Relational Semantics in Thesauri: Some Remarks at Theoretical and Practical Levels

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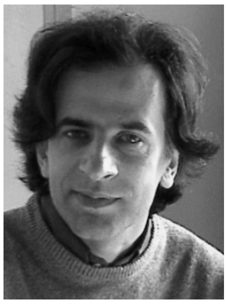

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ABSTRACT: A thesaurus is a controlled vocabulary designed to allow for effective information retrieval. It consists of different kinds of semantic relationships, with the aim of guiding users to the choice of the most suitable index and search terms for expressing a certain concept. The relational semantics of a thesaurus deal with methods to connect terms with related meanings and are intended to enhance information recall capabilities. In this paper, focused on hierarchical relations, different aspects of the relational semantics of thesauri, and among them the possibility of developing richer structures, are analyzed. Thesauri are viewed as semantic tools providing, for operational purposes, the rep-

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resentation of the meaning of the terms. The paper stresses how theories of semantics, holding different perspectives about the nature of meaning and how it is represented, affect the design of the relational semantics of thesauri. The need for tools capable of representing the complexity of knowledge and of the semantics of terms as it occurs in the literature of their respective subject fields is advocated. It is underlined how this would contribute to improving the retrieval of information. To achieve this goal, even though in a preliminary manner, we explore the possibility of setting against the framework of thesaurus design the notions of language games and hermeneutic horizon.

A thesaurus is a controlled vocabulary designed to allow for successful information retrieval (IR). It includes different types of semantic relationships that guide indexers and searchers to the selection of the most suitable terms for expressing given concepts/queries (Dextre Clarke 2001). The relational semantics of a thesaurus are concerned with methods to connect terms with related meanings and constituted by the set of meaning relationships. The basic relationships which typify a traditional thesaurus are three: hierarchical, associative and of equivalence. Being functional and not semantic tools strictu sensu, in most cases thesauri do not provide a complete and precise definition of the meaning of terms (Schmitz Esser 1991). The relational structure is designed, in fact, mainly to enhance the information recall performance (Svenonius 2000). Nonetheless, thesauri can still be regarded as (operational) semantic tools in the sense that thesaurus relations are semantic relations and that a thesaurus provides the conceptual structure of a subject field (Hjørland 2007).

A number of scholars have stressed the importance of semantic research in relation to information science (IS), and in particular to its subfield of knowledge organization, which is concerned with "the construction, use, and evaluation of semantic tools for IR" (Hjørland 2007, 369). The kind of meaning understanding can have, in fact, a considerable impact on how knowledge organization systems (KOSs), as a thesaurus, and their relational semantics are designed and implemented. The primary relationships employed in a thesaurus, in fact, although at some levels they reflect certain basic cognitive inclinations of the human form of life (as the one towards classification and hierarchization), are not 'given' as such—and thus necessarily and universally valid—but 'constructed' and defined within a certain (cultural and) theoretical tradition. In some cases, they are even based on assumptions rooted in the centuries of the history of philosophy (Hjørland 2007), as occurs with the notion of genus and species whose origin can be traced back to Aristotle and which is based on an idea of meaning that has been predominant in the Western culture.

A more detailed discussion on such a topic is beyond the scope of this paper and would concern a further investigation on the nature of semantic relations as being mostly theoretical constructs because built within the framework of a cultural *form of life* (Wittgenstein 1953), this latter being, however, expression of a most basic human *form of life*, which defines our primary cognitive means and other basic characteristics as being members of the same species. A number of models of conceptualization of the world have been crystallized and with them also certain ways to consider meaningful the relationships between words. In the Western culture, some of these relations (genus-species, synonyms, antonyms, etc.) are common to all knowledge fields. Others are more specific to particular domains (in a thesaurus they can be represented as associative relationship sub-kinds). However, the implementation of any relation always depends on the conceptual and linguistic knowledge of the domain they refer to (in a thesaurus it depends on operational concerns, as well).

Thus, in order to acquire a deeper understanding of KOSs as operational semantic tools, it is important to investigate which theories are behind the principles determining how the relations have to be established. At the same time, it is also important to explore if other theoretical approaches exist and if they can provide useful insights for such issues. A chance to deepen this topic is offered by a new trend in the panorama facing thesauri. In recent years thesauri have entered a larger area of application including knowledge and language engineering. As a consequence, in this new framework and for present and future information retrieval and intelligent processing needs, the thesaurus relational structure is likely to require an enlargement and a refinement of its definition. In order to achieve these goals, a more thoughtful exploration of the theoretical bases that guide its development appears to be necessary.

Analyzing different aspects of the relational semantics of thesauri (the focus will be restricted to the hierarchical relationship) is the subject of this paper, structured as follows. Section 1 presents the basic roles of relational semantics in thesauri as well as the actual trend towards its refinement. After hav-

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ing introduced in section 2 the difference between the instance and the generic relationships, in section 3 we investigate a number of issues involved in meaning representation occurring in thesauri through the classificatory and taxonomic aspects of their relational semantics, such as the criteria upon which the construction of the (logical) hierarchical trees are normally based and the distinction between genus-species and perspective hierarchies. In this framework, what insights may be gained from the perspective of hermeneutics and from Wittgenstein's notion of *language game* is explored, too, together with their possible practical implications for the retrieval of information. Section 4 analyzes the partitive relationship and the possibility of its refinement, through a differentiation into distinct subkinds. An overview of existing taxonomies of partitive relations is presented, too. Taking the partitive relationship as a case study, a more general discussion concerning the factors on which the choice of the kind of relations, as well as their implementation depend, is also outlined.

1. Relational semantics in thesauri: its role and possible refinement

1.1 The (general) role of the relational semantics

Thesauri are tools designed for the purpose of improving information retrieval. They are based on a natural language that is transformed, however, by means of certain semantic treatments, into an 'artificial' and normalized language where terms are basically monosemic and relations among them are made explicit. Two different semantic structures are used in order to achieve this scope: the referential and the relational semantics (Svenonius 2000). Referential semantics consists of methods to limit the meanings or referents of thesaurus terms: homonyms and polysemes are disambiguated in order to improve precision in IR.

It is through the relational semantics of a thesaurus, that is the object of interest of this paper, that terms are connected to each other when related meanings are identified, devising in this way the relational structure that enhances the information recall performance, although it can also contribute to improve precision by suggesting more specific terms that can refine the search and help to eliminate unwanted information. The network of relations of a thesaurus plays a semantic role since by means of it a further representation of the meaning of each thesaurus term and a structured representation of the general understanding of a subject area are provided. As stated by Soergel (1995, 369), in fact, "a good thesaurus provides, through its hierarchy augmented by associative relationships between concepts, a semantic road map for searchers and indexers and anybody else interested in an orderly grasp of a subject field".

1.2 Trend towards a refinement of the relational semantics

Bearing in mind these important functions of the relational structure, it is then necessary to define the degree of complexity on the basis of which the thesaurus is conceived, in order to ensure its effectiveness for information indexing and retrieval. Methods to measure its richness have already been developed. Examples can range from the number of relation types to more sophisticated indicators, e.g. the ratio of the number of semantic relations and the number of terms which are included in a thesaurus (Van Slype 1976). The traditional thesaurus format—which stems from the more than twenty year old recommendations of the Standard for thesaurus development—has been created to cope with information needs in the library and archival fields (Schmitz Esser 1991).

However, many things have changed and are presently changing (this has been partially reflected in the development of new Standards like ANSI/NISO Z.39.19.2005). Technological advance, which has also brought a larger and differentiated community to search for information on a computer basis, has established a different framework, which requires reassessing prior assumptions and reconsidering whether the existing types of relationships still cope with the current needs of information organization. And actually, a rather widespread opinion is that the traditional thesaurus format is no longer the best-suited means of dealing with these needs. It seems that a richer and hierarchically organized set of relations would be more clearly apt to face them and, as stated by Milstead (2001, 65):

> There is reason to expect that provision of semantic relationships in controlled vocabularies will become much more extensive in a future standard, though this does not automatically mean that users will need to be aware of all kinds of relationships in order to use a particular vocabulary.

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Despite the general trend towards an expansion of the semantic structure, the outcome of some past experiments comparing systems that incorporate different degrees of semantic structure seems somehow to question the equation *more structure- more effectiveness*. Besides, in order to evaluate the effectiveness of a semantic structure in IR, other factors should be considered, too, such as the comprehensiveness of the language or the manipulation in retrieval of the subject language (Svenonius 2000). This refinement is necessary to enhance thesaurus suitability for uses in the artificial intelligence (AI) and the Semantic Web environments, as well as to increase possibilities for IR. In particular, AI applications are creating a demand for more elaborated KOS able to ensure higher expressive capabilities in order to allow inference (Dextre Clarke 2001). In such a setting, the traditional relational structure is considered insufficiently detailed and lacking of a well-defined semantics. "All the well-know relationships are fuzzy in most thesauri. We could afford to allow them to be fuzzy as long as their only purpose was to achieve the desired degree of order in our documents, which is a modest requirement compared with what we need for Language and Knowledge Engineering" (Schmitz Esser 1991, 145).

Hence, along gaining a higher (conceptual and lexical) user interaction with the KOS in that the refinement of the relational semantics might improve query formulation and subject browsing, examples of new applications for which such refinement is advocated include supporting automated processing; query expansion; RDF representations of thesauri for the Semantic Web; and interoperability among different KOSs (Soergel *et al.,* 2004; Tudhope *et al.,* 2001).

Finally, the adoption of more expressive semantic relations is advised also to improve the degree of internal structural consistency. In many cases, in fact, the standard set of relationships has not been consistently applied (for instance, many links, labelled as hierarchical, could be best resolved through an associative relationship). For some authors, this is exactly a consequence of the fact that thesaurus relationships are not provided with a precise semantics (Soergel *et al*., 2004).

Some advanced thesauri are developing or have already included—mainly in the medical domain as *UMLS* or *MeSH*—richer sets of semantic relationships. A further example is the Italian CNR's EARTh project (Mazzocchi & Plini, 2005). Other projects, such as the FAO's AGROVOC, are instead more concerned with the reengineering of thesauri into ontologies. They aim at developing an enriched set of relationships—the latter would be explicitly labelled and applied with specification of rules and constraints—on the basis of a more fully concept-oriented organizational model, where concepts are regarded as independent from and preceding their designation (Soergel *et al.,* 2004). Indeed, the approach towards building thesauri with an extended relational structure partially converges with the idea and work behind ontology development. An investigation on ontologies, however, is not the focus of the present paper, even though a number of assumptions that are normally associated with them are part of the discussion.

The idea of developing thesauri and other KOSs with a more precise and rich semantics, or of using formal logic methods, and employing a notion of concept as if it were an a priori entity, can somehow be viewed as expressions of the same theoretical point of view, based on logical positivism. What is searched for is creating the conditions for an unambiguous interpretation of terms and relationships mainly to make KOSs suitable for AI applications. According to Svenonius (2004, 585):

> The knowledge representations resting upon the epistemological foundations of logical positivism in its operationalist and representational approaches to meaning are … formalized to a greater degree and as such are simpler, more uniform, and relatively free from subjective interpretation. The objectivity they provide through definitional rigor is essential for automated applications in retrieval.

This idea of objectivity, however, conflicts with the fact that meanings and semantic structures in KOSs are always established within a given *horizon* (reflecting certain theoretical views and applied to specific knowledge domains and operational contexts).

While, of course, the choice to reduce the complexity of reality for operational purposes can be made, and attempts of narrowing it down to such an extent that it becomes manageable are not rare in the AI tradition, a better refinement and specification of relations or the adoption of a logicist view of semantics does not eliminate as such the issues posed by this complexity.

The role played by human judgement in such a task and the multiplicity of different contexts in

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which all of this can occur cannot, in fact, be ignored. And this is something that we will try to demonstrate throughout the whole paper, with special focus, though, on the hierarchical relationships.

2 An introductory note on the hierarchical relationship in thesauri

The hierarchical relationship connects pairs of terms when the scope of the broader term (BT) fully includes the scope of the narrower term (NT). Generally speaking, the purpose of the hierarchical relationship is to provide a semantic tree pathway, which can be useful both as a tool for semantic control and specification—the meaning of each term is, in fact, (partially) identified by its position within the tree—and as a navigational aid, by offering users the possibility to choose the terms to employ, when referring to a certain concept, among a range situated at different levels of specificity (Dextre Clarke 2001). This relation comprises the following three different kinds: generic, instantial and partitive. In a restricted number of thesauri they are distinguished as follows:

BTG/NTG:	generic
BTP/NTP:	partitive
BTI/NTI:	instantial

The next section will first introduce the generic and instance relationships. Then, a discussion about the main features of the generic relation and a comparison with perspective hierarchies will follow. Special emphasis will be placed on how any given classification or hierarchization of a term depends on which of its conceptual features are made salient in the light of a given perspective. Section 4, instead, will analyze the partitive relationship.

3 The generic and instance relationships

The generic relationships--named also inclusion, subsumption or hyponymy—connects a genus with its species (e.g., *animals—mammals*). An important property of this relation, also used as a criterion for its identification, is the inheritance of properties: any attributes of the genus (hypernym) must also be attributable to the species (hyponym). In this sense, the meaning of the hyponym derives from the meaning of the hypernym, plus some additional features. Chaffin *et al.* (1988) distinguished four kinds of inclusion according to the type of concept involved: *natural object-kind*; *artefact-kind*; *state-kind*; and *activity-kind*. In the instance relationship the narrower terms are nor parts neither types, but individual instances of the broader terms. In a thesaurus, this characteristic of *individuality* is expressed through a proper name (e.g., *deserts—Sahara desert*).

At this stage, the distinction between generic relationship and instantiation seems clearly stated. Nonetheless, Milstead (2001) has emphasized that in the standards for thesauri there is no method used to determine the genus-species relationship that could not be applied also to the instance relationship. For example, the 'all-and-some' test—which is used to assess the validity of the generic links (ISO 1986)—can be applied to both cases (if grammatical differences in number are admitted). The same is true also for 'is a' attribution:

1a. All *mammals* are *animals* / Some *animals* are *mammals*
1b. All (although only one exists) *Sahara desert* are *deserts* / Some (one) *deserts* are (is) *Sahara desert*

2a. a *mammal* is a *animal*
2b. the *Sahara desert* is a *desert*

All of this may also lead to conceive the instance relationship as a variant of the genus-species relationship. However, unlike the generic one (concept-to concept relationship) the instance relationship points to a change of 'logical level' (individual-to-concept relation).

3.1 Associative, perspective and logically-based hierarchies

The hierarchical relationship, and particularly the generic kind, is perhaps the most important within a thesaurus and its proper application plays a key role in ensuring the quality of a structured vocabulary. But can we estimate such aptness in an abstract sense? It is true that in many thesauri this relationship has been implemented in quite an inconsistent way, often resulting in unpredictable semantic structures (Dextre Clarke 2001).

As mentioned before, a higher degree of rigour is thus advocated to improve the level of structural consistency. Nonetheless, different contexts may require different solutions, each having its own implications. Furthermore, it is of the utmost importance to investigate the underlying assumptions that the generic relationship, on which basis hierarchical trees

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are built, entails not only to deepen our understanding of it, but also to have the chance to critically analyze these assumptions in the light of a comparison with alternative models.

3.1.1 RT-kind version of hierarchy

Many existing thesauri have labelled as hierarchical relations between terms not belonging to the same conceptual category. An example of it can be found in the GEMET thesaurus where the term *Recycling ratio* (a parameter) is considered to be a Narrower Term of *Recycling* (an operation). Relationships like this have been established according to a definition of hierarchy that is of a 'pragmatic' nature and oriented towards the function of the search process: "Concept A is broader than concept B whenever the following holds: in any inclusive search for A all items dealing with B should be found. Conversely B is narrower than A" (Soergel 1974, 79).

Using such a version of the hierarchical relation can be useful to manage certain databases. But if it may somehow function efficiently at local levels, i.e. in a specific operative context, in a different and wider framework, this choice may result unsatisfactory, since a so-developed hierarchy would suffer lack of consistency with other structures, not being conform to the standard thesaurus format. Moreover, confusion may also arise if RT-kind (associative) hierarchies, like the above example, are labelled in the same way as the genus-species relation (or in any case as a hierarchical kind).

3.1.2 Genus-species and perspective hierarchies

In developing the thesaural relational structure, and thus hierarchies, Foskett (1980) emphasized the importance of the logical perspective: a thesaurus would benefit if the choice of terms and relationships reflected the logical structure of a subject field, instead of being a scarcely systematized gathering of terms extracted from the literature. Other authors as Maniez (1988) stressed that the usefulness of logical relationships should be subordinated to the purposes of information indexing and retrieval. Svenonius (2000), for her part, underlines the distinction between genus-species and perspective hierarchies. In a more general sense, this distinction, taken up by a number of thesaurus standards, is expressed as being between paradigmatic/a priori relations—e.g., genus-species and syntagmatic/a posteriori ones—among them, perspective hierarchies. The genus-species relationship is viewed as logically-based, definitionally true and functioning context independently. Besides, corresponding to the logical relationship of inclusion, it has been defined in terms of the properties of reflexivity, antisymmetry and transitivity.

Conversely, perspective hierarchies are regarded as functioning more contingently in given empirical contexts and depending on the point of view. Normally, they are not provided with the same logical properties of the generic hierarchies. They express, in fact (Svenonius 2000, 164):

> Points of view or aspects from which an object or concept is regarded. In many discipline-based classifications, the point of view is the knowledge domain in which the object or concept is located .... The genus-species relationship limits a rat to being a rodent; a perspective relationship allows it to be an agricultural pest, an experimental animal, and so on.

Thesaurus standards argue that relationships to be included in a thesaurus should be a priori rather than a posteriori. However, the genus-species and the perspective relationships can have different functions and, in defining which hierarchical relationships a thesaurus has to be made of, different factors should be taken into consideration, including the characteristics of the vocabulary to be structured and the purpose for which the relations are intended in retrieval.

Concerning the first point, Svenonius (2000 and 2004), for example, in terms of hierarchy, considers a stricter logical ordering as particularly apt to structure terms whose meanings are somehow more fixed, e.g. scientific terms, whereas she regards perspective hierarchies as more suitable to represent polysemantic and vague lexicons, as is mostly the case in social sciences. Regarding the second aspect, the genus-species relation, being logically based, is valuable, for example, for search broadening and narrowing as well as for retrieval strategies playing on inheritance properties. Perspective hierarchies, instead, are not suitable for these applications. Their added value in IR consists of providing contexts that elucidate from which point of view is a term being considered. In this way, they can assist in navigation and are apt for the disambiguation of multireferential terms (Svenonius 2000).

Perspective hierarchies are used by classifications such as the *Dewey Decimal Classification* (*DDC*). The term 'Insect', for example, while it can be located only in a single genus-species hierarchy (BT:

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'Arthropoda'), it can instead pertains to several perspective hierarchies according to the points of view from which its meaning is regarded: an insect can be viewed, for example, as an agricultural pest, a disease carrier, etc. (Svenonius 2000 and 2004). In the EARTh thesaurus, the idea of multiple thematic classifications of terms as a complement of placing them into the genus-species tree has been developed on a similar basis (Mazzocchi & Plini, 2005).

It should be noted that terms linked by perspective hierarchies belong to the same conceptual category. Yet, being these links based on a situated perspective, they are not amenable to the 'all-and-some' test and thus, according to a strict application of the standards, not accepted as a valid hierarchy. To explain this, ISO 2788 mentioned as an example 'Parrots BT Birds', which is invariably a true (generic) hierarchy, and thus compatible with the all-and-some test, and 'Parrots BT Pets', that, however, is not (being a perspective hierarchy), since some Pets are Parrots, and only some Parrots are Pets. Yet, if this is mostly true, there may be special cases or particular circumstances where this does not apply. For example, in the restricted context of a specialized thesaurus on domestic animals, Parrots as NT of Pets can be, instead, accepted.

Anyway, despite special cases, being perspective hierarchies somehow context-dependent, it seems that only genus-species hierarchies have the potential to provide the basis for a more consistent application throughout different systems.

3.1.3 The all-and-some test

Indeed, this matter is more complex than it appears. A couple of criteria are normally used to determine genus-species hierarchies. First, terms have to belong to the same conceptual category. This is a necessary (but not sufficient) condition to ensure that a hierarchy is logically based. Both the logical and perspective hierarchies are compatible with it, but (normally) not the RT-kind hierarchy.

The other criterion is compatibility with the all-and-some test. In this latter, Fisher (1998, 20) has recognized the extensional definition of subsumption:

> Informally, it is said there that concepts are taken as classes which have members, and that for a genuine narrower concept [**all**] its members must also be members of the broader concept while for the broader concept only [**some**] of its members must also be members of the narrower concept.

It should be said, however, that if on the one hand its usefulness is undeniable, on the other this test seems to present a number of issues that still need to be addressed. For example, the test does not discriminate which levels of a genus-species tree are linked when establishing a hierarchy. 'Parrots BT Birds', 'Parrots BT Animals' and 'Parrots BT Organisms' are all validated as hierarchies, since all parrots are birds, animals and organisms. But, of course, they encompass a different degree of (conceptual) information.

3.1.4 The intentional definition of the generic relationship and its historical predecessor

Naturally, the genus-species relationship may also be described on the basis of a representation of terms/concepts as sets of attribute values or features. We proceed from superordinates to subordinates, which contain all the attribute values of the former, by means of the addition of further key conceptual features (Fugmann 1993). In this formulation, Fisher (1998) has recognized a form of the intentional definition of subsumption. Of course, as concepts become more specific they will also correspond to smaller classes of referents.

In order to better clarify this scheme, it might be helpful to briefly refer to the philosophical tradition from which it derives. Broadly speaking, the origin of the notions of genus and species in the history of the Western thought can be traced back to Plato's and Aristotle's philosophies, whereas the representation of a series of subsequent genus-species links, that starting from a top level (categories) go down to the ultimate or *infima species*—which in turn are superordinate to the *individuum*—through a vertical taxonomic structure, was firstly conceived with the Porphyrian tree.

The crucial notion for the establishment of the genus-species relationship is that of *specific differentia,* which represents the key distinctive element differentiating a species from all others sharing the same *genus* (co-hyponyms). For example, the category 'substance' with the *specific differentia* 'material' becomes the subordinate genera 'body', while with the *differentia* 'immaterial' it becomes 'spirit.' The tree in figure 1 derives from adding, along different hierarchical levels, *differentiae* to the first of the ten Aristotle's categories, *substance.* Even though Aris-

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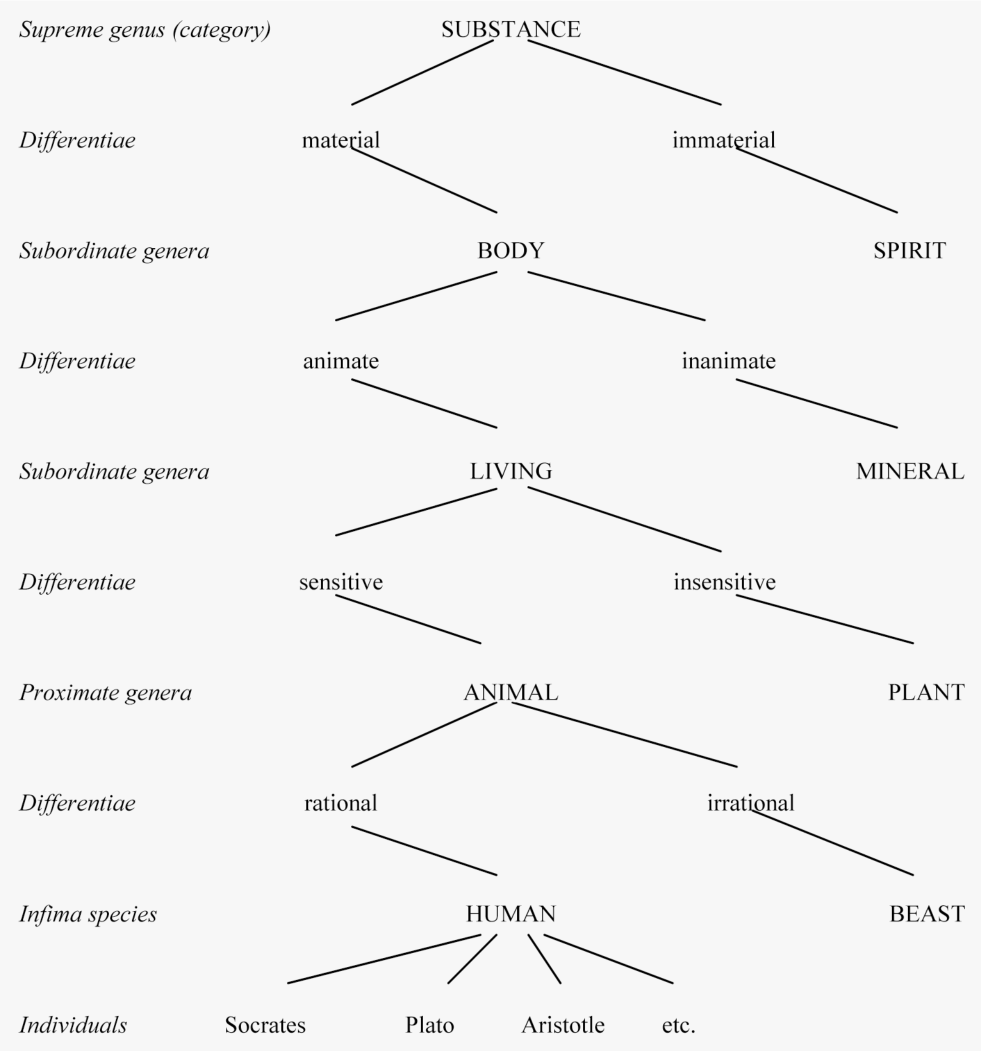

Figure 1. the Tree of Porphyry, as drawn by the 13th century logician Peter of Spain (by Sowa 2000, slightly modified)

totle never puts it in this way, by means of the same method analogous trees are expected to be developed from any of the other categories (quality, quantity, relation, where or place, when or time, position, having or state, action or operation, passion or process). According to some authors (Girgenti 2004, introduction to Porphyry's *Isagoge*), the genus-species tree can be navigated both in an upward direction—ascension, according to a logical point of view—or in a downward direction—declination, based on an ontological perspective.

The same notion of *differentia* plays a key role also in defining. A classic example is the definition of man (human) as a 'rational animal.' The parts of this definiens are 'animal', the *proximate genus* that incorporates within its range of meaning all the essential elements of the superordinate genera and 'rational', the *specific differentia* distinguishing man from all other animals. Listing all the *differentiae,* 'human' is defined as 'rational sensitive animate material substance.'

Summing up, in a hierarchical arrangement obtained in this way, two items are most relevant: the mechanism of conceptual feature addition (the lower level is always a subclass of the higher one) and the key differentiating character of the added conceptual features. For Aristotle, such a method reflects, on the logical and language planes, a principle that operates on an ontological level with the purpose of identifying the distinctive features of things. Should the latter be adopted, the problem is then how to put it into practice, also considering that our highly structured contemporary knowledge systems seem to be developing more on a horizontal and sectorial plain, than on a vertical level, as a univocal unfolding from an *Ur*-structure.

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More generally, the possibility itself of accessing on a rational level the 'meta' point of view— i.e., the fundamental 'place of observation' where the ontological order is unveiled—has become, from an epistemological point of view, questionable and thus, together with it, also the chance to separate, in a final and objective way, what is essential from what is accidental and to develop that 'unique' genus-species tree, which derives from the further addition of *specific differentiae* to the top categories.

According to Eco (1983), also Aristotle in some of his works, such as *De partibus animalium*, recognizes at an another level the possibility to develop multiple trees, that could be complementary among themselves, according to different perspectives. Given the impossibility to univocally distinguish accidental from distinctive features, such characteristic of distinctiveness can, in Eco's view, be acquired only in relation to a situated perspective (e.g., the classificatory or definitory problem in question).

Contemporary biological systematics and taxonomy provide an interesting example of synchronic copresence of different theoretical approaches. The classic Linnean approach—arranging organisms by their morphological similarities—and cladistics (or phylogenetic systematics)—where living beings are classified on the basis of their order in branching in an evolutionary tree—coexist and may also be used in a combined way to obtain further information. Different (theoretical) perspectives can, thus, lead to focusing on a diverse set of characteristics. But they need not necessarily be regarded as being in opposition. There may be cases in which they provide complementary information, useful in obtaining a more complete picture of the matter.

3.1.5 Classification as interpretation

Broadening the perspective, this latter position may (partially) be related to the notion of interpretative horizon as developed, in Gadamer's work, in the framework of contemporary hermeneutics. Such a notion, in fact, has mainly been used to explain the historicity of human understanding, yet in a more general way it can be regarded as the range of vision including "everything that can be seen from a particular vantage point" (Gadamer 1976, 302). In opposition to an objectivistic and universalistic view, the idea of 'classification as interpretation' acknowledges the fact that any classificatory act is always made from a delimited horizon, which determines how classification is conceived and undertaken and, thus, within the limits of certain basic constraints, which aspects of an item (term or object) are made salient.

In information science, Hjørland and Nissen Pedersen (2005) have developed a theory of classification for IR (that by extension can be applied to hierarchization) somehow reflecting this principle and that has been summarized by Hjørland himself (2007, 373) as follows:

> Classification is the ordering of objects (or processes or ideas) into classes on the basis of some properties. (The same is the case when terms are defined: It is determined what objects fall under the terms) .... The properties of objects [which are portrayed in the conceptual features of the terms used to name such objects] are not just 'given' but are available to us only on the basis of some descriptions and pre-understandings of those objects [although these still have 'objective' properties] .... Description (or every kind of representation) of objects is both a reflection of the thing described and of the subject creating the description .... The selection of the properties of the objects to be classified must reflect the purpose of the classification. There is no 'neutral' or 'objective' way to select properties for classification because any choice facilitates some kinds of use while limiting others .... Any given classification or definition will always be a reflection of a certain view or approach to the objects being classified.

Regarding classification as interpretation means to acknowledge the fact that we always act from a *classificatory horizon* (Paling 2004). This notion, however, needs to be further explained and this can be done by indicating its possible constitutive elements. First, it comprehends the ontological and epistemological meta-assumptions that provide the 'lens' through which we look at the world (Kuhn 1970) and the way in which they are reflected in the scientific activity. For example, positivism and instrumentalism or hermeneutics have different views of the (same) world and, accordingly, lead to different conceptions of classification and hierarchization, too. Secondly, it includes the domain to which the classification is referring. As stressed in their theory by Hjørland and Nissen Pedersen (2005), criteria for classification are (usually) domain-specific, since different domains may need different descriptions and

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classification of items in order to meet their specific purposes.

For example, 'benzene' can be described and defined in several different ways depending on the discipline or context in which it is considered. Chemists, of course, emphasize its structural properties in being precursor of a class of chemical compounds. Yet, physicists may focus on other properties and see it as a volatile and inflammable. Other descriptions can emphasize its possible effects—biologists may consider its toxicity and the different routes through which it can enter an organism—or employments—engineers would consider it as a fuel for combustion engines (Fugmann, 1993). Furthermore, the fact that within the same domain conflicting paradigms and views can coexist should also be taken into consideration (Hjørland 2007, 385): "in every domain, there exist different theories, approaches, interests, or 'paradigms', which also tend to describe and classify objects according to their respective views and goals."

Finally, the purpose of classification plays a role in determining the *classificatory horizon,* too. In fact, even if a domain can be viewed in terms of a common paradigm, different practical concerns may lead to different choices in establishing classificatory and hierarchical structures.

3.1.6 Possible insights from the language games theory

In this context, we believe that the notion of language games (*Sprachspiele*) can play a significant role and be relevant for IS issues, too. This notion has been introduced by Wittgenstein (1953) to explain the multiplicity of language practices that occur within a language. Language does not consist, in fact, of a single unified game. It is regarded, instead, as a collection of multiple and indefinite games. The basic assumption of this theory is that the meaning of a word should not be regarded in terms of its referent, but of its use. Speaking language is a social action. To know the meaning of a word means to know how to use it as part of an activity, within the framework of a particular language game and its rules.

Wittgenstein has introduced also the notion of *family resemblances*. Considering several possible and different *Sprachspiele*, the instances of the use of a word do not (necessarily) share a common denominator or essence (as it is, instead, assumed in class inclusion). They are 'peripherically' linked through family resemblances, being similar but each in a different manner, like members of a family (where some may have the same eyes, others the same form of mouth or chin, but without a single feature that necessarily all share).

Following this theoretical approach, it is clear that, having language and meaning the above characteristics, they should not be confined to the rules of a particular language game. Should a deeper investigation still be required, this has a number of important implications with respect to the idea of hierarchical arrangement (in general and applied to a thesaurus) and to a number of other issues. As stated by Svenonius (2004, 578):

> Subscribing to the concept of language games entails subscribing as well to the position that knowledge representations are not descriptive of things and relations in the real world; rather they are descriptive of linguistic behavior. The use of knowledge representations to organize information is one kind of language game, one kind of linguistic behaviour.

Besides, linking again the main point to what has been said in the previous paragraph, it could be affirmed that each field of knowledge, which has its own set of conceptualisations, has also its particular language games with specific rules (although this does not mean that they cannot share common elements). Meaning of words can, therefore, change (at least partially) from one domain to the next: "the meanings of words—and, thus, words used to name subjects—are in part fixed and, in part, variable. The variable part assumes its value by being contextualized within a system of concepts" Svenonius (2004, 581).

Further considerations would be needed to investigate whether a hierarchy of conceptual features is possible, if some of these features cannot be 'cancelled' (without causing the total alteration of the associated meaning) and what their nature is. The meaning of a term has, in fact, also a more stable part, that is likely to be maintained also after a major paradigm shift or along different domain-based viewpoints. Coming back to the example of 'benzene', all the listed descriptions share a common premise: benzene, first of all, is a 'substance' (that can have toxic effects, be used as fuel, etc.). Similarly, although diverse taxonomizations of a certain kind of animal may be possible (see note 5), none of them questions its recognition and classification at a higher level as an animal. These features, thus, provide a more stable *background* while modifications occur mostly at a *foreground* level.

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Furthermore, in a given historical period, being expression of the dominant view, certain semantic relations (and then those conceptual features on which their establishment is based) appear to be more 'stable' and can be (extensionally) validated by the all-and-some test. For example, according to the taxonomy of the scientific discipline which is interested in studying it (chemistry), benzene <is_a> 'organic aromatic substance' and this 'always' holds. But this is not always the most important aspect in terms of application. In a nature conservation thesaurus, it might be more useful to represent the meaning of benzene as a 'pollutant' rather than as an 'organic aromatic substance'. It is, however, true that this kind of relationships, in virtue of the stronger consensus sustaining their institution, can (at least) provide a basis to ensure a certain degree of compatibility and interoperability among different systems.

Of course, not all the words convey meaning in the same manner. Some of them have more variable meanings, i.e. more dependent on the context, than others. For example, words used in the social sciences are regarded to have more variable meanings, whereas words used in science as having more fixed meanings. But this is only partially true. Not only, in fact, meaning of scientific words changes along history in correspondence of paradigm shifts (Kuhn 1970). The idea that, in a given historical moment, science is a knowledge system based on universal conceptual structures and that words used in scientific discourses have one and the same meaning in all disciplinary domains has been questioned by part of the XXI century epistemology. Kuhn (2000), for example, regards each discipline or community of practitioners of a certain scientific field as bearing its own set of conceptualizations, crystallized in a particular lexical taxonomy, in the frame of which terms acquire specific meanings. This implies that for a (restricted) number of terms meaning changes along different disciplinary fields (local incommensurability).

Evidently, this fact can be particularly relevant for the design of the hierarchical arrangement of scientific thesauri whose subject field is multidisciplinary (as those devoted to 'environment'). Moreover, the fact that in a given field of knowledge, different theoretical views can exist simultaneously, providing different descriptions of objects and interpretations of the meaning of terms, although less evident (and also less agreed upon) may be applied to scientific disciplinary areas, too (see also note 5).

Thus, in all cases, concepts are not a priori (and as such universal) entities, but should be regarded in the context of a given conceptualization system in which they are embedded. The meaning of words, including those that are part of scientific vocabularies, should be understood according to the rules of the language games they belong to. The same word can have (slightly or significantly) different meanings according to its use in diverse language games, which can pertain to different knowledge fields or to different theoretical views inside the same domain.

3.1.7 Implications for the retrieval of information

Both principles based on a hermeneutic perspective and the language games theory have practical implications for the retrieval of information (based on the use of a thesaurus). Many databases contain, in fact, documents that have been produced in different subject fields and, when within the same domain, sometimes according to different theoretical perspectives. Meaning, however, cannot be defined by examining the documents of a literature as such. Documents should rather be seen as a means to access the conceptual structure of a given knowledge field and the language games that it encloses.

Words (used in documents), in fact, pertain to given language games. Each paradigm within a given domain (of which it embodies the 'cognitive' authority), specifies the basic rules of the use of any term and, then, its meaning. If searchers, as is actually the case, look for concepts (contained in documents) as defined in subject fields and their literatures, semantic tools such as thesauri should be able to represent—by means of their hierarchical arrangement and other relations—the meaning of words consistently with how these are defined in the language games of such domains. The retrieval of information would, in fact, be facilitated if a subject field represented in the documents of a database had such documents indexed and searched by means of words used in accordance with the (domain-based) language games they refer to (Andersen & Christensen 1999).

In particular, users should be made aware of the possible different views on the meaning of words (as occurs in different language games) and, thus, of all the possible different views on a given topic (that can focus on as many aspects of it) which may be useful for them (Hjørland 1998). As underlined by Hjørland (2007, 389), while attempts at standardizing terminology can cause the removal of some of these views, "a precondition for designing quality

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KOS is that the designer knows the different views and is able to provide a reasonably informed and negotiated solution."

Of course, a thesaurus has its own language game, too, whose rules are basically oriented towards the achievement of a semantic univocity for operational purposes. However, there are a number of devices that can be used in a thesaurus to represent the different aspects of the semantics of terms and (wherever necessary) to disambiguate them. One of these is the coupled use of genus-species and perspective hierarchies, in order to exploit the different functions that they could have. As already mentioned in 3.1.2, perspective hierarchies can provide additional views about the semantics of a term (or the aspects of a given topic) and can be used for disambiguation purposes, while 'all-and-some' hierarchies can also provide a shared basis to make different KOSs more compatible and interoperable.

4. The partitive relationship

This section deals with the partitive relationship. A number of taxonomies organizing it into subclasses are also presented, followed by some remarks on the role played by 'interpretation' in implementing these relations (and semantic relations in general) to satisfy the needs of different conceptual contexts and empirical circumstances.

In the partitive relationship (also named meronymy) the narrower terms are parts of the broader ones. In linguistics, a number of test-frames are used to detect it, such as 'an X is a part of a Y' (or inversely 'a Y has an X / Xs'), but none of them seems to provide an unambiguous indicator of it, since they can also be used to express non-meronymic relationships (Cruse 1986).

Furthermore, which basic properties (among reflexivity, antisymmetry and transitivity) may be ascribed to this relationship is still a debated topic (Iris *et al.*, 1987; Winston *et al.*, 1986). As a rule, thesauri standards regard only four types of this relation as hierarchical: those taking place among parts of the body; organizational structures; geographical locations and disciplines or fields of knowledge. All other cases are classified, instead, as associative relationships, even though exceptions may be accepted in specific subject areas (ISO 1986). The partitive relationship is, thus, not restricted to material objects and should be viewed as a collection of different subkinds (Iris *et al.*, 1988). Yet, no consensus has been reached on the identification of such subkinds, nor has on the linguistic patterns that express them.

4.1 An overview of existing taxonomies of partitive relations

A number of interesting studies have been undertaken in different knowledge fields, such as linguistics, logic and cognitive psychology, in order to develop a taxonomy of partitive relationships. Mostly, they focus on the degree of differentiation of the parts and on their role with respect to the whole. Despite their different origins and aims, the outcome of these studies provides useful insights also for a refinement of this relationship in thesauri.

Perhaps the most influential taxonomization is by Winston *et al.* (1987), based on experimental data and on a psychological perspective. Winston and his co-workers distinguish six subtypes on the basis of the values of three relational elements, which summarize the attributes of the relationships:

1. Functionality (functional/non functional): parts are/are not in a specific spatial or temporal position with respect to each other, which sustains their functional role with respect to the whole.
2. Degree of similarity (homeomerous/non homeomerous): parts are similar/dissimilar to each other and to the whole to which they belong.
3. Spatial cohesion (separable/inseparable): parts can/cannot be physically separated from the whole.

Subtypes	Examples	Functional	Homeomerous	Separable
Integral object-component	Cup-handle, Linguistics-phonology	+	-	+
Collection- member	Forest-tree	-	-	+
Mass-portion	Salt-grain	-	+	+
Object-stuff	Bike-steel	-	-	-
Activity-feature	Shopping-paying	+	-	-
Area-place	Desert-oasis	-	+	-

Table 1. Winston et al.'s taxonomy of the partitive relation

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This scheme has already been integrated in some advanced thesauri, e.g. in the project for the development of an environmental thesaurus—EARTh (Environmental Applications Reference Thesaurus).

Together with the description of each relation of the Winston *et al*.'s scheme, in order to have a look at some results of this implementation, we have listed a number of demonstrative partitive cases extrapolated from EARTh's environmental (and closely related) terminology.

Integral object-component
It takes place between a whole (an 'integral object')—which presents some kind of patterned organization or structure—and its components. These latter are also patterned and generally bear specific structural and functional relationships to one another and to the whole of which they are parts. Integral objects consist both of things having an extensive dimension, such as physical things (e.g., natural objects or artefacts), and things whose parts are not extensively contained in their wholes, such as abstract objects and organizations. Due to this reason, a further differentiation in subtypes might still be planned. Accordingly, in the EARTh thesaurus this relation is expressed as follows: <has_component/is_component_of>, used for material objects—these include, for example, biological systems (cells, anatomical structures, plants) and, among artefacts, instruments, installations and buildings—and their parts; and a second expression, which however still needs to be defined (for the time being the generic <has_part/is_part_of>) to be used, instead, to express the relation between abstract entities, as for example disciplines, and their 'parts'.

Cell <has_component> *Cell membrane*
Cardiovascular system <has_component> *Heart*
Electric vehicle <has_component> *Electric engine*
Ecology <has_part> *Land ecology*

Collection-member
It records membership in a collection. This relationship does not require that members have a given structural organization or carry out a particular function in relation to each other and to the whole. Collection-member has some similarity to (and can consequently be confused with) the relationship of inclusion since both involve membership of individuals in larger sets. Nevertheless membership in a class (genus) is determined by similarity to the other members (species) based on a set of intrinsic properties. Membership in a collection is instead defined on the basis of characteristics that are extrinsic to the individual members, such as spatial or temporal proximity or a social connection. Chaffin and Herrmann (1988) distinguish three subkinds of this relationship: *group-member* (e.g., herd-cow); *member-collection-member* (e.g., tree-forest, fleet-ship); and *organization-unit* (e.g., army-battalion). Up to now, in EARTh *collection-member* has been applied to connect material objects and is expressed by <has_member/is_member_of>.

Flora <has_member> *Plants*
Game <has_member> *Game species*
Car population <has_member> *Car*

Mass-portion
Portions are homeomerous parts of physical objects or masses since every portion is similar to the others and to the whole. They have arbitrary boundaries and lack functional relation to the whole. They should also be distinguished from 'pieces' that originate, for example, from the destruction of an object and, unlike portions, are not always homeomerous. In Cruse's words (1986, 158) "The contrast between parts and pieces is potentially operative even with highly integrated wholes such as animal bodies: there is a clear difference between such a body hacked to pieces, and one carefully dissected into its parts". Chaffin and Herrmann (1988) make also a distinction between *mass-measured portion* (e.g., pie-slice) and *mass-natural tiny piece* (e.g., salt-grain). Furthermore, they include also *measure-unit* (e.g., mile-yard) as a third subkind. In EARTh, so far it has had a quite limited application and is expressed by <yields_portion/is_portion_of>.

Land <yields_portion> *Parcel of land*

Object-stuff
This relation links an object to the substance or material from which the object is naturally made or manufactured/created. It differs from the object-component relationship in that the stuff of which an object is made cannot be physically separated from it without altering its identity. Chaffin and Herrmann (1988) distinguish *mass-stuff* (e.g., trash-paper) from *object-stuff* (e.g., lens-glass). These authors, like others such as Ahmad and Fulford (1992) and Iris et *al.* (1988), do not regard this relationship as partitive. It can, in fact, be considered also as a kind of associative relationship, as has occurred, for example, in EARTh where it is expressed by <consists_of/ is_matter_of>.

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Road <consists_of > *Asphalt*
Can <consists_of > *Tin*
Bicycle <consists_of> *Aluminium*

Activity-feature
It points to the relation focused on those parts—phases, stages, discrete periods, features, etc.—that form, in a structured manner, a process or an activity, which constitutes the whole. Chaffin and Herrmann (1988), who do not include it among partitive kinds, distinguish *process-phase* (e.g., growing up-adolescence), *continuous activity-phase* (e.g., cycling-pedaling), and *discrete activity-phase* (shopping-buying). In EARTh, this relationship has been applied to (mostly natural) processes and to (social and other related) activities and their 'parts'. It is expressed by <includes_ phase/is_phase_of>.

Metabolism <includes_phase> *Anabolism*
Environmental policy <includes_phase> *Nature conservation policy*
Transport planning <includes_phase> *Road planning*

Area-place
It is applied to things that have a spatial extent, indicating the relation between areas and specific places within them. The latters are inaliable parts of the whole (areas) in which they are included. However, like members of a collection, places are not parts because they functionally contribute to the whole. In EARTh, it has been applied mostly to geographic entities and expressed by <spatially_includes/is_ spatially_ included_in>.

Desert <spatially_includes> *Oasis*
Earth <spatially_includes> *Continent*
City <spatially_includes> *City centre*
Park <spatially_includes> *Central park area*

Apart from Winston *et al.*'s proposal, there are also other taxonomies of the partitive relationship, mostly developed in the linguistics domain. For example, the above mentioned Chaffin & Herrmann (1988), distinguish a set of subkinds by using relational elements that do not coincide with those of Winston *et al.*. Iris *et al.* (1988), propose a classification founded on four basic models. Three of them (the *functional component*; the *segmented whole*; *collection and members)* are similar to the first three Winston *et al.'s* categories, whereas the other *(sets and subsets)* resembles the notion of class-inclusion. Another comparable list has been proposed by Gerstl & Pribbenow (1995), who identify kinds induced by (*mass/quantities*, *collection/elements* and *complex/components*) or independent of (*segments* and *portions)* the compositional structure. Finally, Cruse (1986) classifies the partitive relationship according to quantificational differences.

WINSTON *et al.*	IRIS *et al.*	GERSTL & PRIBBENOW
Integral object/component	Functional component	Complex/components
Collection/member	Collection and members	Collection/elements
Mass/portion	Segmented whole	Mass/quantities

Table 2. (Partial) overlapping of partitive categories in three of the cited taxonomies

In the work carried out by the Subcommittee on Subject Relationships/Reference Structures of the ALA (American Library Association) Subject Analysis Committee (1997)—who has compiled a master list of 165 relationships from subject indexing and cataloguing literature—two main categories are distinguished: the first, *composition partitive relationships,* focuses on aggregates or composites of various members of a class of entities; and the other, *whole/part pairs*, is based on structural and spatial relations and consists of further eight subtypes.

- Composition partitive relationships
- Whole/part pairs
  - Non-physical whole/part pairs
  - Physical whole/part pairs
    - Anatomical whole/part pairs
    - Artefact whole/part pairs
    - Geographic whole/part pairs
  - Topic inclusion
  - Discipline/subdiscipline pairs
  - Whole/attachment pairs
  - Whole/integral part pairs
  - Whole/piece pairs
  - Whole/segmental part pairs
  - Whole/systemic part pairs

Table 3. Subtypes of the partitive relation from ALA (simplified version)

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Of course, in the framework of ontologies, where attempts to eliminate problems of ambiguity by providing formal definitions of relations are undertaken, the issue of meronymy is greatly discussed, too. An interesting paper dealing with this topic, though in the framework of a broader analysis, is from Smith *et al.* (2005), who have advanced a Relation Ontology to assist the development of biomedical ontologies, such as the Gene Ontology, and promote their interoperability.

4.2. *Some remarks on relation refinement and implementation*

Without going further into this analysis, even though the overview is still incomplete, it seems possible to infer an interesting point, that can be applied to all relational patterns. Despite the general agreement regarding a restricted number of basic relationships (namely hierarchical, associative and equivalence), that are in fact used in thesauri and other KOS, a consensus on how to differentiate them into distinct subkinds has still not been—and seems more difficult to be—achieved. Some authors such as Tudhope *et al.* (2001) have highlighted the risk of an undisciplined extension of the basic semantic model. For this reason, in order to ensure a certain degree of interoperability among advanced systems adopting different solutions, they advocate the adoption of a minimum common denominator—namely the basic thesaural relationships—for different types of applications.

All of this may be partly comprehensible since we are still at an experimental stage in this research field. However, even though, as viewed in the case of the partitive subkinds, there is a more stable consensus among scholars on some more specific relations, the difficulty of univocally determining the 'final' set of relations may also be connected to an impossibility of identifying a solution for any circumstance and context and which could be regarded as equally valid from all viewpoints. Hjørland (2007, 380-381) has underlined, for example, how choices concerning which kinds of semantic relations a system should include have to be related to their practical usage in IR: "In a way, it is the specific 'information need' that determines which relations are fruitful and which are not in a given search session. A semantic relation that increases recall and precision in a given search is relevant in that situation."

The fact is that the further differentiation of the basic semantic relations into subkinds and their better definition do not necessarily guarantee the same results in all applications. Once a shared set is established, this latter may still be dissimilarly implemented. As already said in describing classification, multiple features can, in fact, be ascribed to terms (or objects). Depending on which of these features are made salient in a given context, different relations can be established.

Indeed, the application of the relations in a thesaurus should reflect the knowledge of the subject area that the thesaurus aims to represent (with its paradigms and language games). Besides, it can vary according to different practical concerns and, in any case, to the way in which the criteria defining relations are interpreted and implemented in given circumstances. This might be applied to the partitive relation, too. Depending on all these factors, there could be room left for different ways of conceiving how parts relate to wholes. As underlined in their study of partitive relations by Chaffin & Hermann (1988), even the same pair of objects, and thus of words representing these objects, can be viewed as being connected by different relations once the context changes. This means that, even though cases of strong relational 'ambiguity' of such kind are somehow limited to a restricted number, there is not a single way to associate a word-pair to a relation kind (and this concerns also other kinds of relations) (Chaffin & Hermann 1988, 321-22):

> The phenomenon of relation ambiguity makes the point that relations are constructed from knowledge of the two concepts related and that a particular relation may make use of some aspects of the two concepts and ignore others .... If two words have more than one relation, then each relation must be based on somewhat different aspects of the two concepts. This point about relation ambiguity may be clarified by comparison with ambiguity in other domains. The closest parallel is with categorization of concepts .... A word pair, more strictly a pair of word senses, may likewise support more than one relation. A relation need not to give equal weight to all aspects of the meaning of the two words. Relations typically emphasize some aspects and ignore others.

An example analyzed by different authors is 'kitchen-refrigerator' (Chaffin & Hermann 1988; Iris *et al.*, 1988; Winston *et al.*, 1987). It has been viewed as:

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integral object-component, when the most important aspect of the refrigerator is considered to be its function in relation to the kitchen (position shared by most of the authors);
mass-portion, when the important feature to focus on is size, e.g., in those situations where small kitchens in contrast to large refrigerators are considered (this attribution seems, however, too circumstantial);
area-place,–when the focus is on the occupied spatial area in relation to the kitchen.

In particular, the possibility of interpreting a word-pair either focusing on the component function and the whole or on the spatial relation occurring between them, pertains, indeed, also to other cases concerning, for example, body structures and geographical items. Remembering that a *component* (normally) plays a functional role in relation to an *integral object* taken as a whole but is separable from it, and that, instead, a *place* is not in this same relation to the *area*, but is rather a spatial and inalienable part of it, not always these criteria are easily applicable. A refrigerator normally stands in a kitchen (although it is not an inseparable part of it). From the viewpoint of a kitchen, refrigerators are functional but 'optional' parts since it is possible for a kitchen to lack a refrigerator (Cruse 1986). From the point of view of the refrigerator, however, its functional role can be considered apart from its relation with a kitchen (though this is its usual location). Its function, in fact, i.e. 'to store food (or other products) at a low temperature' seems more in relation to 'what' (to store) than to 'where.'

This is quite different from the relation, for example, between 'handle' and 'cup' where the functional role of the handle applies only if it is attached to the cup (of which it constitutes a 'canonical' part) and only in relation to that whole. It is interesting also to know that while they regard a refrigerator as being (normally) a functional part of a kitchen, Winston *et al.* (1987, 433) consider, instead, this latter as "merely a place within a house, not a component of the house" (in other words, 'house—kitchen' is an example of *area—place* kind). Yet, this attribution seems to be rather problematic (who would live in a house without a kitchen?).

Summarizing, in our interpretation, neither 'kitchen-refrigerator' (where a refrigerator is separable from a kitchen and has a 'partial' functional role in relation to it, in the sense that it has a kitchen primarily as its usual functional location), nor pairs like 'house-kitchen (where the part is not separable from but has a functional role in relation to the whole) seem to fit entirely in one of Winston *et al.*'s categories and can be, also for this reason, differently classified. This is not only a possible flaw of the taxonomy, but it may also derive from the fact that the complexity of the matter seems to require descriptions based on different perspectives in order to obtain a fuller view. This case seems also to underline the need for more fuzzy-boundaried relational categories: many situations could be more easily classified if conceived as part of a continuum between the two discussed categories.

What has been discussed in this paragraph furnishes, obviously, only some preliminary remarks on this topic. However, to conclude, we may affirm that, while a more elaborated structure can contribute to decrease the level of arbitrariness in the implementation of thesaurus relations, and this of course is highly recommendable, there is no guarantee that only one valid set of relations exists or that the implementation of more specific relations can provide consistent results in all situations. The hermeneutic principle mentioned in the discussion about classification is, in fact, still relevant, since different choices can be made according to different perspectives and in order to satisfy the needs of different domains and operational contexts.

5. Conclusion

A thesaurus is a tool which semantically organizes a domain of knowledge for operational purposes. Its relational semantics is concerned with methods to connect terms with related meanings and designed to support information indexing and retrieval. With focus on hierarchical relations, different aspects of the relational semantics of thesauri as well as the possibility to develop richer structures by differentiating standard relationships into subtypes have been analyzed. We have also examined how semantic issues are implied in thesaurus construction. From a certain viewpoint, a thesaurus relational structure may be regarded as a system providing the representation, for operational purposes, of the meanings of the terms contained in the thesaurus. Thus, theories of semantics, which hold different perspectives about the nature of meaning and how it is represented, affect the way in which the relational semantics of thesauri is designed.

In traditional approaches to knowledge organization the influence of logical positivism has played a

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significant role. And this is also reflected in the current trend towards an increase of formalism and standardization. The search for a more refined relational semantics in thesauri has arisen from this same framework and, according to its advocates, holds the promise to eliminate much of the ambiguity problems.

In our opinion, while it is likely that this field of study will bring valuable results in terms of an improvement of the methodological basis and of a more consistent application, different ways of interpreting meanings and of establishing semantic structures (and thus of organizing knowledge) will continue to be developed, on the basis of different paradigms, domains and operational contexts. Thus, if standardization might be justified in given operational frameworks other solutions should be explored, too. The usefulness of static and monolithic structures is, in fact, rather limited. Tools are, instead, needed that are capable of representing the universe of knowledge domains and structures in its complexity (and also flexible enough to incorporate the continuous changes in languages and meanings, not mentioning how all of this is affected by the development of technology), in order to facilitate access to its constitutive elements (concepts) that are the true object of searching.

Therefore, it is important to consider which contributions may derive from theoretical positions such as those based on hermeneutics and those based on Wittgenstein's view of language and meaning, which are more inclined to value such complexity (in terms of diversity of perspectives, contexts, rules, etc.). The possibility of their application in thesaurus design and other IR issues has been illustrated, even if this topic needs to be further investigated.

References

Ahmad, Khurshid and Fulford, Heather. 1992. *Semantic relations and their use in elaborating terminology.* Computing Science reports CS-92-7. Surrey: University of Surrey.

American Library Association (ALA), Subject Analysis Committee, Subcommittee on Subject Relationships/Reference Structures. 1997. *Final report to the ALCTS/CCS Subject Analysis Committee.* http://www.ala.org/ala/alctscontent/catalogingsection/catcommittees/subjectanalysis/subjectrelations/finalreport.htm (consulted: 15.09.2007).

Andersen, Jack and Christensen, Frank Sejer. 1999. Wittgenstein and indexing theory. In Albrechtsen, Hanne and Mai, Jens-Erik eds. *Advances in classification research. Proceedings of the 10th ASIG SIG/CR Classification Research Workshop* vol. 10. Medford, NJ: Information Today, pp. 1-21.

Chaffin, Roger and Herrmann, Douglas J. 1988. The nature of semantic relations: a comparison of two approaches In Evens, MarthaWalton, ed. *Relational model of the lexicon, representing knowledge in semantic networks.* Studies in natural language processing. Cambridge: Cambridge University Press, pp. 249-94.

Chaffin, Roger, Herrmann, Douglas J., and Winston, Morton. 1988. An empirical taxonomy of part-whole relations: effects of part-whole type on relation identification. *Language and cognitive processes* 3: 17-48.

Cruse, D. Alan. 1986. *Lexical semantics*. Cambridge: Cambridge University Press.

Dextre Clarke, Stella G. 2001. Thesaural relationships. In Bean, Carol and Green, Rebecca, eds. *Relationships in the organization of knowledge*. Dordrecht: Kluwer, pp. 37-52.

Eco, Umberto. 1983. L'antiporfirio. In Vattimo, Gianni and Rovatti, Pier Aldo, eds., *Il pensiero debole*. Milan: Feltrinelli, pp. 52-80.

Fischer, Dietrich. 1998. From thesauri towards ontologies? In el-Hadi, Mustafa, Maniez, Jacque, and Pollitt, Stephen A. eds., *Structure and relations in knowledge organization: Proceedings of the 5th International ISKO Conference.* Würzburg: Ergon, pp. 18-30.

Foskett, Douglas J. 1980. Thesaurus. In Kent, Allen, ed., *Encyclopedia of library and information science*, vol. 20. New York: Marcell Dekker, Inc., pp. 416-63.

Fugmann, Robert. 1993. *Subject analysis and indexing. theoretical foundation and practical advice*. Frankfurt/Main: INDEKS Verlag.

Gadamer, Hans-Georg. 1976. *Truth and method,* trans. G. Barden and J. Cumming from the 2nd German ed. London: Sheed and Ward.

Gerstl, Peter and Pribbenow, Simone. 1995. Midwinters, end games and body parts: a classification of part-whole relations. *International journal of human-computer studies* 43. 865-89.

Hjørland, Birger. 1998. Information retrieval, text composition, and semantics. *Knowledge organization* 25: 16-31.

Hjørland, Birger. 2007. Semantics and knowledge organization. *Annual review of information science and technology* 41: 367-405.

Hjørland, Birger Pedersen, Karsten Nissen. 2005. A substantive theory of classification for informa-

https://doi.org/10.5771/0943-7444-2007-4-197 - am 13.01.2026, 12:18:33. https://www.inlibra.com/de/agb - Open Access -

tion retrieval. *Journal of documentation* 61: 582-97.

International Standards Organization (ISO).1986. *ISO 2788: Documentation—guidelines for the establishment and development of monolingual thesauri.* 2nd ed. Geneva: ISO.

Iris, Madelyn A., Litowitz, Bonnie E. and Evens, Martha Walton. 1988. Problems of the part-whole relation. In Evens, Martha Walton, ed., *Relational model of the lexicon. representing knowledge in semantic networks*. Studies in natural language processing. Cambridge: Cambridge University Press, pp. 261-88.

Kuhn, Thomas S. 1970 *The structure of scientific revolutions***.** 2nd ed. Chicago: University of Chicago Press.

Kuhn, Thomas S. 2000 *The road since structure: philosophical essays, 1970-1993, with an autobiographical interview.* Conant, James and Haugeland, John, eds. Chicago: University of Chicago Press.

Maniez, Jacques. 1988. Relationships in thesauri: Some critical remarks. *International classification* 15. 133-38.

Mazzocchi, Fulvio & Plini, Paolo. 2005. Thesaurus classification and relational structure: the EARTh experience. In Madsen, Bodil Nistrup and Thomsen, Hanne Erdman, eds., *Terminology and content development. Proceedings of the 7th International conference on Terminology and Knowledge Engineering.* Copenhagen pp. 265-78.

Milstead, Jessica L. 2001. Thesaural relationships. In Bean, Carol and Green, Rebecca, eds., *Relationships in the organization of knowledge*. Dordrecht: Kluwer, pp. 53-66.

National Information Standards Organization (NISO). 2005. *ANSI/NISO Z.39.19.2005: Guidelines for the construction, format and management of monolingual controlled vocabularies*. Bethesda (USA): NISO Press.

Paling, Stephen. 2004. Classification, rhetoric, and the classification horizon. *Library trends* 52(3). 588-603.

Porphyry. *Isagoge,* Girgenti, Giuseppe ed.. 2004. Milan: Bompiani.

Schmitz-Esser, Windfried. 1991. New approaches in thesaurus application. *International classification* 18: 143-47.

Smith, Barry, Ceusters, Werner, Klagges, Bert, Köhler, Jacob, Kumar, Anand, Lomax, Jane, Mungall, Chris, Neuhaus, Fabian, Rector, Alan L. and Rosse, Cornelius. 2005. Relations in biomedical ontologies. *Genome biology,* 6: R46.

Soergel, Dagobert. 1974. *Indexing languages and thesauri: construction and maintenance*. Los Angeles: Melville Publishing.

Soergel, Dagobert. 1995. The *Art and Architecture Thesaurus* (*AAT*): a critical appraisal. *Visual resource* 10. 369-400.

Soergel, Dagobert, Lauser, Boris, Liang, Anita, Fisseha, Frehiwot, Keizer, Johannes and Katz, Stephen. 2004. Reengineering thesauri for new applications: the AGROVOC Example. *Journal of digital information* 4 issue. 4. Article No. 257. http://jodi.ecs.soton.ac.uk/Articles/v04/i04/Soergel/ (consulted: 01.10.2007).

Sowa, John F. 2000. *Knowledge representation. logical, philosophical, and computational foundations.* New York: Brooks/Cole.

Svenonius, Elaine. 2000. *The intellectual foundation of information organization*. Cambridge, MA: The MIT Press.

Svenonius, Elaine. 2004. The epistemological foundations of knowledge representations. *Library trends* 52(3). 571-87.

Tudhope, Douglas, Alani, Harith and Jones, Christopher. 2001. Augmenting thesaurus relationships: possibilities for Retrieval. *Journal of digital information* 1, Issue 8, Article N.41. http://jodi.ecs.soton.ac.uk/Articles/v01/i08/Tudhope/ (consulted: 01.10.2007)

Van Slype, Georges. 1976. *Definition of the essential characteristics of thesauri*. Prepared for the Commission of the European Communities. Bruxelles: Bureau Marcel van Dijk.

Winston, Morton E., Chaffin, Roger, and Herrmann Douglas J. 1987. A taxonomy of part-whole relations. *Cognitive science* 11: 417-44.

Wittgenstein, Ludwig. 1953. *Philosophical investigations*, trans. Gertrude Elizabeth Margaret Anscombe. New York: Macmillan.

https://doi.org/10.5771/0943-7444-2007-4-197 - am 13.01.2026, 12:18:33. https://www.inlibra.com/de/agb - Open Access -