowell, feature  $[\pm O]$  corresponds to feature  $[\pm N]$ , determining (nouns & adjectives) and (verbs & prepositions) as natural classes, with  $[\pm O]$  categories being defined as those whose complements may include a surface NP direct object. Jackendoff's feature  $[\pm S]$ , which replaces  $[\pm V]$ , defines  $[\pm S]$  categories to be those whose phrasal projections contain a syntactic subject position, i.e. nouns and verbs. Adjectives and prepositions are then  $[-S]$ .

Features are assigned to major word categories in the two schema as follows:

CHOMSKY

	$[-N]$	$[+N]$
$[+V]$	verbs	adjectives
$[-V]$	prepositions	nouns

JACKENDOFF

	$[-O]$	$[+O]$
$[+S]$	verbs	nouns
$[-S]$	prepositions	adjectives

In other words:

$[-N]$	verbs, prepositions	$[+N]$	adjectives, nouns
$[-V]$	prepositions, nouns	$[+V]$	verbs, adjectives

$[-O]$	verbs, prepositions	$[+O]$	nouns, adjectives
$[-S]$	prepositions, adjectives	$[+S]$	verbs, nouns

Lexical categories are redefined as:

$$N = \begin{bmatrix} +N \\ -V \end{bmatrix} \quad \text{Adj} = \begin{bmatrix} +N \\ +V \end{bmatrix}$$

$$\text{Adj} = \begin{bmatrix} +O \\ -S \end{bmatrix} \quad N = \begin{bmatrix} +O \\ +S \end{bmatrix}$$

$$V = \begin{bmatrix} -N \\ +V \end{bmatrix} \quad P = \begin{bmatrix} -N \\ -V \end{bmatrix}$$

$$V = \begin{bmatrix} -O \\ +S \end{bmatrix} \quad P = \begin{bmatrix} -O \\ -S \end{bmatrix}$$

The feature systems therefore predict the following natural syntactic classes:

$([-N, -V], [-N, +V])$	prepositions & verbs
$([+N, -V], [+N, +V])$	nouns & adjectives
$([-N, -V], [+N, -V])$	prepositions & nouns
$([-N, +V], [+N, +V])$	verbs & adjectives

$([-O, -S], [-O, +S])$	prepositions & verbs
$([+O, -S], [+O, +S])$	adjectives & nouns
$([-O, -S], [+O, -S])$	prepositions & adjectives
$([-O, +S], [+O, +S])$	verbs & nouns

The feature systems also predict the following “unnatural” syntactic classes:

([+N, -V], [-N, +V])	nouns & verbs
([+N, +V], [-N, -V])	adjectives & prepositions

([+O, -S], [-O, +S])	adjectives & verbs
([+O, +S], [-O, -S])	nouns & prepositions

Chomsky’s feature system accommodates the intuition that P and V are related, in that, as observed by Vergnaud, Chomsky, and others, the class of Case-assigners is the natural class of lexical categories defined by [-N]. Only [-N] categories take bare NP objects, while adjectival and nominal objects are preceded by a preposition. It also offers complementary support, in that as noted by Chomsky, and by Jackendoff, of-insertion only occurs in NP and AP categorial phrases, which accords with the natural class [+N], of nouns and adjectives.

However, it also recognizes prepositions and nouns as a natural class defined by [-V]. Stowell, following Jackendoff, observes that this class corresponds at XP level to the set of phrases that may be focused in cleft constructions. Chomsky’s assigning of [-V] to P, and consequent natural classification of N with P, is a strong argument against subsuming P as degenerate V. Elsewhere, Stowell [2, p. 25] observes that the pairs of categories which the feature system defines as natural classes, are often collapsed into single categories in non-English languages. The categorial distinction between NP and PP is eliminated, and the prepositional function is taken over by nominal Case affixes. This suggests P and N do share a universal natural affinity, perhaps based on the association of P with N: it is often the case that nominal subjects govern P, and P often governs nominal objects. But association does not imply affinity; the fundamental mathematical operators {+, -, x, /} frequently associate with natural number; they do not therefore form natural classes with natural number \*{3, 7, +, 11, x}, but are qualitatively different.

The situation is redressed by Jackendoff’s competing theory of syntactic features. Jackendoff, like Chomsky, considers P and V form a natural syntactic class. Chomsky’s and Jackendoff’s feature sets agree in finding natural affinities between V and P, which strengthens my thesis. Unlike Chomsky, Jackendoff determines P and N form an “unnatural” class, which lends further support. However Jackendoff also determines P and Adj form a natural syntactic class; Chomsky’s position, that P and Adj

show no strong natural affinity, accords more with my sensibility.

Both theories are unsatisfactory. Chomsky understates the natural affinity between V and P by on the one hand assigning P a [-V] feature, and on the other recognizing a natural affinity between N and P (by assigning both an [-V]), that is questionable. His schema does however posit N and V as polar opposites. Jackendoff remedies that understatement by regarding N and P as opposites, and thus not co-members of a natural set; but in so doing introduces a troubling (P, Adj) affinity. Perhaps the difficulty lies in trying to fit a too-complex structure into a structurally inadequate schema.

## 7. Can Prepositions be considered degenerate Verbs?

I have explored similarities and differences between P and V, attempting to establish whether P can be subsumed as a degenerate case of V. Fundamental to this argument is the intuition that P and V are essentially of the same nature. N refers to entities “in themselves”, while Adj and Adv serve as modifiers of entity N and operator V respectively. Unlike these other categories, V and P are both operators, which relate arguments that are generally nominal. But while V governs its subject, P is governed by its subject. This suggests that P may be incorporated into V by assigning the larger class, designated V<sup>+</sup>, a parameter that reflects whether it is transmissive (as in V) or receptive (as in P). As [Trans] already denotes Transitive, I term this parameter Govern Subject [GS]. In general, V<sub>[+GS]</sub> designates traditional V, while V<sub>[-GS]</sub> designates P. However an interesting aspect is that V<sub>[-GS]</sub> exists prior to the inclusion of P; passive verbs do not govern their subject, and therefore V<sub>[-GS]</sub> already includes [-en], i.e. passive V. Here though, the argument structure is different from P, and therefore a further differentiation is required. But it suggests that degenerate V already exists in some form, i.e. the Passive.

Intransitive V can also then be considered degenerate V, which does not take a direct object, and bears structural similarities to Intransitive P; that is to say V<sup>+</sup> may contain a degenerate subset of elements that do not take a direct object, which in turn consists of subsets Intransitive V and Intransitive P.

As there are a great many Transitive V, and very few Ditransitive V, it is not sensible to consider Transitive V as a degenerate form of Ditransitive V. But recalling the geometric example, one might conceivably argue instead that Ditransitive V is a degenerate form of Transitive V, which exhibits additional behaviour, namely taking an indirect object. However “degenerate” is a poor choice of words for what is essentially more complex behaviour, the more appropriate term being perhaps “super-generate”; and here I suggest another geometric analogy. In an order of polyhedra I elsewhere advance [6], each class contains a few corresponding elements that embody the full development of that class, which is only ever partly instantiated in the many other elements. In a similar sense, Ditransitive V may embody the full potential of V, which is only completely realized in the elements of that class. That Ditransitive P does not exist may illustrate a further example of P-degeneracy.

## 8. Conclusion

The syntactic evidence reviewed indicates that it may be possible to subsume English prepositions as degenerate members of an enhanced category of verbs. This has potential implications for computational linguistics, as it concerns the structure of linguistic knowledge that a human needs for generating and understanding language [7]. It may even impact on artificial intelligence, the branch of computer science that aims at computational models of human cognition. In both fields, the degeneracy structure can conveniently be subsumed into the more general case.

V<sup>+</sup> then tolerates a degenerate subclass P, of elements that never inflect for tense or person, govern their subject, take an indirect object, nor head a clause. However this presents major difficulties: P is closed while V is open; P cannot replace V as head of a clause; and in English, it appears that all verbs inflect, and prepositions never do. This latter difficulty appears insurmountable, as there is a clear-cut disjunction between the two, which is also apparent distributionally. In light of this obvious disjunction, what is to be gained by subsuming one into the other?

But recall the linguistic principle that mutually exclusive terms indicate that those terms may represent different aspects of the same phenomena.

Notwithstanding their differing syntactic use, mutual exclusivity might actually constitute evidence that V and P are in some fundamental sense different expressions of the same super-category. Lexical categorization should then reflect that reality.

Certainly, it comes as no surprise to learn that others have had a similar intuition, notably Devin [8] who observes, “*Thus prepositions appear to be just a special class of degenerate verbs...*”

Therefore, acutely aware of the limitations of this superficial analysis, I propose that it is high time prepositions be recognized for the degenerate verbs that they are.

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