Taxonomies for categorisation and organisation in sites

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Sumario

1. The concept of Taxonomy

At the moment when this article is published, a fact will have happ should mark a before and after in the evolution of taxonomies organisation systems: the appearance of the final draft of the rev ANSI/NISO Z39.19-1993 standard, *Guidelines for the construction, management of monolingual thesauri* [1] . This revision has been between 2002 and 2004 by the Thesaurus Advisory Group (herein created in the National Information Standards Organization, fo introduction of a more user-friendly language in the standard, the u scope to the current environment of digital information and the exte scope to the wide range of production and content organisations.

We do not have the draft of the revised standard, but we do have of its contents and the notes from the TAG meetings. From these we can see that one of the global modifications that have been pro change of the standard title - *Guidelines for the construction, f management of monolingual thesauri* - for *Construction, f management of monolingual controlled vocabularies* . The vocabularies include the four main types: the lists, the synonym taxonomies and the thesauri. The revision of the standard ANSI/N proposes the "normalisation" definition of the four types, and esta essential elements for the construction and management of Specifically, in the "TAG Conference Call, June 30, 2003" (provisional definitions below were included:

- List: "A set of words or phrases displayed in an organized seri
- Synonym rings: "A set of words or phrases that are consi

equivalent for the purposes of retrieval. Synonym rings ar during input."

- Taxonomy: "An organized set of words or phrases used for information and primarily intended for browsing."

- Thesaurus: "A controlled vocabulary that indicates prefer variant terms, and term relationship. Usually considered to b complex of controlled vocabularies." From the modifications p the TAG, the final definition is the following: "A set of words with equivalent terms explicitly identified and with ambiguou phrases (e.g. homographs) made unique. This set of terms include broader-narrower or other relationships."

In accordance with this definition, taxonomy does not require its c to be connected by a specific type of relationships; it simply r components to be organised. The defining characteristics are its prioritising browsing- and, therefore, the application environment environment-.

Nevertheless, in some documents relative to the process of revi ANSI/NISO Z39.19 standard, the difference between the fou controlled vocabularies is determined for the lesser or greater complexity presented. On one hand, the lists and synonym rings c the equivalence relationship; on the other hand, the thesa equivalence, hierarchy and associational relationships. In a centr the taxonomies include equivalence and hierarchical relationships.

Waiting for the TAG works to provide a normative definition of the taxonomy, we should highlight that we currently do not have a accepted concept of said term.

Etymologically speaking, taxonomy comes from the Greek term ordering, and "nomos", rule. Aristotle was one of the first to use th the year 300 before Christ, to name hierarchical schemes orien classification of scientific objects. The botanist Carl Linnaeus (1 named with the term taxonomy the classification of the living hierarchical groups, ordered from the most generic to the mo (kingdom, type, order, gender, and species). From this classic taxonomy developed as a subfield of biology, dedicated to the clas organisms in accordance with their differences and similarities. In with Grove (2003, p. 2774), the principles providing a strict gu construction of taxonomies were the logical basis, the empirical o the hierarchical structure based on feature inheritance, the evolu and the pragmatic use. The terminological sources of the general la include the meaning specifically oriented to the experimenta environment, as proven by the article including the latest version the *Diccionario de la lengua española* (2001) -Dictionary of th Language-:

"1. f. Science dealing with the principles, methods, and p classification. It is specifically applied, within Biology, to the ordering and systems, with the names of the groups of animals and

2. f. classification (? action and effect of classifying)."

In its basic concept, linked to the experimental sciences, taxonom mono-hierarchical criterion in the establishment of the classificatio

that is: each one of the groups or types making it up can only have and only one, in the hierarchical structure.

At the beginning of the 90s, in the 20th Century, the concept of t included in other fields of knowledge, such as Psychology, Social s Information Technology, to name almost all the access syste information that attempt to establish coincidences between the ter the user, and that of the system. The first specialists developing w organisation systems were part of the knowledge management area, coming from fields close to information technology and (content management and information architecture); not being a tradition of the documental languages of the Information Sciences used the term taxonomy for the systems they developed. Th currently used to name the content organisation systems in t context, although the theory and practice of the documental lan been intensively applied in this context.

Before proposing a definition of the term of taxonomy in accordan current development scopes, we have carried out a work of identif confrontation of the semantic features with which they are define purpose, we have carried out an extensive search for definitions study, development scopes and/or application of the term of Initially, we have not placed any limitation whatsoever on the o definitions; we have only discarded those made from a classical the term. The result has been the localisation of 36 definitions between 2000 and 2005 in various types of sources [2] .

The analysis of the definitions shows that these give importan variables: the place occupied by taxonomy in the scope of the organisation systems (hereinafter KOS); the information con taxonomy is applied; the purposes sought by taxonomy; and the model with which the elements making up taxonomy interrelate.

From the documentation drafted by the NISO TAG, and in the mainly accepted properties in the definitions formulated in development and/or application scopes, the following definition is pr

Taxonomy is the type of controlled vocabulary where all the connected by means of any structural model (hierarchical, tree, f and specially oriented to browsing, organisation systems and contents of the web sites.

It is necessary to specify three points in the contents of this definitio

- The terms (or categories) represent some aspect of the conte or structure of the information resources, and not only the co
- The structural models are not usually presented in a pure possible (and in the real world, usual) that a same taxono structures resulting from the mixture of models.
- The documents reflecting the discussions in TAG show agreement regarding the applications and preferential u taxonomies. Some of the notes of the meetings of said example, "TAG Conference Call, May 19, 2003" (2003)), refle concept of taxonomy was initially oriented to browsing and t in prejudice to the recovery ("searching"); in the final ver definition for taxonomy its application also includes this last m

- The folksonomies or distributed classifications are excluded concept of taxonomy (Mathes, 2004).

Once the definition of taxonomy is established, we shall carry out on the taxonomy construction processes and the applicati categorisation of resources, and the development of informat systems of the web sites. Both processes should be preceded b planning determining what characteristics the taxonomy should pr the analysis of the context-that will identify the priorities of the co the organisation and presentation of the information on the web s audience -that will identify the needs and search behaviour and the information by the various user segments- and of the content identify content patterns-.

2. Construction of taxonomy

2.1. Processes for the construction of taxor

The construction of corporate taxonomies involves the carrying processes:

1. Limitation of reality (entity, knowledge area, industrial sector, et be represented by the taxonomy.

2. Extraction of the group of terms or categories that represent said

In order to carry out this process the establishment is necessary, place, of what the priority sources are and the ideal extraction mecl each one of them. There are three types: the personal sources int web users and specialists at the web domain; document sources, in documents representative of the types of contents identified at th planning stage; and the taxonomies or knowledge representation i already existing (from nomenclatures of the units and existing reso entity to the administration classification charts).

It is necessary to identify the extraction mechanisms for each sources; thus, in the case of the personal sources, the interviews wi users and the analysis of the search transaction registers are especi

The result of this process is a register of representative terms or cat

3. Terminological control of the terms or categories.

This process involves the carrying out of two tasks. In the first terms making up a same concept are identified; in the event tha two or more, it is necessary to specify which one is consic preferential and which are the less. Secondly, giving a correct and shape to all the taxonomy elements is necessary, regardless of wh are preferential or not.

The result of this process is the establishment of the equivalence between all the taxonomy terms.

4. Establishment of the scheme and organisation structure of th categories.

The organisation scheme includes the criteria used to divide and categories. At the beginning, the criteria are limitless and their depends on the object that should be represented by the taxonomy of the most widely used criteria are the following: the subjects, t and/or disciplines; the people; the addressees; the process, ta functions; the types of documents; etc.

The structural model defines the type of relationship established b category groups derived from the organisation scheme. The genera has been the application of the hierarchical model (based on th relationship) and the tree model (based on the "part of" relationsh fact, the international and national rules for thesauri designing that applied to the corporate taxonomies exalt these two structural mod model, the faceted, is a good alternative for the hypertext environm the breakdown of various perspectives from which a same concept be seen is key. In fact, this model is being used more and more fre certain types of web sites. Nevertheless, the documentation we h revision of standard ANSI/NISO Z39.19 does not seem to show the this alternative.

Traditionally, two techniques for the development of the structure o have been distinguished: the up to down technique and the d technique.

- The application of the up to down technique involves identification of a limited number of higher categories, and th of the rest of categories in successive levels of subordina reaching the most specific levels of categories. This technic oriented both to the application or a hierarchical structural mo tree model) as well as faceted. The possibility of exercising control on the main categories makes this technique applic construction of taxonomies that have, as exclusive or priorit the development of browsing systems.

- The application of the down to up technique is based on identification of the most specific categories, which are successive levels of subordination up to reaching higher categories. Generally, this technique is mainly oriented to the of a hierarchical structural model (and/or tree model) althoug previous case, can facilitate the analysis for decision tak structural model most ideal to be applied. In any event technique that is applied to the development of intervention representatives of real and potential users in the establishn structure of taxonomies (for example, the card sorting metho

2.2. Automation of the processes of const of taxonomies

A critical factor in the construction of taxonomy is the degree of applied to the previously indicated processes. The degree of automa seen as a *continuum* : on the one hand the manual systems (or i are placed, and on the other, the automatic ones. The semi-automa are placed in a central point.

We should highlight that, currently, fully manual systems are rarely creation of taxonomies.

In the minimum level of automation, there are two types of sol taxonomy templates, specialised in a certain industrial sector, that adapted to the specific conditions of a certain organisation [3] taxonomy edition tools. This second type of solution offers the adr of the taxonomy a tank for term management, a friendly environm establishing of relationships between terms, and various mo presentation and viewing of results. Many of these applications alre as thesauri administrators, and have not included excessive inno their new function in the context of taxonomies. Examples of these be the Multites 2005 (http://www.multites.com) or T (http://www.termtree.com.au) products.

At the maximum level of automation, we find programmes that a corpus of digital resources of a web site and extract categories in fa of resources by means of the application of statistical analysis and/ processing. Generally, the process of construction of taxonomy a categorisation of resources is the same; even in some cases, th directly editable as a browsing system. An extreme option of this modality is that giving rise to the so-called dynamic taxonomies: resulting resources of a search in a search engine that usually res statistical analysis of frequencies than to linguistic processing. In the systems, the possibilities of establishing equivalence and relationships between the categories is very limited; the result is us taxonomy, closer to a clustering of resources than a classification i example of these solutions is the Automatic Taxonomy Generati from IDOL Server (http://www.autonomy.com/content/Products/ID

The completely automatic solutions have not offered, up to t moment, satisfactory results on taxonomy construction. Conseque automatic alternatives are being developed that, as Ultraseek To (http://www.verity.com/products/ultraseek/index.html), assist in t of creation and maintenance of taxonomy at the same time that it p interface for the revision and approval of categories.Said systems algorithm of statistical basis that analyses a resources corpus an terms and relationships between terms to the administrator of the this to accept them or reject them. All this in a friendly working envi

3. Resource categorisation

Categorisation can be defined as the content representation proce and/or structure or information resources by means of the assignati from a documental language -categorisation by assignation- or by the extraction of terms of the own resources -categorisation by extr

The most efficient categorisation model currently existing is that metadata. According to Méndez and Senso (2004), we can define m

" all that descriptive information on the context, quality, co characteristics of a resource, data or object with the finality of fac recovery, authentification, evaluation, preservation and/or inter-op ".

There are various models of metadata. The elements all establishment of differences between these models are, basically, tw

- Which aspects of the resources represent (the elements).

- How those elements are represented (the syntax).

For example, Dublin Core, one of the most widely used mod description of all the types of information resources, includes, in format (simple level), fifteen elements [4] . The syntax of ea usually includes three components:

- Identification of an element. For example, in Dublin Core, the element is identified by means of the metalabel DC.Subject.
- One or more qualifiers that specify some specific attrib element. For example, a qualifier of the metalabel DC.Subj SCHEME, which identifies the name of the controlled vocabul for the categorisation of the element.
- The value or values of the element assigned to the resou described. For example, the terms extracted from the language used for the categorisation of the element.

In a web page coded by means of HTML metalanguage, the syntax element would present the following aspect:

<META NAME="DC.Subject" SCHEME="TAGS" CONTENT heritage; Cultural events; Exhibitions; Administration docu management; Internet; Files; Information Management ">

In a categorisation model based on metadata, the taxonomy constit of controlled vocabulary that is very useful for value extraction the will be assigned to the elements describing the information res previously indicated, the application of taxonomies should not be lin elements expressing the contents of the resources, and more exa matter, subject or discipline. The elements relative to the context a structure can also be expressed by means of categories extr taxonomy.

The use of taxonomies in the information resource taxonomies general strong points of the controlled languages, as: the treatm semantic and syntactic aspects of the language; the representatior concepts; the creation of a global vision of the domains obj representation; the exhaustiveness in the indexing; the solut problems involved by the multilingual contexts. From the management point of view, the use of taxonomies in the categ resources offers two additional important benefits:

- On one hand, makes the construction and maintenance eff taxonomy and resource categorisation profitable, as the san be re-used in the development of various search, brov personalisation applications.
- On the other hand, it allows maintaining the conceptual an consistency in the representation of the elements of a san which creates in the users an image of consistency in the who and in the entity creating it and maintaining it.

The categorisation model applied by a certain organisation should to four essential questions: what information resources will be c With what purpose? Who will categorise them? How will this be done

The last two questions are closely related to the degree of automat in the assignment of values to the metadata. From this point o categorisation systems can be conceived as a *continuum* , on on manual systems (or intellectual) are placed, and on the other, the ones.

In the first case, an expert analyses the content, context and/or str resource and assigns the appropriate categories to this from a language (categorisation by assignation) or from the text of the res (categorisation by extraction). The intellectual categorisation offers points, a high level of exactness in the description of resource capacity of including the contextual meaning in the description. Adc facilitates the categorisation of non-textual documents (images, a etc.); the weak points are the limited scalability, the high cost resources and the lack of consistency and exhaustiveness.

The automatic categorisation is based on algorithms that statistica the document word sequence, identify word behaviour patterns variables such as collocation, order, proximity, frequency, etc., and documents that show similarities in said behaviour. The results are resources that show similar behaviour patterns, labelled by means sequence extracted from the resources themselves that best rep similarity.

A grouping system should be able to carry out the following tasks: analyse the resource word sequences; calculate the value representing the content of a document; and compare the values (sub) documents and determine their degree of similarity.

Currently, the algorithms designed for the analysis of frequencies the following analysis methods, or a combination of various: methods (Bayesian method Rocchio method, ...); vectorial methods Neighbor method, Support Vector Machines...); and trees and decisi

Examples of automatic categorisation can be the Automatic Cat module from IDOL (http://www.autonomy.com/content/Products/IDOL), based on th probability method, and Lotus Discovery Server (http://www.lo based on the vectorial method [5] .

The strong points of the automatic categorisation are the efficiency of processing, the high level of scalability and high level of cons biggest weak point is the low level of exactness that it usuall making the very frequent use of these systems bases for decisior human categorisation experts.

The semi-automatic or hybrid categorisation systems combi intelligence, which can identify the various levels of meaning exis documents, and the efficiency of the automatisms. Four t semiautomatic systems of categorisation can be identified.

- Systems statistically analysing the resources and present human experts recommended terms for categorisation for the them and approve them. An example of this type of sys Ultraseek Advanced (http://www.verity.com/products/ultraseek/index.html).
- Categorisation systems based on search rules. Allows linking t

of the taxonomy categories a search equation designed by sp means of advanced options (search rules). By means of an the system analyses the documents and determines which equation/s with more coincidence. Then, the document is assi category or categories which have said search rules linked. E this type of system can be K2 Enterp (http://www.verity.com/products/k2_enterprise/index.htm Ultraseek Content Classification (http://www.verity.com/products/ultraseek/cce.html), Verity.

- Categorisation systems based on groups of training o documents. Allows linking each one of the categories of taxo limited number of documents selected by specialists that are the most relevant. By means of an algorithm, the system a new documents that could be categorised and determines w example documents is most similar to. Then, the document to the category or categories of the most relevant ones.An this type of system can be Mohomine (http://www.kofax.com/products/mohomine/classifier.asp Mohomine.

- Categorisation systems based on the linguistic analysis. An this type of system can be Smart Discovery [7] from InXight.

The strong points of the semi-automatic categorisation systems ar balance between efficiency and exactness, the fact that the proces by human reasoning; and the capacity of accumulating and gene learning. Amongst the weak points, we should highlight the requ knowledge, skills and efforts of management and maintenance.

In a questionnaire carried out by Delphi Research [8] , the manag large companies all over the world (60% North American) gave th answers to the question on the type of taxonomy implementa hybrid; 26%, automatic; 23%, manual; the rest, or other opt comment.

4. Application of taxonomy in the develop information search systems

As previously indicated, the differentiation of the taxonomy creation of resource categorisation by means of taxonomy categorie application of taxonomy offers multiple benefits. The objecti construction of this is the representation of a reality (an area of the scope of an organisation activity, etc.) in the most appropriate purpose and interests of the entity that could exploit said repr Additionally, it should be the expression of the image and corpora of the entity itself.

The applications of taxonomy in the web site context can be div focus on the information architecture scope, a same taxonomy car basic or auxiliary tool for the various browsing, organisation a search, labelling and personalisation systems. The re-use of a same for various information architecture tools offers various types of ben

- In the first place, it allows the profitability of the initial ef creation of the taxonomy and of the subsequent maintenance

- Secondly, it facilitates the management of the functior taxonomy applies: a modification of categories or in the re between categories of the taxonomy can uniformly and cons transferred to all the functionalities.

- Thirdly, it improves the use of the web site as a group as it c reduces the requirement of cognitive, memory and learning lo

- Fourthly, it facilitates the interaction with the website and the a consistent image of the organisation creating and ap taxonomy.

There are various taxonomy presentation options.

- Integral presentation of the taxonomy, with all its cate relationships interconnecting them (equivalence relationship, or faceted structural model, etc.).

- Partial presentation of the original taxonomy, to be able t contents from temporary or use criteria.

- Reduction of the taxonomy to the equivalence relationship, in that the taxonomy adopts the synonym ring shape.

- Reduction of the taxonomy to the hierarchical relationship, fo category exploration system. In this case, this usually in decrease of the amplitude and depth levels to adjust the ta the recommendations derived from the cognitive, visual ar capacity limitations of the standard user.

- Alternative presentations, as can be the alphabetic order categories, or the tree, graphic and metaphoric presentations.

The selection of an option depends on various factors; the funct which it is applied, the users to which it is addressed, etc. Ger combination between various presentations of a same functionality results.

One of the functionalities of the web sites where taxonomy plays ar role is in the search for information.The systems that allow searchi in the web environment can be classified into three main groups searching and filtering.

The browsing search engines offer the users an organised s categories where the information resources are included, and mechanism through said categories to find the relevant resourc information requirement. These browsing systems are especially situations when the users are unable to specify the need for inforr high level (exploration search). The browsing system can be:

- The taxonomy original hierarchical or faceted structure, c reduced.

- One of the alternative presentations previously indicated: tree, graphic or metaphoric.

- The combination of two or more presentations in a way that t

select the most suitable for the information requirement condi

The information search systems offer the users the possibility of search equation from a word or word combination. These explorati are especially suitable for search situations where the users can information requirement with enough detail (search for a known taxonomy is included to the search system to help the user in the ic of relevant terms for the creation of the search equation, and also the result and presentation and search reformulation proce exploration and search systems imply interaction in real time betwe and the search mechanism.

The third modality, the filtering systems, offers the user the pc create and declare an information need (user profile) and receive ar reply when a certain period of time elapses, or when the syster relevant resources for said need. In this case, taxonomy allows th selection of relevant terms for the specification of the profile.

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6. Notas

[1] In accordance with "TAG Notes November 1, 2004" (2004), the should be ready for January 2005. [volver]

[2] A copy of the references can be obtained by sending an e-mail this article's author (miguel.centelles@ub.edu). The reason for this req be included. [volver]

[3] An example of this option is Semio Taxonomy from Entr information from: http://www.entrieva.com/entrieva/product Hdr=scts [Consultado: 13-mar-2005]- [volver]

[4] Information extracted from the Metainformation web site: D (2003), maintained by RedIRIS. [volver]

[5] In accordance with the report Information intelligence classification and the enterprise taxonomy practice (2004 , p. 38), has a market share of 14% and Lotus Discovery Server of 7%. [volv

[6] In accordance with the report Information intelligence classification and the enterprise taxonomy practice (2004 , p. 38) market share of 15%. [volver]

[7] In accordance with the report Information intelligence classification and the enterprise taxonomy practice (2004 , p. 3 Discovery has a market share of 4%. [volver]

[8] Information intelligence: content classification and the taxonomy practice (2004 , p. 26). [volver]

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