Aspects of cognitive linguistics and neurolinguistics: conceptual structure and category-specific semantic deficits

Ana Laura Rodríguez Redondo

Universidad Complutense de Madrid - Departamento de Filología Inglesa I
analaura@filol.ucm.es

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ABSTRACT

The goal of this paper is to establish certain links between basic assumptions of Lexical Category Structure in Cognitive Linguistics, and aspects of the organization of semantic memory resulting from the theoretical and experimental work carried out in Cognitive Neuropsychology, through cases of Category Specific Semantic Deficits. These studies highlight the relevance of distinctiveness against that of similarity, which has been mainly focused by Cognitive Linguistics as one of the main parameters for conceptual organization. Also, these deficits evidence the need to consider different conceptual structures according to domains. Moreover, research on these cases contributes to a more specific account of schematization processes for each domain here focused on, the domains of living and that of non-living things.

Key words: neurolinguistics, cognitive linguistics, conceptual structure, categorization, domain, living and non-living things, category specific semantic deficits.

Aspectos de lingüística cognitiva y neurolingüística: estructura conceptual y déficit semánticos de categoría específicos

RESUMEN

El objetivo de este artículo es establecer una cierta relación entre supuestos básicos de la estructura categorial léxica de la Lingüística Cognitiva y ciertos aspectos de la organización de la memoria semántica, según los resultados de la investigación teórica y experimental realizada en el campo de la Neuropsicología Cognitiva, a través del estudio de casos de Déficits Semánticos de Categoría Específica. Estos estudios ponen de manifiesto la relevancia de lo distintivo frente a lo similar. Esto último ha sido, hasta ahora, el parámetro más importante sobre el cual se ha centrado principalmente el estudio de la organización conceptual, en Lingüística Cognitiva. Igualmente, estos déficits evidencian la necesidad de considerar las diferencias de estructura conceptual según diferencias de dominio. Asimismo, la investigación de este tipo de déficits contribuye a una interpretación más específica de los procesos de esquematización según el dominio, en este caso, en los dominios de cosas vivas y no vivas.

Palabras clave: neurolingüística, lingüística cognitiva, estructura conceptual, categorización, dominio, cosas vivas y no vivas, déficits semánticos de categoría específicos.

Sumario: 1. Introduction. 2. Conceptual organization and types of information in cognitive linguistics. 3. Neuropsychological research: category specific semantic deficits. 4. CSSD and categorization in cognitive linguistics. 5. Conclusion. 6. References.

1. INTRODUCTION

The contribution of neuropsychological research to theoretical linguistics is not new, and it has always proved to be an essential source of information that contributes to the study of lexical categorization in linguistics, since the work of E. Rosch (1976, 1978). However, neuropsychological studies are difficult to approach for a non-specialist, because they are usually addressed to psychologists or neuropsychologists, as the ultimate goal of this research is the understanding of the semantic system for clinical purposes, such as the diagnosis and recovery of brain damaged people. Therefore, this paper attempts, on the one hand, to approximate linguists to the new account of differences of conceptual domain organization that steam out of experimental research on Category Specific Semantic Deficits (CSSD) and, on the other hand, it aims at relating these findings to some of the underlying principles of two proposals that account for lexical conceptualization within Cognitive Linguistics (CL), namely, the hierarchical model developed from Rosch's work and Langacker's (1987, 1990, 1994, 1998) schematization processes.

Conceptual domain differentiation in CSSD research has generally been observed between the large domains of living and non-living things. In CL this differentiation was acknowledged, but it was recognized on the basis of the sensory-functional theory supported by the work of Warrington and his colleagues (Warrington 1975; Warrington and Shallice 1984; Warrington and McCarthy 1983; McCarthy and Warrington 1988). However, later research, mainly based on distributed accounts of semantic memory, provides the bases for an approach to categorization which, we believe, presents a deeper and more detailed insight into the structure of semantic domains, and contributes to the specification of the structure and processes of categorization dealt with in Cognitive Linguistics. We think that these findings, opposite to the main perspective of Lexical Cognitive Semantics, enhance the approach to distinctiveness rather than to sameness of structure. This approach leads to the need not to establish a unique conceptual structure, but to be able to accept and describe different conceptual structures across domains.

We will see that specific parameters of domain differentiation become relevant for lexical categorization theory if understood within an open and dynamic framework, such as that of Langacker's schematization strategies. On the contrary, it becomes clear that closed-framed models that impose the same structure to all concepts, such as the hierarchical model, are not suitable enough to take charge of these new findings regarding differential conceptual architecture.

In the first part of the paper, we briefly review basic ideas about conceptual organization in the hierarchical model, and the schematization processes established by Langacker. Then, we summarize the literature on CSSD that focused on the establishment of conceptual domain differentiations, and we end up with a commentary on the possible contribution of CSSD findings within the two cognitive linguistics proposals for conceptual structure.

2. CONCEPTUAL ORGANIZATION AND TYPES OF INFORMATION IN COGNITIVE LINGUISTICS

Here we deal with two types of conceptual organization that offer two different perspectives on conceptual structure. On the one hand, we present the basic tenets of a shaped hierarchical structure mainly derived from the work of Rosch and her colleagues in the 70s and, on the other hand, a conceptual organization based on strategies of processing.

2.1. HIERARCHICAL STRUCTURE

The best known image of the organization of the conceptual structure is the hierarchical model, which consists of three levels, the basic, the superordinate and the subordinate one.

According to this model, our knowledge is mainly organized at the basic level. Here we conceptualise things around us, as functional and perceptual *gestalts* (Rosch et al. 1976). This is the level of imaginability (Lakoff 1987), where all concepts possess many describable features, both functional and perceptual, and where the mental images that reflect the whole category are formed. At this level, the members of a category are identified as functionally and perceptually similar among themselves, but they minimize the similarity with other categories (Neisser 1987:14; Taylor 1990:51). That is, intra-category distinctions are blurred, but inter-category distinctions are enhanced.

Superordinate concepts highlight the most relevant and general features of the category, which are mainly of a functional type. Concepts at this level have few describable features and therefore, they are not characterized by their imaginability. Categorical features found at this level are few and of great scope and therefore, they are found in elements at a lower level (Wierzbicka 1985; Ungerer and Schmid 1997:78).

At the subordinate level, on the one hand, concepts within a category share many common features which overlap and thus, the differentiation among the members of the category is lower (Rosch 1978:31; Taylor 1990:51). However, a bundle of specific and highly distinctive features are added (Ungerer and Schmid 1997), and this is what makes it possible to distinguish, for example, the features of a *kitchen chair* from those of a *living-room chair*.

The most important level is the basic one in which the gestaltic image is formed mainly from perceptual features. This image at the upper and the lower levels coincides with that at the basic level.

This hierarchical structure is posed theoretically for any category that belongs to any domain thus, the category of *furniture* that belongs to the domain of non-living things is structured in the same way as the category of *birds* that belongs to the domain of living things. There is no distinction of domain. In both, inter-category differentiation benefits from basic level conceptualization, whereas intra-category distinctions take advantage of subordinate concepts.

2.2. SCHEMATIZATION PROCESSES

Another form of conceptual organization proposed from Cognitive Linguistics is the Schematization processes proposed by Langacker (1987, 1990, 1994, 1998). Schematization refers to the process by means of which speakers form a conceptual image which includes all those features that different referents, experienced by individuals, have in common. This results in a conceptual image called schema.

The schema is formed from the observation of specific and common features, both functional and perceptual. The higher level schema derives from features that are considered common to all items which are believed to belong to a certain category, whereas the lower level schema is formed with features that are distinctive for each member of the category. The level of activation of the schema depends on the task (Langacker 1987:378). For example, when categorizing an element, such as a *Persian cat*, the activation of a high level schema will be used to enable us to include a *Persian cat* within the category of *cats*. However, if we are to identify a particular cat as a *Persian cat*, a lower level schema will be activated.

In addition, according to Langacker (1987), the schema of a category can be modified either by processes of Extension or Elaboration. On the one hand, Elaboration processes imply the construction of a schema according to degrees of specification, for example, in the case of the mental image of a *Persian cat,* this will be developed from specifications on the more global image of a *cat*. On the other hand, Extension depends on degrees of perceptual similitude in relation to a prototype (1987:371), as in the case of the categorization of a *lion* within the category in which *cat* is the basic level concept, and where the use of higher levels of abstraction would be necessary. That is, Elaboration relies on contrastive processes, whereas Extension relies on comparison processes.

As it can be observed, neither the hierarchical model nor the schematization processes account for differentiations of domain. However, from our point of view, the open and dynamic nature of the schematization model allows to relate these strategies to the findings of CSSD in relation to the conceptual structure, in order to fit the differentiation in conceptual structure across domains.

2.3. ATTRIBUTES IN COGNITIVE SEMANTICS

Attributes are considered as dimensions to account for the similarity between entities. They are variable according to their contribution to the establishment of the inclusion of a concept within a category (Taylor 1990:93). Also, attributes are perceived by speakers as integrated units that can be relatively schematic, depending on the specificity or generality of the information activated (Langacker 1987:22).

The types of attributes that are considered within the topic of categorization in Cognitive Linguistics are interactional (Labov 1973; Lakoff 1987:57), cultural (Wierzbicka 1985:177), shared, specific, functional and perceptual. Those that are shared are essential, as they support the inclusion of an object within a category, since they are used as parameters of reference, whereas specific attributes make possible the differentiation among concepts (Langacker 1987:22). Functional attributes are those related to the use of the object (Lakoff 1987:57), and perceptual features are related to the sensorial experience of the object.

Moreover, perceptual features have critical importance in Cognitive Linguistics categorization, since they are the attributes that constitute the basis of the prototype. The prototype is formed at the basic level by perceptual resemblance among objects. Prototypical members have the largest number of common attributes with other members of the category, but the smallest number of attributes shared with members of other categories (Ungerer and Schmid, 1997:29). The prototype represents the best example of the category, and it is mainly used as a referent for concept inclusion within a category.

Furthermore, Cognitive Linguistics deals with bundles of correlated attributes, that is, those that occurred together. Both functional and perceptual features form part of those bundles of correlated attributes, which are further characterized as being generic, specific or not shared. In addition, the nature of functional and perceptual bunches of attributes determines the level of conceptualization of an object, within the hierarchical structure of the category. What is more, the relative saliency of functional or perceptual information becomes relevant for the description of the conceptual level. In this way, the characteristics of bunches of features at each level can be summarized as follows: At the Superordinate level there are few number of features, mostly shared by all members of the category and basically functional in nature. To these, salient generic attributes are added. At the Basic level we find many correlated attributes, that is, they usually occur together. These are both shared and specific, and both functional and perceptual. However, there are a lot of shared perceptual features which result in an overlap of shapes. At the Subordinate level, there are many shared and specific attributes, basically perceptual to which salient specific attributes are added (Ungerer and Schmid, 1997: 60-113).

Here, once more, we observe that, even when dealing with types of attributes, there is no differentiation across domains. Moreover, the idea of correlation of attributes refers to bundles of features that usually occur together. Only graded amounts and types of features are described for each level, but there are no established patterns of links between the different types of features that occur at each level. In addition, perceptual properties become salient features for categories of any domain, since they constitute the basic mortar to build up the prototype of a category. This means, for example, that the prototypes of a category in the biological domain and in the man-made domain, such as *robin* and *chair*, will be equally based on bunches of perceptual features forming a gestaltic image at the basic level, that is, both at the same level of conceptualization. As we will discuss later, this sameness of levels of conceptualization cannot longer be maintained, and neuropsychological findings on CSSD provide experimental support for this differentiation.

2.4. THE RELATIVE CONTRIBUTION OF TYPES OF INFORMATION IN CL

The relevance of the distribution of different types of features in the formation of the conceptual categories was an important part of the work developed by Wierzbicka

(1985). She made special reference to functional and perceptual features according to their relative contribution to the category according to the domain of concepts, that is, whether they were biological or non-biological concepts.

According to Wierzbicka (1985) we find differences of domain at the superordinate level. Biological or taxonomic concepts are based on the most relevant contribution of perceptual attributes, whereas non-biological or non-taxonomic concepts are based on functional features. However, Wierzbicka does not maintain this domain differentiation between biological and non-biological concepts, in the rest of the conceptual levels. The relative weight of perceptual or functional information which was used as a parameter for domain differentiation, changes in order to be applied as a parameter to establish relationships between concepts, at different levels of the category. For example, in the relationship between superordinate and basic level concepts, the relationship is mainly based on functional features, and it applies to both biological and non-biological domains, such as in the relationship between *dog-pet,* which is sustained by the same functional relationship than that in *doll-toy*.

In addition, the relationship between basic level concepts and subordinate ones is based on perceptual features, which can also apply to both biological and non-biological concepts. However, whereas in biological concepts, the perceptual features are those relevant to the establishment of the relation between *flower* and *daisy,* in the case of non-biological kinds, this perceptual relationship needs deeper levels of perceptual specification as in the case of *chair-kitchen chair*. That is, although for Wierzbicka the different contribution of perceptual or functional information is no longer a hallmark for domain differentiation beyond the superordinate level, she already pointed to the differential processing demands between biological and non-biological domains, at least in the basic and subordinate level relations.

Wierzbicka's ideas about the use of the relative weight of the different types of information according to different conceptual domains were linked to the research on CSSD developed by Warrington and his colleagues in the 70s and 80s (see also Caplan (1992 (1987)). However, the relevance of these findings was consigned to oblivion and Cognitive Linguistics preferred to follow the path opened by those studies that focused on psychological research on subjects without deficits, such as those of Rosch (1976, 1978) and her colleagues among others. In this paper we try to pick up the threat of Wierzbicka's findings in light of the recent developments on Cognitive Neuropsychology research, mainly based on the study of specific semantic deficits.

From our point of view, the recent findings of CSSD contribute to the Cognitive Linguistics research on semantic structure, since they provide deeper and more specific information about that structure. These neuropsychological studies have proved that things are categorized in different ways according to domain. This implies that the description of the organization of the semantic structure in each domain cannot longer be held to be the same, as we saw in the case of *furniture* and *birds.* These studies provide a more specific description of what is to be understood as functional and perceptual features, as well as how these features contribute to the conceptual structure of each domain. As a result, neuropsychological research establishes patterns of intercorrelations between different types of features for concepts of different domains.

3. NEUROPSYCHOLOGICAL RESEARCH: CATEGORY SPECIFIC SEMANTIC DEFICITS

Semantic deficits in neuropsychology are those observed in subjects that show a poor access to semantic memory. These deficits are usually a consequence of various types of brain damage that lead to mental disorders, such as those produced by Alzheimer, or Semantic Dementia etc. (Caplan 1992:238; Saffran and Sholl 1999; Saffran 2000).

Category Specific Semantic Deficits are those observed in brain damaged individuals that show a poor performance on tasks dealing with specific types of information, as in the case of concrete *versus* abstract information (Warrington 1975), or with different stimulus input modalities, such as presentation of information through pictures *versus* words (McCarthy and Warrington 1988). Also, there are selective deficits that depend on the type of attribute, visual or non-perceptual which is stated explicitly in the definitions presented to brain damaged individuals (Silveri and Gainotti 1988). Furthermore, we find cases of Double Dissociations where the performance of a brained damaged subject is contrasted, when presented with objects that belong to the same semantic category, through two different input modalities (McCarthy and Warrington 1988).

In this section of the paper, we focus on the results of the research on CSSD, taking into consideration the parameters of semantic category and types of attributes. The influence and relevance of the type of input modality falls outside the scope of this paper.

The categories on which these studies have focused are mainly those pertaining to the domains of living and non-living things. Although, with some exceptions (Caramazza 1998), there is no differentiation between the terms of domain or category, the neuropsychological results tend towards the interpretative generalization in terms of domain, therefore, in this paper, we will keep to the general results of domain.

3.1. TYPES OF INFORMATION

The types of information dealt with in CSSD research are mainly of two types, perceptual and functional. On the one hand, perceptual or sensory information refers to those features that are received through any of our senses. In this area, the visual input has been the most widely studied. On the other hand, functional information is that which is accessed without direct exposure to the object, and it includes all types of information that are not perceptual.

It was the work of Warrington and his colleagues, specially that of Shallice and McCarthy, which played a crucial role in the study of the nature of categorical structure (Warrington 1975; Warrington and Shallice 1984; Warrington and McCarthy 1987; McCarthy and Warrington 1988). The work of these researchers made relevant the importance of the conceptual knowledge being categorized according to the type of information and modality, as well as the importance of the contribution of the relative weight of the type of information in object recognition.

According to these studies, whereas sensory information was more relevant in the domain of living things, functional information was more salient in the domain of non-living things. Moreover, they claimed that the relative importance of these types of information was to be defined for each specific category, since there are objects that belong to the domain of non-living things, as for example, *big objects*, for which the load of visual information is more significant than the functional information.

These theses were supported later on by the results of computational simulation and experimental research on non-brained damaged individuals (Farah and McClelland 1991; McRae et al. 1997; Devlin et al. 1998). However, these first theses were about to change, as it can be observed in the following development of section 3.

3.1.1. The importance of functional information

In neuropsychological experiments, functional information covered a wide range of knowledge. When preservation of functional knowledge was tested, patients were faced with questions that mixed functional, as well as associative or encyclopaedic information, such as the place where animals live in, or things that animals ate or whether a certain animal was intelligent or not (Tyler and Moss 1997:514). However, since the work of Tyler and Moss (1997; Tyler et al. 2000; 2001) it became important to specify what was to be considered functional information across domains. Their purpose was to establish a more detailed explanation of what could constitute a CSSD when functional information was involved, as well as to determine the importance of such functional information in living and non-living things domains.

To achieve these aims, Tyler and her colleagues turned to Developmental Psychology (Carey 1985; Mandler 1992; Keil 1994) and Cognitive Linguistics (Wierzbicka 1985). In these areas of study, functional information is considered that which allows us to know what type of thing an object is. It depends on the interaction of the object with and within the environment where it is placed, including people as part of that environment. Also, functional information varies according to domain. In the case of living things, functional information is of a biological kind, that is, it depends on the interaction of the object with the environment, the context where biological kinds are found, actions and sounds performed by them etc. (Tyler and Moss 1997; Tyler et al. 2000; Humphreys and Forde 2000). In the case of non-living things, functional information is that related to the purpose and motor actions developed by people in relation to artefacts.

Based on these ideas, Tyler and Moss (1997) made a parallel of functional relations for living and non-living things domains, by the extension of the form-function relationship that had been claimed for artefacts (Wierzbicka 1985). According to this, since the form of artefacts is directly influenced by the function they are designed for, for example, *an object used for cutting, has a blade and a handle*, the parallel, in the case of living things, was set between body parts and biological function, as in *eyes-see, ears-hear* (Tyler and Moss 1997:534). Moreover, to this body part-biological function relation, these authors added all those functions derived from primitive theories, mainly formed from observation about what constitutes a living entity, such as *everything that has lungs, breathes* and viceversa. (Mandler et al. 1991).

Once these researchers (Tyler and Moss 1997) established what was to be considered functional information in both domains, they proved, mainly by means of *priming* tasks with non-brain damaged and impaired subjects, that: a) the activation of functional properties is quicker than the activation of perceptual properties; b) functional features of non-living things, such as *sweater-warm*[1]; *fork-eat,* and functional biological features in living things, as *monkey-tree, onion-cook* have the same priming effect; c. functional biological information, for example, *cow-breath,* is more stable and less susceptible of loss in case of damage than non-functional or associative information, as in the case of *cow-farm*; d. property relations such as *fox-red; desk-wood,* have the same priming effect than the taxonomic relations of the type of *fox-animal; desk-furniture*.

Thus, these studies showed that functional information was equally important in both domains, but that salient functional information differs across domains, and specified what was to be considered functional information in the case of living things, as that which refers to biological functions and the theories related to them. This information proved to be more stable and more quickly activated than non-functional information. In addition, these functional biological properties are of a general character, which implies that is more suitable for categorization or classification rather than for recognition processes (Tyler and Moss, 1997).

3.1.2. Non-functional information

Visual properties were considered the most important features for the identification of biological objects (Warrington and Shallice 1984). And CSSD showed evidence of this fact when perceptual information was damaged (Silveri and Gainotti 1988; Sartori et al. 1993a; De Renzi and Lucchelli 1994).

Living things have been widely studied regarding their visual or perceptual properties, and are described as being *visually more complex* than those objects of the man-made objects domain. According to Sheridan and Humphreys (1993) in order to identify objects of the living things domain, it is necessary to use more detailed and specific visual information. For example, when distinguishing between a *horse* and a *zebra,* we need to use very specific and distinctive information, such as *has* or *does not have stripes*, since the global perceptual image is not enough to differentiate them. Also, they show more *intra-category structural similarity* than perceptual features in the man-made objects domain (Humphreys et al. 1988; Forde and Humphreys 1999; Humphreys and Forde 2000), because biological objects share a greater number of visual properties[2] that affect their global image (Riddoch and Humphreys 1987; Sheridan and Humphreys 1993). In addition, these visual features of natural objects *vary multidimensionally,* that is, they vary in more than one dimension simultaneously (Arguin et al. 1996; Humphreys and Forde 2000). This idea is further supported by

[1] The first word is the priming and the second one the target.

[2] See McRae et al. 1997, where it is observed that the greater number of shared properties exert influence in a non-linear way, producing a similarity effect that accelerates the processing of living things.

experimental results from non-impaired subjects who made more semantically and visually related mistakes when naming living objects, than when naming non-living things (Vitkovitch et al. 1993).

Familiarity is another fact that plays an important role in the processing of object features, specially structural properties (Funnell and Sheridan 1992:147-148). Objects such as *body parts, furniture* or *kitchen tools* are more familiar than *birds, animals* or *musical instruments,* since we make use of them more often, and that daily interaction requires a more detailed observation of these types of objects (Moss et al. 1997). Also, research on non-impaired subjects confirm this thesis (Farah et al. 1989).

However, visual complexity and familiarity are not considered the only and fundamental parameters in the cases of CSSD, showing disadvantage of living things (Caramazza and Shelton 1998; Humphreys and Forde 2000). On the one hand, because in some cases, this deficit affects objects that form part of our daily life such as *apples* or *dogs* (Humphreys and Forde 2000) and, on the other hand, because familiarity and visual complexity cannot provide an answer to cases where these facts are controlled (Sartori et al. 1993b; Barbarotto et al. 1995; Farah et al. 1996; Funnell and De Mornay Davies 1996; Forde et al. 1997). For example, the case of Michelangelo (Sartori et al. 1993 a,b) who showed a disadvantage in the identification of living things even though he was member of the *World Wildlife Fund*. Also, Barbarotto et al. (1995) studied the case of MF, an architect that suffered a living things deficit, but who was neither able to recognize famous buildings such as the Parthenon, nor to distinguish different architectural styles such as the Gothic or the Romanesque. Likewise, according to Sacchett and Humphreys (1992:74), structural similarity that affects the domain of living things could not be the only explanation for deficits that affect the domain of man-made objects, since in this domain the visual similitude is lower (Warrington and McCarthy 1983, 1987; Hillis and Caramazza 1991).

In addition, other experimental studies (McRae, de Sa and Seiderberg 1997; Devlin et al. 1998) support the almost equal relevance of sensory information across domains. For example, Tyler and Moss (1997) showed that perceptual attributes were almost equally primed in the domain of living things, e.g. *swan-white*; *pumpkin-round,* and in the domain of non-living things, e.g. *bike-pedals*; *axe-handle*. Therefore, although familiarity and visual complexity cannot be maintained as the fundamental reasons for deficits on living things, perceptual properties of biological entities can be established as important dimensions to differentiate the domains of natural and man-made objects. Thus, living things concepts are characterized by being less familiar, more similar and visually more complex, and concepts of the domain of non-living things are more familiar, less similar and visually less complex (Funnell and Sheridan 1992; Sheridan and Humphreys 1993; Key and Hanley 1999).

As it can be observed, the ideas supported by the first neuropsychological work on CSSD have changed. The claim that the difference between the domains of living and non-living things was based on the relative weight of information, where perceptual features were more salient for the biological domain, and the functional features were more relevant for the artefact domain is no longer held. Functional information has been redefined for the domain of biological objects, and perceptual information has been claimed not to be enough to explain deficits in the domain of living things. This fact led the research on CSSD to change the focus of the investigation that was no longer on the content of the information, but on the graded features of those properties. That is, they became concerned with the quality of these types of information, and the interrelationships between the different quality-like features.

3.2. CORRELATION OF INFORMATION

The thesis that functional and sensory information interacted differently across the domains of living and non-living things steamed from the basic idea of the connexion between form and function, as well as from the experimental research by De Renzi and Lucchelli (1994)[3]. Namely, it was claimed that sensory and functional relations were stronger for the domain of living things, than for the domain of non-living things. For example, McRae, de Sa and Seidenberg (1997) supported these ideas about relative weighting of correlations, and they claimed that there were many more shared features, that is, that occurred together in the domain of biological objects, than in the domain of artefacts. Thus, features such as *having skin* and *having whiskers* are properties of many biological objects such as the *seal, the cat, the mouse* etc. However, these intercorrelations are fewer in the domain of artefacts. Therefore, the feature correlation is also greater for biological objects than for non-biological elements (1997:111).

Likewise, Caramazza and his colleagues (Caramazza, Hillis, Rapp and Romani 1990; Hillis, Rapp and Caramazza 1995; Caramazza and Shelton 1998) in their *Organised Unitary Content Hypothesis* (OUCH) maintained that the members of the superordinate category share many common features, forming groups of sensory and functional properties that are differently distributed for each category (1998). For these authors, this implies that the semantic space is observed as heterogeneously distributed with areas of more correlated features of both types, and other areas with less correlated features. Densely correlated areas are those of the domain of living things, whereas less dense areas are occupied by the domain of non-living things. However, it is possible to find densely correlated areas in the domain of non-living objects since there are certain objects that have many form-function correlated features, such as *small objects with handle that are used for cutting*.

Furthermore, studies on the development of neuronal damage and its projection in CSSD (Devlin et al. 1998; Moss et al. 1999 in Tyler et al. 2000) showed the relevance of the difference in density of correlations. Computational simulation (Devlin et al. 1998) demonstrated that in the initial stage of the damage, a slight deficit can be produced, although not necessarily, which mainly affects the identification of objects within the domain of non-living things, but it does not affect the domain of living things. It is only from the middle stage of the damage that the identification of living things is affected. At this stage, a high number of correlations are lost with the consequent massive loss of concepts that belong to the biological domain. However, the concepts of the domain of non-living things are lost in the advanced stage when the

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[3] See also Caramazza and Shelton 1998 for a summary of experimental evidence on this fact.

critical features of concepts are just affected, since these are not highly intercorrelated (Devlin et al. 1998; Tyler et al. 2000).

Tyler et al. (2000) highlighted the importance of the interdependency between functional and perceptual features, as derived from these studies. In this way, they showed the fact that in the domain of living things, those features that are common to all the members of the category, such as *having mouth*, are directly related to a common biological function, in our example, to *eating*. On the contrary, distinctive perceptual features of living things, e.g. *the mane of a lion*, are not so closely related with functions or modes of interaction with the environment, except to an expert. Moreover, in the domain of non-living things functional distinctive features are correlated with perceptual distinctive features. For example, the specific function of a *knife* such as *cutting* is directly related to its specific characteristics, for example, *having a blade and a handle* (Moss et al. 1997). Opposite to this, common features in the artefact domain are not linked to specific functions but to scenarios, events or situations where man-made objects are used (Tyler et al. 2000). Thus, according to Tyler et al. (2000) living things consists of many shared features and few distinctive ones, whereas non-living things consists of few shared features and many distinctive attributes.

In addition, Tyler at al (2000) established that the correlation of functional and perceptual features are learnt and stored as part of the conceptual representation of an object, so that the activation of sensory features makes possible the access to functional properties and vice versa. Furthermore, in cases with highly developed damage it was found that subjects progressively produced mistakes between superordinates within the same domain of living things, but never inter-category mistakes of the type *animal-fruit*. However, inter-category mistakes were found in the domain of non-living things, such as *brush-wheel.* According to Tyler at al (2000) intra-category mistakes in the domain of living things are due to the close relations among concepts, this explains why the problems for a possible intra-category distinction raise when they lose non-correlated features. On the contrary, in the domain of artefacts, the intra-category mistakes are more frequent, because the distance among concepts of different categories is closer than among concepts within the same category. Therefore, for these authors, categories within the domain of living things are more distinctive among themselves than those of the domain of non-living things. For example, the difference between *animals* and *fruits* is greater than between *tools* and *vehicles.* In this way, categories of the biological domain form more stable and distinctive hierarchies than those of the artefacts domain.

3.2.1. Correlation of information and information retrieval

Patterns of correlation and intercorrelation also play an important role in the retrieval or activation of semantic knowledge. The theory that supported the use of inferences to retrieve perceptual features from functional information (De Renzi and Lucchelli 1994; Wierzbicka 1985) was rejected by Tyler and her colleagues (Tyler and Moss 1997; Tyler et al. 2000). These researchers proved that information retrieval was not based on inferences, which implied a longer processing of artefacts. They claimed that the retrieval was based on a chained activation between nodes of functional and perceptual information. These authors used priming tasks in conditions of quick and automatic access to state that there was no special increase of time when they compared visual features of biological and man-made objects. Therefore, they explained (1997:943) that the perceptual disadvantage of subjects with living things deficits was due to the lower activation of the nodes that carry visual information from an input stimulus. This lower activation cannot be compensated since there are but few activation relations between visual and functional information that would allow the identification of living objects.

This thesis has been supported later on by experiments with impaired and non-impaired individuals (Davis et al. Internet). Also, Moss et al. (1997) observed a special difficulty in the retrieval of those features that cannot be retrieved from general information, such as parts or colours, for example, *pig-curly,* or *potato-brown.* According to these authors, this is because biological functional information is of a general character, such as *it has fingers-it can grasp*, but this is not enough to identify an object. In this way, for some researchers (Tyler and Moss. 1997; Moss et al. 1997; Tyler et al. 2000), the intercorrelation of information implies, on the one hand, a quicker and easier access and, on the other hand, a greater or lesser resistance to damage. Therefore, in the case of living things, the density of the intercorrelations of common visual features with common functional properties increases the possibilities of access to information common to all the members of a category. However, in the case of non-living things, the correlation of specific visual features with specific functional features provides access to particular information. These facts, in turn, are supported by the patterns of deficits derived from computational simulations previously commented.

Furthermore, the graded association of features observed in these studies - the greater the damage to the semantic system, the more important the effect on the domain of non-living things (Tyler et al. 2000) becomes relevant to Humphreys and Forde's (2000) ideas about different levels of processing across domains. For these authors, the problems of CSSD caused by the access to the structural description are due to the different processing demands on living and non-living things. Namely, the great intra-category structural overlapping among living-things concepts implies greater and deeper processing demands at the level of the structural description (see also Sartori et al. 1993a)[4].

From what has been set out on intercorrelation patterns, it can be concluded that the domains of living things and non-living things are differentiated according to the amount and type of common shared and distinctive features, as well as according to their patterns of correlations. In this way, living things have many common shared perceptual features that are strongly linked with common functional biological attributes, whereas distinctive features are fewer and not frequently related with distinctive functions. Non-living things, in turn, present not many distinctive properties, but these

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[4] Also, there are cases where such structural description is not affected (Riddoch and Humphreys 1987; Riddoch et al. 1999), then the problem lies in visual processing, and perceptual similarity becomes specially relevant for both living and non-living things.

are strongly correlated with distinctive functional information, and just but a few shared features which are mainly of a situational or cultural character.

4. CSSD AND CATEGORIZATION IN COGNITIVE LINGUISTICS

From our point of view, experimental research on CSSD shows us the picture of what is mostly entrenched in our minds concerning categorization of objects. It shows the basic tenets of our basic conceptual structure, since it proves what is the backbone of that structure.

Although it has been admitted in Cognitive Linguistics (Rosch 1976; Wierzbicka 1985; Lakoff 1987) that there are domain differences in conceptualization, we still find the tendency to overgeneralization models, when dealing with conceptual structure (Hilferty and Cuenca 1999). Even in theoretical studies, where differentiation of domains is acknowledged (Lakoff 1987; Ungerer and Schmid 1997), no different domain schemata are proposed, probably, because no detailed analysis of the internal features of the domains are tackled. An example of this overgeneralization tendency is found in the hierarchical model of conceptual structure, where the same types of attributes and levels of conceptualization are posed for elements of any domain. Perhaps, the work of Wierzbicka (1985) has been the closest attempt to develop practical linguistic analysis, bearing in mind possible domain differentiations, although these were mainly based on the sensory-functional proposals of Warrington and colleagues, already commented. However, the neuropsychological studies keep on providing evidence of different semantic structures across domains, however, current research shows that the relevant difference lies in the different weighting of intercorrelation patterns rather than just in the weighting of types of features according to their content.

Regarding types of attributes, CSSR studies demonstrated that encyclopaedic or associative information is early lost in cases of brain damage, as it is no relevant in cases that affect semantic memory, therefore, although research on Cognitive semantics is mainly based on this information (Langacker 1987; Hilferty and Cuenca 1999), it cannot be accounted as the basic foundation of our conceptual structure. Also, what is considered relevant functional information varies across domains. In the case of functional information for the artefacts domains, the form-function relationship as well as the interactional functions were already established in linguistics (Wierzbicka 1985; Lakoff 1987, Taylor 1990), however, within the biological domain, form-function relationships were not clearly defined, and so functional information included many associative attributes, such as contexts, in a relationship of the type, *cat-home* versus *lion-jungle.*

What becomes more relevant for the domain differentiation are the patterns of correlations. In Cognitive Linguistics, the concept of correlation is looser than in neurocognitive research. For cognitive linguistics, correlation is understood as the occurrence of features that usually happen to be together. However, in these neurocognitive accounts the correlation of features refers to the link between specific types of features. It is not a question of bundles of features that occur together, but of certain features which not only occur together but that are linked to one another.

For example, in the schematic representation of objects such as *table* and *chair,* at the basic level, the concept of *chair* is described (Ungerer and Schmid, 1997:68) by means of specific attributes, such as, *has seat; has back; is used to sit on etc,* and in the case of *table* those specific attributes are *has plain top; is used to write on; is used to eat on etc.* The shared attributes of both are *has legs; made of wood or metal; goes with chair / table*. However, neuropsychological research shows that what is relevant across domains are, precisely, the links between the given features that usually occur together. For example, if we apply this concept to the examples of *chair* and *table*, in the case of *table*, the occurrence of features relevant for this concept would be re-written as: *Has a plain top* ν *things can be placed on*. In the case of *chair* the specific attributes could be paraphrased as: *Has a seat* ν *it can be sit on*. The common attributes could be rewritten as *Has legs* ν *but they cannot move on themselves* ν *it can stand*[5].

In addition, domain differences emerge in the form of patterns of correlations, when establishing these links. As already said, in the case of man-made objects, these links are found between distinctive functional-perceptual features, whereas in the biological domain, these are established between shared general biological functional-perceptual attributes. These patterns of correlations, understood within the framework of Langacker's (1987; 1998) conceptualization strategies, contribute to the understanding of these different strategies applied across domains. In this way, it can be interpreted that what will constitute the main conceptualization process will be different for each domain: in the living things domain the intercorrelation patterns imply the use of extension processes, developed by means of comparison strategies, whereas in non-living things domains these patterns of intercorrelation imply elaboration processes, which are mainly based on contrast between distinctive features, until what is common to all of them is reached.

Moreover, Langacker's (1987; 1998) idea that extension processes activate high-level schemata, and elaboration processes low-level schemata agrees with the fact that the domain of living things would take advantage of extension processes, whereas the domain of non-living things would benefit from elaboration processes. Likewise, it would be in accord with Humphreys and Forde's (2000) claim that living things domain benefits from higher levels of processing and non-living things from lower levels.

If we were to reinterpret patterns of correlations within the frame of the hierarchical model, the fact that correlations of common shared features are more relevant, in the biological domain, and therefore, that these concepts show greater optimal processing in categorization than in recognition tasks leads to the idea that the basic towards superordinate level is more relevant for concepts of this domain. In fact, Rosch (1976) already stated that for natural objects the basic level was at a bit higher level than that of artefacts. Thus, this supports the fact that, in the case of man-made objects, the patterns of correlations show greater relevance of few common distinctive features links, which benefit recognition processes over those of categorization. In addition, this implies that for this domain the most important level of conceptualization would be the basic towards subordinate levels.

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[5] In this case, in order to link perceptual and functional features, additional information derived from basic theories of the world is needed.

As it can be observed, if the patterns of correlations established by CSSD studies are applied within the hierarchical model, although the model may be used as a referent, it shows shortness of description tools to cover differentiation patterns, since it presents the same conceptual structure for both domains.

However, many questions are still unsolved and need specific experimental testing in CSSD. For example, in the case of the living things domain, the scarce inter-category mistakes have been proved, however, most of the common correlated shared features that can be applied to categories such as that of animals, can also be applied to people such as *having ears* v *being able to hear; having lungs* v *breathing; having legs* v *being able to walk*. That is, it will be interesting to know the intercorrelations of functional-biological-form relations that maintain the sub-domain differentiation between, in this case, animals and people.

5. CONCLUSION

In this paper we have attempted to approach some of the questions of Cognitive Linguistics lexical categorization theory to the recent research on semantic system structure, as derived from research on CSSD.

Specifically, we have reviewed the differences between the domains of living and non-living things. Intercorrelation patterns derived from research on CSSD show, at least in general terms, the different conceptual foundation of these two domains. These neuropsychological findings have been linked to ideas derived from Cognitive Linguistics on categorization and conceptualization processes, specially to those ideas that are drawn from schematization processes. The result is different to what has been usually maintained in categorization studies, where no domain differentiations are specified neither in structure, nor in conceptualization strategies. Namely, the link between neuropsychological research in CSSD and Cognitive Linguistic Schematization theory suggests that not only different conceptual structures, but also conceptualization strategies across domains can be proposed. On the one hand, in the domain of living things, the correlation patterns show an advantage of shared common information, specifically of functional biological and perceptual features. This will favour the activation of high level schemata, and the use of conceptualization processes based on comparison strategies, that is, on extension processes. On the other hand, non-living things take advantage of correlation patterns that involve distinctive perceptual-functional features. Thus, man-made objects will favour the activation of low-level schemata and the use of contrastive conceptualization strategies, that is, elaboration processes.

In addition, we believe the results of this research perfectly fit those cognitive linguistics theories that propose open and dynamic models that allow differentiation of categorization process, such as that of Langacker's model. The advantage of this perspective is that it provides the possibility to deal with parameters of distinctiveness rather than with parameters of sameness. In this way, it is possible to embrace the reality of category overlapping, and to adequate better to the existence of different and specific semantic spaces. Therefore, closed-framed models such as that of the hierarchical structure, as it is mainly based on sameness, cannot account for distinctive specificities of conceptualization, since it does not provide enough tools to represent those differences.

Moreover, these experimental results get us closer to a more fine-graded view of the processes and strategies used in categorization, although perhaps more specific experimental studies should be carried on to discover the details of sub-domain categorization. But, we also know that this linguistics goal is not easy to achieve because of the difficult interaction between neuropsychological and linguistics researches, mainly due to their pursuing of different goals.

Departamento de Filología Inglesa I
Facultad de Filología
Universidad Complutense de Madrid
28040 Madrid
e-mail: analaura@filol.ucm.es

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