Prototype Theory: an evaluation

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1. Preliminaries

This paper discusses prototype theory and aims to evaluate the proposal that prototype structures can serve as word meanings. It has been proposed that prototype structures have cognitive representations that could serve as representations of real world categories. This issue is discussed on the basis of a mainly theoretical approach, while particular issues are more extensively exemplified. A central conclusion is that prototype structures can be considered as having a supplementary role to word meanings, yet do not form an adequate or non-problematic basis overall. The following section introduces some basic features of prototype theory.

2. Prototype Theory: the underlining theory for prototype structures

> "What kind of bird are you, if you cannot fly", said the little bird to the duck. "What kind of bird are you, if you cannot swim", said the duck and dived. (Prokofiér, *Peter und der Wolf*)i[1]

Prototype theory, within the field of prototype semantics, originated in the mid 1970s with the psycholinguistic research of Eleanor Rosch into the internal structure of categories. Its revolutionary character marked a new era for the discussions on lexical meaning and brought existing theories (such as the classical view) into question.

The above quote represents the essence of the prototypical conception of the structures of categories; people create categories of things and assign the same name (or label) to things that are not exactly the same but similar. In the example although the duck easily observes that the little bird (which could be a sparrow or a blackbird for instance) could not swim and the little bird similarly observes that the duck cannot fly, they still call each other 'bird'. Entities such as birds seem to share the same features such as 'animal', 'feathers', 'wings', 'laying eggs', and so forth. Such features, however, do not allow a clear distinction of other categories such as snakes, which lay eggs but are not birds. In this context, the categorization of penguin as bird — since it shares few of the above features with other 'kinds' of birds — would remain unclear. In other words, componentional analysis is not ideally applicable for the

categorisation of, for instance, ‘natural kinds’ since it allows fuzzy boundaries in the categorisation of the entity it aims to represent.

For this reason, Rosch states that human categorisation “should not be considered the arbitrary product of historical accident or of whimsy but rather the result of psychological principles of categorisation” (1978, p.27). This means that human cognition is the primary element for any categorisation process (linguistic categorisation included). Rosch argues that an object is assigned to a category through comparison with its prototype object rather than a set of criterial features. This prototype object consists of a mental entity in the human mind.

Considering some of the experiments that Rosch conducted, her thesis of prototypicality appears promising. In an experiment she conducted, a number of participants were given a list of items and were asked to rank these items according to how typical they considered them to be with respect to a given category. The results appeared very consistent since a large measure of agreement was found among the participants on what items they considered as very good examples of a specific category. For instance, it was agreed that robins and swallows are the most typical birds, while ostriches and chicken are the least typical birds. In another experiment Rosch examined how long it took participants verify category membership. In this case, they had to press a button indicating true or false in response to a list of statements, for example ‘A Chicken is a bird’ or ‘A Sparrow is a bird’. Results showed that response times were generally shorter for more representative exemplars, such as ‘robin’, than for less representative exemplars, such as ‘chicken’. The production of exemplars was tested in another experiment that supported Rosch’s previous results. When participants were asked to list or draw examples of category members, they generally produced more typical examples. Rosch’s experiment results showed that when people categorize objects they appear to have a shared idea of the characteristics of a most representative exemplar, in Rosch’s terminology, a prototype. It seems that people decide on what extent something is a member of a given category by matching it against certain features of the prototype by assigning similarity features. A question that arises here, however, is on which basis do people measure similarity?

It appears that judgements are often made on the basis of appearance so that it plays a significant role in categorising ‘natural kinds’ such as ‘birds’. However, there are categories, such as vegetables, in which appearance does not seem to play a primary role. If people were to compare the appearance of a pea with that of other vegetables, then we would expect carrots to be considered a marginal member of the

vegetable category. In categorisation tasks however both peas and carrots are ranked equally high. Another factor in the judging of similarity is variation. In Labov's (1973) experiment on linguistic categorisation of household appliances, subjects were asked to imagine receptacles, such as cups, mugs, bowls, or vases, filled with different kind of things. If the receptacles were imagined as filled with hot coffee, then 'cup' responses increased. If they were imagined as filled with mashed potatoes, then 'bowl' responses increased. Though such categorisation appeared to be influenced by functional attributes, the actual effect was not clear-cut. Appearance, frequency and usage may then be considered as symptoms rather than causes of prototypicality.

2.1 Features of prototype theory

The experiments of both Labov and Rosch mentioned above, show that prototype theory involves a psycholinguistic notion that aids human categorization.The related features can be summarised as follows:

1. 1. A prototypical structure underlies every category.
2. 2. Prototype categories cannot be realised by means of a set of features, since the various members may not share the same amount of such features.
3. 3. Prototype categories may be blurred at the edges.
4. 4. Category membership can be realised in terms of gradience.ii[2]
5. 5. Semantic structures of such categories often cluster and overlap in meaning.

The above five features can be characterised as related in two dimensions, according to Taylor, "prototypicality, as studied by Rosch, is intimately up with what we might call the 'two axes of categorisation" (1989, p.46). In Rosch's terms the horizontal dimension describes the internal structure of a category, while the vertical dimension describes the intercategorial structure. The horizontal dimension is concerned with descriptions such as why x is a cat and not a dog, but it does not consider why in certain cases x is categorised as animal or mammal. The vertical dimension, on the other hand, exhibits a threefold subdivision: basic levels, superordinate levels and subordinate levels. The basic level is considered as the most informative and can therefore be claimed as the most economical with relation to cognitive processes. In fact, the basic level terms can be considered as of privileged status reflected in everyday situations. For example, supposing there is an apple on the kitchen table, it is likely that a person would ask another'could you please fetch the apple for me?' but it would be unlikely that they would them to pass 'the Golden Delicious' or 'the piece of fruit', 'the Golden Delicious' being in a subordinate category and 'the piece of fruit' being in a superordinate category. This explains the above statement that basic level objects, such as apples or dogs, attract a privileged status because they belong to the most inclusive level at which, according to Kleiber, "information-rich bundles of

co-occurring perceptual and functional attributes" are to be found (p.59); these are also common to all or most of the category members. The following section considers the relation between prototype structures and meaning.

2.2 Prototype structures and meaning

Rosch's view support the argument that the notion of prototype is defined as the best or most representative member of a given category. Applying this theory to a theory of word meaning, the above definition needs to be reconsidered. It would not be appropriate to claim that the meaning of a given lexeme , such as 'bird', is expressed by the meaning of its prototype, such as sparrow or blackbird. Instead, and according to Colman and Kay,

> many words have as their meaning not a list of necessary and sufficient conditions that a thing or event must satisfy to count as a member of a category denoted by the word, but rather a psychological object or process which we have called a PROTOTYPE. (p.43)

In relation to the above quote, Kleiber argues that the prototype should be regarded as a cognitive representation, which is generally associated with a particular word and serves as the reference point for categorisation. Therefore, the meaning of a given word is not defined by a concrete prototype, but rather by the mental representation of the prototype. This mental picture is not necessarily the representation of a realistic example of a given category, but rather an abstract entity that involves some combination of related typical features.

These typical features, if considered as prerequisite for the creation of an abstract representation, maintain the idea of the internal structure of a lexical category as a family resemblance structure. Therefore, meanings may cluster or overlap due to the underlying semantic structures. In which case, meanings that show a degree of overlapping involve more structural weight than those that serve as peripheral members of a given category. The mental representation of a prototype, then, should exhibit the greatest degree of overlapping. It could be argued that within category resemblances meaning is not equally distributed among the constituents so that the components — the smaller segments of meaning — can serve different degrees of meaning and are of unequal importance.

2.3 Considering the nature of prototype structures

Armstrong et al. claim that "it is not notably easier to find the prototypic features of a concept than to find the necessary and sufficient ones" (p.272). Taking the lexeme 'bird' and the feature 'ability to fly' it can be argued that it is a prototypical feature

since it is shared by most members but only a few no-members (bats, for instance) of the bird category. In addition to this Rosch states that prototypical features involve the greatest degree of 'cue validity', where features are shared by most members of a given category and only by few members of peripheral categories. The relevancy of making this point is that prototype theory itself has a somewhat ambiguous character — it is rather a matter of conceptual consideration — and therefore it is not an easy task to associate and even evaluate it with respect to word meaning alone.

Prototype structures can also be said to fail to account for the external significance of the language. Trying to account for the extension of conceptual representations in the mind, it faces problems in accounting for the fact that the prototype of a concept might be wrong, might change or might be non-existent (Lawrence and Margolis, p.34-35). Fodor claims that there is no prototype for the concept "not a cat", since anything could fill the slot of the "missing prototype" (p.34-35), and as Lawrence and Margolis put it "their extensions are too heterogeneous" (p.36). They also note that concepts such as "31st Century invention" produce no typicality effects. And that the extension of a prototypical structure may fail to capture instances of a category such as "3-legged albino tigers" (p.34); these are still tigers, but the underlying theory of prototype structures cannot account for them.[iii][3] Similarly a prototypical 'dog' can be described as an 'animate, four-legged pet, however, by this definition a dog that has three legs cannot be classified or named as a 'dog'. Prototype theory categorizes constituents of entities according to whether these satisfy particular conditions (features). Thus the above case is obviously untrue and gives additional evidence for prototype structures being problematic and unable to accurately account for word meanings.

2.4 The Prototypicality of Prototype Theory

Following Fodor's considerations instances such as the phrase 'pet snake' also appear problematic. For many people the prototype for the word 'pet' is a dog, or a kitten, while for the word 'snake' the prototype may be a poisonous wild snake. The compositional meaning of the two words, however, does not entail the meaning of each one of the constituents directly and individually. Compositionality is therefore a notion that cannot be clearly and adequately explained through prototype theory.

Taking a cognitive perspective Geeraerts notes that considering the clear and salient centre of lexical categories would not be sufficient,

> Cognitive linguistics is not only interested on what constitutes the centre of a category, but also in how this centre can be extended toward peripheral cases and how far this extension can go. (1989, p. 603)

When considering prototype theory as the underlying theory for prototype structures we may argue that it is primarily a theory of categorization rather than a theory of meaning in itself. However, what makes it an indispensable, as well as supplementary, approach in the field of semantics is its contribution to how people actually create linguistic categories as representations in their mindiv[4]. The above discussion underlines the claim that prototype semantics declare prototypicality as the 'gist' of human categorisation. This, however, raises the question of in what respect prototype structure theory can be incorporated within a linguistic theory of meaning.

3. Theoretical status and implications of prototype structures with respect to word meaning

Through several statements and examples above I have indicated that the meaning of linguistic categories (with respect to prototype structures) is not always defined by a set of distinct features, but is often blurred at the edges. However, it would be wrong to assume that prototype theory leads to prototypical category structures or even equates fuzzy boundary words with fuzzy meaning. In Wierzbicka's words "concepts encoded in natural language, are, in a sense, vague, but this does not mean that their semantic description should be vague, too" (p.365).

The above quote suggests that prototype structure theory serves as a descriptive model for describing meaning on the level of performance. Prototype categories have not only the functional advantage of offering "maximum information with the least cognitive effort" (Rosch, p.28), but according to Geeraerts they also "maintain themselves to changing circumstances and new expressive needs" (1988, p.223). For instance, prototypical 'vehicles' of the early 19th Century (carriages) are not the same as prototypical 'vehicles' of the early 21st Century (motor-cars). If, however, the *prototype* of 'vehicle' has changed in the past hundred years, this does not mean that the *meaning* of 'vehicle' has also changed. This consideration of temporal changes creates an additional problem for prototype structures as representations of real world categories. In this context, however, Lehrer remarks that the same words are not used only in their prototypical sense but that single words are frequently extended in meaning for other peripheral events, processes or situations. She adds that this strategy can be useful to account for an infinitive set of expressive needs by a finite lexicon. Therefore, fuzzy boundary words are useful in the sense that they are applicable to a wider variety of things, situations and events. Thus, lexical economy can be achieved.

Conclusions

Prototype structures (according to the Roschian view) can be seen to be a performative, usage-based approach to language categorisation. Certain areas of prototype structures appear problematic in their theoretical base. For example, The problem of compositionality, where prototype structures fail to render an adequate account of compositionality and therefore the compositional aspect of word meaning. Another problem is that many concepts are lacking prototypes and in such cases word meanings fail to be the outcome of an existing prototype structure. So, while prototype structures form a vigorous basis of psychological data and seem to provide a plausible classification model, they nevertheless fail to satisfy the basic desiderata for adequately serving as word meanings.

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i[1] "Was bist du für ein Vogel, wenn du nicht fliegen kannst", sagte der kleine Vogel zur Ente. "Was bist du für ein Vogel, wenn du nicht schwimmen kannst", sagt die Ente und tauchte unter.

ii[2] It is important to add to this point the assumptions made in a study by Barsalou (1987), who, following that the graded structure of a category is not stable but varies across contexts, concluded that invariant structural characteristics of categories are not represented by graded structures. This instability in graded structure is triggered by the temporal representations of concepts of the same category in the working memory domain, on different occasions. Accounting for these graded structures as highly dynamic and an unstable phenomenon, he evaluated the proposal that the memory stores such representations; certain associative strengths (between the category and its exemplars) represent a category's graded structure in long-term memory. Assessing the strength of these associative relations, people assign higher typicality values to higher strengths. For an extended discussion see Barsalou, 1987.

iii[3] Dual Theories try to account for and explain these facts but they still seem to involve certain implications and inherited influences from the classical theory.

iv[4] See Wittgenstein (1978) and Armstrong et al. 1983.

Works Cited

Armstrong, S.L., et al., "What some concepts might not be" *Cognition* 13, (1983).

Barsalou, L.M., "The Instability of Graded Structure: Implications for the Nature of Concepts" in Neisser, U., (ed.), *Concepts and Conceptual Development: Ecological and Intellectual Factors in Categorization* (Cambridge: Cambridge University Press, 1987).

Colman, L and P. Kay, "Prototype Semantics: the English Word LIE", *Language* 57.1, (1981).

Fodor, J.A., *Concepts: Where Cognitive Science Went Wrong* (Oxford: Oxford University Press, 1998).

Geeraerts, D., "On necessary and sufficient conditions", *Journal of Semantics*, Vol 5, (1986).

——, "Where does prototypicality come from?" in Rudzka-Ostyn, B, pp.207-229. (1988).

Kleiber, G., *Prototypensemantic*, (trans.), Michael Schreiber (1993).

Labov, W., "The boundaries of words and their meanings", in Bailey, C.J. and R. Shy, (eds.), *New ways of analysing variation in English* (Washington, D.C. 1973).

Laurence, S. and E. Margolis, (eds.), *Concepts and Cognitive Science*, (London: Blackwell. 1999).

Lehrer, A., "Prototype theory and its implications for lexical analysis" in Tsohatzidis, S.L. (ed.), *Meanings and Prototypes: Studies in Linguistic Categorization* (London: Routledge, 1989).

Rosch, E., "Principles of categorization" in Rosch, E. and B.B. Lloyd, (eds.), *Cognition and Categorization* (Hillsdale, N.J.: Erlbaum. 1978).

Taylor, J.R. (ed.), *Linguistic Categorization, Prototypes in Linguistic Theory*, (Oxford: Clarendon Press, 1989).

Wierzbicka, A., "Prototypes save: on the uses and abuses of the notion of 'prototype' in linguistics and related fields", in Tsohatzidis, see Lehrer above

Wittgentein, L., *Philosophical Investigations*, (Oxford: Oxford University Press, 1978).