SEMANTIC CLASSIFICATION OF THE WORD

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Abstract: Within linguistics a word class is defi ned in grammatical terms as a set of words that exhibit the same syntactic properties. In this paper the aim is to argue that the meanings of different word classes can be given a cognitive grounding. It is shown that with the aid of conceptual spaces, a geometric analysis can be provided for the major word classes. A universal single-domain thesis is proposed, saying that words in all content word classes, except for nouns, refer to a single domain.

Keywords: Conceptual spaces, cognitive semantics, word classes, single domain, convexity, noun, adjective, verb, preposition, adverb.

What is it that you know when you know a language? Certainly you know many words of the language—its lexicon; and you know how to put the words together in an appropriate way—its syntax. More importantly, you know the meaning of the words and what they mean when put together into sentences. In other words, you know the semantics of the language. If you do not master the meaning of the words you are using, there is no point in knowing the syntax. Therefore, as regards communication, semantic knowledge is more fundamental than syntactic.(I am not saying the syntax does not contribute to the meaning of a sentence, only that without knowledge of the meanings of the basic words there is no need for syntax. In Gärdenfors, we connect the semantics of various forms of communication to other cognitive processes, in particular concept formation, perception, attention, and memory. As Jackendoff puts it: To study semantics of natural language is to study cognitive psychology",theoretical starting point is that our minds organize the information that is involved in these processes in a format that can be modelled in

geometric or topological terms—namely in conceptual spaces. The theory of conceptual space was presented in an earlier book. General semantic program is to show that by using conceptual spaces, a unifi ed theory of word meanings can be developed. Most researchers within semantics look at the meaning of words from a linguistic perspective. From this perspective it is diffi cult to free oneself of syntactic concepts. For example, the "arguments" of verbs show up in most semantic analyses (for example, Levin and Rappaport Hovav). The notion of argument derives, however, from syntax. Among other things, this leads to the distinction between transitive and intransitive verbs. However, this distinction does not correspond to any clear-cut semantic distinction. Similarly, it is said that verbs and adjectives are used in a "predicative" manner. The notion of predicative derives from theories in philosophy and linguistics that aim at grounding semantics in predicate logic. In my opinion, this is an artifi -cial construction that does not have a cognitive grounding. In contrast, my ambition is to develop semantic models that are constructed from general cognitive mechanisms. The semantic theory of this article is supposed to be syntax-free. In other words, the semantic notions should not depend on any grammatical categories. This does not mean that I deny that syntax contributes to meaning (Langacker). I only claim that semantics of word roots can be treated independently from syntax. One of the most fundamental concepts of linguistics is that of word classes. In all languages, words can be grouped in distinct classes with different semantic and syntactic functions. In English the words have traditionally been classifi ed into eight classes: nouns, pronouns, adjectives,verbs, adverbs, prepositions, conjunctions, and interjections. When word classes are taught at an introductory level in school, semantic criteria are used, for example that nouns stand for things and verbs describe actions, but these criteria are seldom presented in a systematic and rigorous way. In contrast, within linguistics a word class is defi ned in grammatical terms as a set of words that exhibit the same syntactic proper- In linguistics, the appropriate word for "word" is "part of speech". When we use "word", I normally mean "word stem", since I will not be concerned with morphology. There are other opinions: Gil's work on Riau

Indonesian suggests that it has no distinctions between different kinds of words. There exist, however, other identifi able word classes, for example, numerals and articles.ties, especially concerning infl ections and distribution in sentences. I do not believe in a universal defi nition of word classes. Syntactic structure, including the division into word classes, is language-specifi c. However, one can identify prototypical structures among words that can be used in classifi cations. Croft writes: "Noun, verb, and adjective are not categories of particular languages … [b]ut noun, verb, and adjective are language universal—that is, there are typological prototypes … which should be called noun, verb, and adjective." In contrast, my position is that the syntactic markers have evolved as effects of the divisions of words into categories, not as causes.The fact that major words classes such as verbs, nouns, and adjectives can be identifi ed in almost all languages suggests that there are universal patterns in human cognition that make the division into these classes particularly useful for communication.The structure of communication is subject to the same cognitive constraints as thinking and problem solving in general. Therefore it is reasonable that the structure of language, at least to some extent, is determined by such general cognitive principles. In particular, I assume that the structure of language is governed by the same principles of processing effi ciency of representations as are other cognitive processes. I do not claim that there is any simple mapping between word classes and structures in conceptual spaces. As an illustration, Dixon writes: a lexical root cannot be assigned to a word class on the basis of its meaning. If this were so, then 'hunger/(be) hungry', '(be) mother (of)', '(be) two', and 'beauty/(be) beautiful' would relate to the same class in every language, which they do not." Dixon also points out that the concept of 'needing to eat' is expressed as nouns, adjectives, or verbs in different languages and that mother and father are verbs in some American Indian languages. Nor do words (word roots) necessarily belong to particular word classes. An example from English is round,which can be used as adjective, noun, verb, adverb, and preposition. In this paper the focus will be on showing how the meanings of different word classes can be given a cognitive grounding. I will expand on the analysis of nouns

and adjectives that I outlined in Gärdenfors. Before embarking on that project, however, I will briefl y present conceptual spaces. A conceptual space consists of a number of quality dimensions. Examples of quality dimensions are temperature, weight, brightness, pitch, and force, as well as the three ordinary spatial dimensions of height, with, and depth. Some quality dimensions are of an abstract nonsensor character. In Gärdenfors (2014), I argue that force dimensions are essential for the analysis of actions and events and thereby for the semantics of verbs.Quality dimensions correspond to the different way stimuli can be judged similar or different. For simplicity, I assume that the dimensions have some metric, so that one can talk about distances in the conceptual space. Such distances indicate degrees of similarity between the objects represented in the space.It is further assumed that each of the quality dimensions can be described in terms of certain geometrical structures. A psychologically interesting example is colour. Our cognitive representation of colour can be described along three dimensions. The fi rst is hue, represented by the familiar colour circle going from red to yellow to green to blue, then back to red again. The topology of this dimension is thus different from the quality dimensions representing time or weight, which are isomorphic to the real number line. The second dimension is saturation, which ranges from grey at the one extreme, to increasingly greater intensities of colour at the other. This dimension is isomorphic to an interval of the real number line. The third dimension is brightness, which varies from white to black, and thus is also isomorphic to a bounded interval of the real number line. Together, these three dimensions—one circular, two linear—constitute the colour domain as a subspace of our perceptual conceptual space. It is typically illustrated by the so-called colour spindle. The primary function of the dimensions is to represent various qualities of objects in different domains. Since the notion of a domain is central to the analysis, I should give it a more precise meaning. To do this, I will rely on the notions of separable and integral dimensions, which I take from cognitive psychology (Garner 1974, Maddox 1992, Melara 1992). Certain quality dimensions are integral: one cannot assign an object a value on one dimension without giving it a value on the other(s). For example, an object

cannot be given a hue without also giving it a brightness (and a saturation). Likewise the pitch of a sound always goes with a particular loudness. Dimensions that are not integral are separable: for example, the size and hue dimensions. Using this distinction, a domain can now be defi ned as a set of integral dimensions that are separable from all other dimensions A conceptual space can then be defi ned as a collection of quality dimensions divided into domains. However, the dimensions of a conceptual space should not be seen as fully independent entities. Rather, they are correlated in various ways, since the properties of those objects modelled in the space co-vary. For example, in the fruit domain, the ripeness and colour dimensions co-vary. It is impossible to provide any complete listing of the quality dimensions involved in the conceptual spaces of humans. Learning new concepts often means expanding one's conceptual space with new quality dimensions (Smith 1989)4. Properties and concepts. Conceptual spaces theory will next be used to defi ne a property. The following criterion was proposed in Gärdenfors (1990, 2000) where the geometrical characteristics of the quality dimensions are used to introduce a spatial structure to properties:Criterion P: A property is a convex region in some domain.The motivation for criterion P is that, if some objects located at xand y in relation to some quality dimension(s) are both examples of a concept, then any object that is located between x and y with respect to the same quality dimension(s) will also be an example of the concept. Properties, as defi ned by criterion P, form a special case of concepts. I defi ne this distinction in Gärdenfors by saying that a property is based on a single domain, while a concept is based on one or more domains. This distinction has been obliterated in both symbolic and connectionist accounts, which have dominated the discussions in cognitive science. For example, both properties and concepts are represented by predicates in fi rst-order logic. However, the predicates of fi rst-order logic correspond to several different word classes in natural language, most importantly those of adjectives, nouns, and verbs A paradigm example of a concept that is represented in several domains is "apple"). One of the fi rst problems when representing a concept is to decide which are the relevant domains. When we encounter apples as children, the fi rst

domains we learn about are, presumably, those of colour, shape, texture, and taste. Later, we learn about apples as fruits (biology), about apples as things with nutritional value, etc.

Conclusion Since the relevant domain is often determined by the communicative context in which the word is uttered, applying the single-domain thesis will make the identifi cation of the new meaning much more efficient. Thus we propose that a general single-domain bias provides one of the fundamental reasons why humans can learn a language as quickly as they do.

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