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Learning from Cognitive Science: Developing a New Approach to Classification in Terminology

Abstract

Classification is fundamental to terminology. The classical theory of classification prevails, but cannot account for all cases. Terminologists may benefit from a more flexible approach. Part 1 explores the classical theory and some new approaches to classification developed in cognitive science. Part 2 introduces a *multidimensional* approach to classification. Part 3 examines how multidimensionality is relevant to terminology. Part 4 considers how terminologists currently deal with multidimensionality and suggests how they might better handle it.

0. Introduction

Classification is fundamental to many disciplines. Basically, classification is the act of grouping things into classes on the basis of perceived similarities, expressed as characteristics, that are shared by each class member. In terminology, classification helps terminologists to create concept systems that will help them to delimit the subject field, guide their corpus search, measure the exhaustiveness of their research, and identify concepts which can be used in definition construction and the establishment of synonymy or equivalence.

1. The classical theory of classification

The origins of the classical theory of classification are generally attributed to Aristotle. For the past 2000 years, this theory has been taught as an unquestionable truth and has dominated the classification techniques used in many disciplines, including philosophy, biology, library science, cognitive psychology, and linguistics (Lakoff 1987:6). It has also prevailed in terminology (e.g. Felber 1984).

The first premise of the classical theory is that a concept is defined in terms of a set of *necessary and sufficient (n+s) characteristics* (Taylor 1989:23). For a characteristic to be singly necessary, every instance of the concept must have it; for a set of characteristics to be jointly sufficient, every thing having this set must be an instance of the concept.

For example, the concept BIOLOGICAL MOTHER has the essential characteristics of 1) being female, and 2) giving birth to a child. Each of these characteristics is individually necessary to be a biological mother. The two taken together are sufficient: someone who is female and who gives birth to a child must be a biological mother.

A second premise is that characteristics are *binary*: a concept either possesses a characteristic, or it does not. This leads to two further assumptions: 1) classes have *clear and rigid boundaries*, so there are no ambiguous class members; and 2) all members of a class have *equal status*, which means there are no *degrees* of membership in a class, and no one thing can be considered a "better" member of the class than another (Taylor 1989:23–4).

Finally, the classical theory is characterized by the belief that concepts and classes exist *independently* of human cognition or interaction (Lakoff 1987:157).

In some disciplines, such as biological taxonomy, the classical approach works well, while other disciplines, like terminology, could benefit from a more flexible approach.

1.1 Limitations of the classical theory for terminology

Although most terminology manuals (e.g. Felber 1984; Sager 1990) propose a concept theory based on the classical theory, this poses two main limitations for terminology. Firstly, some concepts *cannot* be adequately described in terms of a set of n+s characteristics (Zawada and Swanepoel 1994). Secondly, *different* classifications of a single concept can be created based on human needs (Lakoff 1987). Since many subject fields examined by terminologists are not conducive to the classical approach, it may be useful to investigate new approaches.

1.2 Classification in cognitive science

Cognitive science is a discipline that brings together what is known about the mind from many disciplines, including philosophy, psychology, linguistics, and computer science. Among the issues concerning cognitive scientists are ones relating to concept systems and classification. In the past, the classical theory was absolute, but recently, some researchers have begun to question aspects of the classical theory and to propose new approaches to classification. Due to limited space, we can provide only brief summaries of the work of four researchers who have contributed to the development of new approaches to classification.

Wittgenstein. Wittgenstein (1953:31) notes that the class GAME does not have clear boundaries and its members cannot be defined by the same set of n+s characteristics. For example, some games are physical, while others are mental; some involve luck, while others involve skill, etc. Wittgenstein uses the metaphor of "family resemblance" to describe the class GAME: just as members of a family resemble each other in varied combinations of features so may games posses an overlap of shared characteristics.

Rosch. Rosch (1978) developed a series of experiments which prove that people find some members of a class to be *prototypes*, or "better examples" of that class than others. She also provided empirical proof of Wittgenstein's theory of family resemblance.

Lakoff. Lakoff (1987:74) observes that concepts are often defined by a *cluster* of cognitive models, and it is easier to understand the entire cluster than it is to understand its individual parts. For example, the concept MOTHER does not have clear n+s characteristics, but rather it is based on a cluster of models, including: 1) the birth model; 2) the genetic model; 3) the nurturance model; 4) the marital model. Lakoff (1987:77) adds that many people feel pressured to pick *one* model as being "correct". However, different people may pick different models, which shows there is no uniformly accepted n+s cognitive model for such a common concept as MOTHER.

Barsalou. Barsalou (1983) explores the notion of goal-oriented classification in a study of *ad hoc classes* (i.e., classes constructed for highly specialized purposes, e.g THINGS NOT TO EAT ON A DIET). Barsalou (1983:213) maintains that concepts can have both context-dependent and context-independent characteristics, and that only a subset of these is normally active. In an ad hoc class, the classifying characteristic is usually context-dependent (i.e., the one which is relevant to the intended goal). In the class THINGS NOT TO EAT ON A DIET, the classifying characteristic is *caloric value* as this is the characteristic of food that is relevant to the goal of losing weight. But Barsalou (1983:226) adds that no matter how a concept is initially classified, it can later be classified in other ways to meet different goals.

2. A multidimensional approach to classification

Based on information in both the terminology and cognitive science literature, we have developed a *multidimensional* approach to classification in terminology. We established above that classification is essentially the grouping of like things into classes on the basis of shared

characteristics. It follows that what is like or unlike depends on which characteristic is chosen to be the classifying characteristic. Despite the classical theory's claim that there is only one correct way of classifying a given concept, it is commonly accepted that people can "see the same thing in different ways". We use the term *multidimensionality* to describe the phenomenon of classification that occurs when *more than one* characteristic can be used to distinguish between things, and hence those things can be classified in more than one way. A *dimension* represents one particular way of classifying a group of things; a classification with more than one dimension is said to be *multidimensional.*

For example, the concept WINE can be classified according to the characteristic *colour* into the subordinate concepts RED WINE and WHITE WINE. However, there are other ways in which WINE can be classified, based on different characteristics that wine can have. For instance, WINE can also be classified according to the characteristic *sugar content* into the subordinate concepts DRY WINE and SWEET WINE. Other classifications are also possible.

2.1 Support for multidimensionality in cognitive science

New approaches to classification in cognitive science are based on ideas that support multidimensionality, which can overcome the limitations imposed by the classical theory (cf. section 1.1). Two main ideas in the cognitive science literature are highly relevant to a multidimensional approach to terminological classification.

2.1.1 Goal-oriented classification

The classical theory states that each concept has one correct classification, which exists outside of human cognition. Goal-oriented classification contests this belief.

Although terminologists generally subscribe to the classical theory, they do, in principle, recognize that the goal of a classification can influence how a concept is classified. Many terminology manuals (e.g. Dubuc 1985:51) advise terminologists to identify the needs of their client. While this advice can be followed by a terminologist working on a project for a well-defined user group with a highly specific purpose, it is more difficult to apply to the widespread situation of terminologists working on projects aimed at a wide range of users with different needs. In such cases, the influence of the classical theory is evidenced by the

fact that many multipurpose and multi-user term banks and glossaries show only one classification. Support for multidimensionality is found in the cognitive science literature, where Wittgenstein, Rosch, Lakoff, and Barsalou all recognize that the goal of a classification determines how concepts are classified.

2.1.2 Inability of n+s characteristics to adequately describe all concepts

One of a terminologist's main tasks is to define concepts. The classical theory has inspired some so-called "rules" of definition, many of which have found their way into theories of terminology (Sager 1990:44). The most difficult rule to interpret requires that a definition give the n+s characteristics of a concept. In practice, this means listing those characteristics which differentiate a concept from its superordinate concept and coordinate concepts, but if strictly interpreted, this rule would require a re-definition *every* time the concept system is altered.

While many concepts can be described according to the n+s characteristics rule, other concepts cannot. Some (e.g. Rey 1995:141) argue that humanities and social sciences differ from natural and pure sciences, which are thought to be more rigid and precise. Yet, Zawada and Swanepoel (1994) show that even some pure sciences cannot be adequately described using the classical approach.

Introducing multidimensionality into a terminological concept system raises some questions with regard to definition construction according to the classical rules. In a multidimensional classification, it is difficult to identify a single fixed set of n+s characteristics for a concept since the relevance of any given characteristic can change depending on the dimension being considered. Hence, a given concept can have a different set of n+s characteristics for each dimension. In addition, a given concept can have more than one superordinate concept.

Support for multidimensionality can once more be found in the cognitive science literature. The notions of family resemblance (Wittgenstein), prototypes (Rosch), and cluster models (Lakoff) show that n+s characteristics cannot always adequately describe concepts (e.g. GAME, MOTHER). Wittgenstein and Lakoff both indicate that the various characteristics possessed by a given concept can be seen as being more or less relevant depending on the situation, while Barsalou notes that some characteristics are context-dependent and are only activated in certain situations. In other words, a characteristic that is deemed necessary in one case may not be deemed necessary in another. All charac-

teristics could potentially be elevated to the level of "necessary" depending on user needs.

3. Relevance of multidimensionality to terminology

Although multidimensional classification is not widely practised in the discipline of terminology, our experience has shown that it is pertinent to terminology for the following reasons: 1) terminologists who consider multidimensional classifications will have a better understanding of the subject field as a whole; 2) terminologists will be able to investigate the subject field more comprehensively if they consider all possible dimensions; 3) terminologists who understand the subject field, and who have explored it as exhaustively as possible, are able to map out a more realistic representation of the subject field, which includes multidimensionality; 4) if terminologists understand the subject field, have investigated it exhaustively, and have represented it realistically, then they will probably be able to create higher quality definitions, and to determine equivalence and synonymy between terms more accurately; 5) a terminology product comprising multiple dimensions will meet the needs of a wider group of users.

4. Multidimensionality in terminology: present and future

Most terminologists *do* recognize that multidimensionality exists in terminology; however, the subject has not been treated clearly or definitively in the literature. The confusion surrounding multidimensionality is evident if one considers the variety of terms used to describe it (e.g. multidimensional concept systems, polydimensional series, polyvalent relationships, polyhierarchic systems, faceted classifications). Some authors discuss multidimensionality without actually referring to it by a term (e.g. Felber 1984), while other authors deal with aspects of it indirectly when addressing other issues (e.g. Rey 1995). Other authors make no mention of multidimensionality (e.g. Dubuc 1985). Practising terminologists, too, have demonstrated little interest in multidimensionality.

One reason that multidimensionality has received little serious attention from terminologists may be its potential complexity. Until recently, many terminologists worked with pencil and paper – a medium that is not conducive to representing complex multidimensional classifications. Now, advances in computer technology, particularly in a

subfield of artificial intelligence known as knowledge engineering, have resulted in the creation of knowledge-based tools that have proven useful for many aspects of terminology work, including creating and manipulating multidimensional classifications. Unfortunately, space constraints preclude giving a description of such tools, or of the multidimensional classifications that have been implemented using them; however, they have been well-documented elsewhere in the literature (Bowker and Meyer 1993; Bowker 1995). It is hoped that as more terminologists gain access to such tools, multidimensionality will be more widely investigated, adapted, and adopted in the field of terminology.

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