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The Relationship between Human Perception and Knowledge Organization

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Abstract
This paper aims to explore the theory and practice of knowledge organization and its necessary connection to human perception. The aim is to study the problem of concept-building and extension, as well as the determination of semantics in different aspects. The purpose is to find criteria for the choice of the solution that best brings users into the design cycles of knowledge organization systems. One question is whether it is necessary to separate concept-building from perception. In other words, are there different systems for cognition/perception, for the determination of semantics and for concept-building?

It is generally agreed that cognition provides the basis for concept-building; however, a debate arises at the next stage of processing. Fundamentally, what is the connection between perception and the superior cognitive processes? The perceptual method does not separate these two, but rather considers them united, with perception permeating cognition. However, the linguistic method considers perception as an information-receiving system. Detached from perception, the cognitive subsystems perform information and data processing, and lead to both knowledge organization and representation. According to this model, it is assumed that high-level concepts emerge from the organization and representation of knowledge.

Keywords
conceptual analysis, cognitive processes, content determination, concept building, human perception, visual perception, knowledge organization, *topic maps*, Neumann-ház, *WebKat.hu*, images

1 Introduction

There are more reasons why perception is one of the most determined fields of my research:

— knowledge organization goes on the conceptual level. Concept-building as a starting point specifies the processes;
— users contact and communicate with the information retrieval system, mostly via any web interface;

— number of users is increasing rapidly and a major part of these people has no experience and their searching methods bring new problems which are in close connection with perception;
— transforming of traditional information retrieval tools in the OPAC and web environment is necessary. Display and availability of the classical solutions has new possibilities;
— necessary to examine the theory of perception and cognition for efficiency of transforming.

There are many historical and modern examples representing perception as a cat sitting before a mouse-hole. This image symbolizes how perception —from the mouse's viewpoint— locks out elements of the environment in order to reflect circumstances, i.e., the mouse's survival. However attention must not always be this excessively and sharply focused. There are more optimal levels of perception. The person perceiving concentrates on the task and keeps watch on symbols, reference marks, intention, experience, and changes involving both inside and outside circumstances.

2 Representation by Cognitive/Perceptual Processes or by Linguistic Processes

For Freud, the ability to transform concrete perceptions into abstract concepts is based primarily on language and linguistic processes, in similarity to his theories on the interpretation of dreams.

Perceptual and linguistic symbols are constituted differently in theory. Perceptually received symbols are direct inputs. Linguistic symbols are transmitted as encoded, or language-based, inputs. The linguistic model suggests that knowledge organization is itself language-based.

Advantages of the perceptual theory:

— homogeneous representation from first perception;
— logical and clear visualization;
— high-level standards of data processing and information retrieval.

Advantages of the linguistic theory:

— common, known, and understandable symbols;
— validation of every cognitive process;
— symbols that communicate directly and instantly.

3 What Characterizes the Symbols of the Cognitive/Perceptual and the Linguistic Processes?

Cognitive/perceptual symbols

— are modal, including both introspective and proprioceptive experience;
— are analog;

— are characterized by their methods of communication and transmission;
— receive their representation according to the perceptual system and its effects;
— develop both simultaneously and in parallel with the representation;
— have dynamic representation; symbol development is open, not closed, because the symbols are changing and improving continuously;
— can convey any essence, aspect, or feeling in the mind, by means of categorization and «formal characterization». (Logical and clear visualizations come from this characteristic.)

Visual experience connects primarily with visual symbols; hearing experience connects with auditory symbols. Other symbols come from different modes.

Linguistic symbols

— are not modal;
— are abstract;
— tend to standardize experience or make it uniform;
— are based on human «decision», independent from the environment, arbitrary;
— develop sequentially;
— are discrete and static because linguistic symbols, once determined, are retained;
— select information and represent it as a list of entities (LEHMANN 1999).

One of the most important contributions of Humberto Maturana is his theory of language. For Maturana, language as a phenomenon of life participates in human evolutionary history. Humans (and arguably some other primates) are animals characterized by living simultaneously in two dimensions of experience: first, in the immediate dimension of reacting to external reality —that which happens to us— and second (unique to humans and perhaps some other primates) in the dimension of explanation, which utilizes language. Only with language, for example, do such categories as «good» and «bad» or «justice» and «injustice» become available to assist us in understanding and explaining external reality.

The first step by which perceptual symbols are received occurs in the central nervous system. Activation samples evolve in different parts of the cortex. Established symbols arrive at long-term memory. In this paper there is insufficient time and space to fully treat the issue of producing, composing, and representing abstract concepts or pay sufficient attention to relevant cases.

Representations like concepts are always in context:

— linguistic representations are in the local lingual environment;
— perceptual representations are «inside the concepts», therefore the concepts become models with many specializations. The concept of car would have any specializations regarding the type, colour, owner, speed, purchasing, parking, movement, etc. (LEHMANN 1999).

The PRECIS system builds up similar context with primary and secondary operators.

4 Visualization, Imagination - Visual Imagery

Perception and visualization attach to mental visual imagery. There is an idiomatic expression: something appears «in the mind's eye». What does that mean? There are many researchers who think that pictorial representation is not only a map of real objects, but rather a reflection of the human mind that makes them. Although visualization is a common action that we do almost every minute, nevertheless the theory of mental pictures, as well as the full process of cognition, is not yet well understood.

Visual imagery plays an important mental or intellectual role, quite like information or data processing, memory, learning, abstract thinking, and linguistic comprehension. Visual perception is a complex process. It begins with sensation, but after that visualization becomes quite individualized. Perception depends, for example, on our experience, knowledge, cognition, or our system of symbols. This process is an explicit, multilevel and symbolic work of the mind. There may be an optimal visual interpretation, according to Crick and Koch. One way to explain visual interpretation is by how the interpretation benefits the human interpreter biologically.

4.1 Visual Imagery, Science, and Scientific Visualization

«Visual turning point» describes the relationship of science to the visual image (Mitchell 1994). As new communications technologies and IT have arisen, the mission of pictures has changed and grown. Pictures play new roles in the fields of science as well, although pictures, images and diagrams are certainly not a new subject for scientific study (Mitchell 1994, p. 11).

What scientific issues are raised by the new conjunction of visual perception and information and communications technology? Here are some possibilities:

— do specialists in knowledge organization need to consider pictorial information and the process of visual imagery?
— does visual representation have different properties than traditional textual denotation and arguments? What are they?
— how can we classify and show the visual elements of scientific documents?
— would visual imagery help us in knowledge organization?
— what visual methods can be used by the librarian in the OPAC and its interfaces?
— what possibilities do pictures and images have in knowledge organization?

Generally we equate the expression of scientific thinking with textual representation, description and argument. Scientific works use linear and sequential order as well as the logic of linguistic composition.

Can pictures play a significant role beyond illustration in science? There are some classical fields where scientific illustration has long been important, for example:

— Botany;
— Medical science;
— Chemistry;
— Ethnography.

Although other scientific disciplines do not use pictures as extensively as these, many do employ a variety of visual representations, such as diagrams, schemas, graphs, charts, maps, tables, models and maquettes. Given the developed state-of-the-art of IT at present, the possibilities of visualization in the sciences are remarkable (LEHMANN 2001). However, scientific visualization is not new, as the works of Linné and Foucault, for example, show. Linné depicted plants in his books. It was clear to him that to merely describe botanical features with words would fail to express fully the essential characteristics of plants.

Picture and text complement, rather than compete with, each other. However, pictures when used alone often call for textual clarification.

Scientific visualizations require competent interpretation, because without it the picture may be meaningless. There are some specific scientific visualization forms (for example, temperature pictures or UV pic-

A comparison of the visual and linguistic possibilities of representation:

Visual possibilities of scientific representation	Linguistic possibilities of scientific representation
Primary representing methods	Secondary representing methods
Analog representing methods	Need transformation for understanding
Simultaneous	Linear time
Complex representing methods	Several conceptual features
Can represent heuristic information	The structure of the text can represent several units of heuristic information
Subjective, but clear meaning	Objective, but need transformation for understanding
Pictures can show visual order, which would be unobserved by the linguistic level	Linguistic syntax is similar to the structure of science
Pictures can express elements of reality	Text expresses reality only in the ideal case
Concrete, individual phenomena	Abstraction, generalization
Close to sensory reality and experience	Far from sensory reality and experience
«A picture is worth a thousand words»	Traditional scientific tool

tures) which represent fine and shaded qualitative rather than quantitative descriptions. The reproduction of qualitative differences by means of language can be impossible. Structure and quality are the main components of perception and interpretation. They are the semantic elements of pictures.

For Rudolf Arnheim, the essence of pictures is the delivery of information via both the senses and experience. Arnheim's concept of «mind mapping» is a tool of thinking that puts visualization in the first place. This method helps to visualize abstract subjects and show relationships between parts.

Visualization is currently one of the most popular research topics in many scientific subjects.

4.2 Visual Imagery and the Internet

What typical categories and subcultures are worthy of investigation?

There are many problems needing research: identities, collective dilemmas, patterns, freedom of information, informational self-determination, and perception: preconception and opinions, etc.

For Andrew Shapiro, Internet search results confront users with decisions and competences such that the information becomes researchable and open to everybody, publicly and equitably for all.

There is a potential for huge transformations in connection with the new science of visual perception and thinking.

— new technical solutions appear in the areas of science, entertainment, industry and daily life;
— visualization would increase the amount of visual and special information very much, and people who use these representations will have to adjust. They will see this change with their own eyes;
— the development is not only a technical one. It also transforms experiences of the world. Firsthand experience gives way to a uniform digital model. The visual picture would now be related to the optical reality of the observer;
— visualization will be a part of both cybernetics and electromagnetism.

> … digital information is the uniform shape of… information. This is the determined form for the present… It intermediates concrete (apparently concrete) and abstract information at the same time and standardizes all fields of experience. (LEHMANN 2003).

4.2.1 *WebKat.hu* - a topic map from Hungary

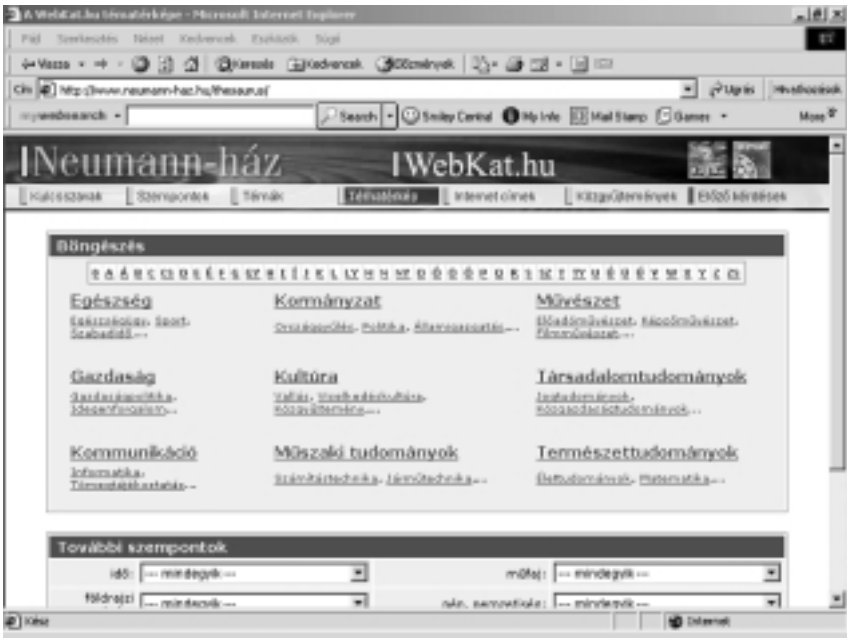
The topic map is one of the structured information retrieval languages. The Neumann-ház (John von Neumann Digital Library and Multimedia Centre) had built its OPAC, *WebKat.hu* by 1999. The specialists connected a topic map structure to the original OPAC in 2004.

Structure of *WebKat.hu*:

There are five facets: subject, people/nationality, time, geographical place, genre.

There are nine subdivisions of subject: health, economy, communication, government, culture, engineering, arts, social science, natural science. The topic map software visualises perceptual concepts.

SUBJECTS:

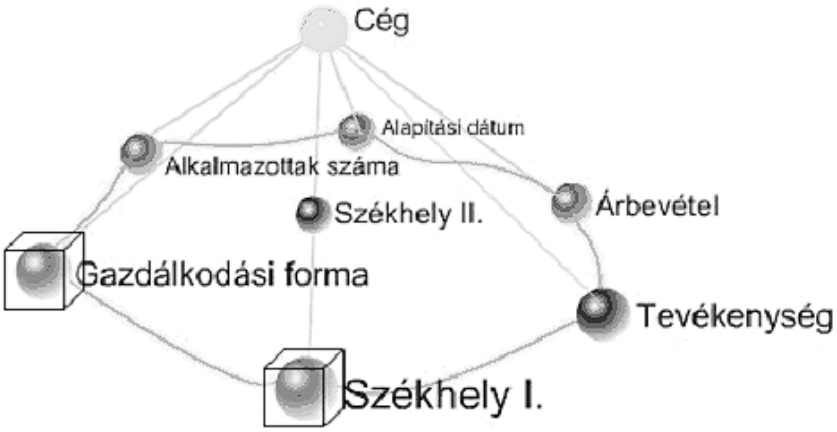


4.2.2 The *Totalzoom* technology

A *Totalzoom* system is not based on the topic map standard. They work with spectacular Flash memory. Although this software was not created for the topic map, or other information retrieval languages, it can solve their tasks and visualize these systems perfectly.

Totalzoom Technology starts from a multi-structured data model: a network, whose independent parts are hierarchical. It puts an end to the differentiation between descriptors and objects. All objects are equal within it, which tackles redundancy. The defined demand has only become feasible with the definition of the informational space as its being an abstract mathematical space. The name of the mathematical model of the informational space is: «amorphous space».

This solution provides information from a database in which the logical connection between elements is explored and structured. The user can penetrate into any part of this structured informational space by choosing from the simple categories offered by the system, and the only prerequisite for this is being able to read.



Technology opens up the informational space before the user, who can roam this virtual reality in such a way that orientation —based on the chosen categories— is always exact. All further steps require only basic decisions on the basis of which the system guides the user toward his destination as if leading him by the hand.

Combining the UDC codes and the Totalzoom technology is an obvious prospect, because it would be able to map and show the hierarchy, tables, codes, common and special auxiliaries spatially. This method not only manages the UDC codes in the OPACs, but it can also integrate other structured databases, especially hierarchically structured ones.

5 Knowledge Organization and Information Retrieval

Each person's symbolic concept-building is a variable. In knowledge organization we have to choose those criteria, characteristics, and conceptual and semantic elements that give rise to the same picture in the mind of all users of any information retrieval system. We must distinguish the semantic elements from the linguistic symbols, both of which determine and characterize concrete concepts.

How can system designers optimize both the quality and the quantity of semantic elements?

Is it enough to choose good conceptual elements and create a concept chain and a structure from them? How is that carried out? How is information management different from knowledge management?

The goals of Knowledge Organization are the revelation, storing and retrieval of information. There are at least two different sides of perceptual access in information retrieval:

— users, who need to find information and to communicate with databases via user interfaces;
— producers and suppliers, who want to provide the users with content, via an easily used, clear and flexible system.

5.1 Symbols and Knowledge Organization

In Maturana's words: «Every rational system has an emotional basis and this explains why it is not possible to convince anyone with a logical argument if an a priori acceptance has not been made beforehand.»

What symbols do Knowledge Organization Systems use?

— direct linguistic signs;
— symbols for abstractions;
— symbols for relationships;
— separators;
— operators;
— metalanguage symbols;
— imaging symbols, etc.

How do they help to manage information? They structure the search language by means of a table or dictionary. They are similar to linguistic standards. They use logical operators to express syntax between concepts. They represent knowledge and relationships.

The most important items to ensure that files are searchable and accessible:

— identifier data;
— data type: title, authors, participates, name of institutes, etc.;
— keywords, significant terms, subjects, relevant words and constructions in the titles;
— chains of concepts, marks, codes, class numbers, index items;
— words of summary;
— surrogates;
— elements of full text, etc.

Why is it important to apply these types of items to structure knowledge?

Individual knowledge is very «plastic» and peculiar to its owner. The construction of knowledge always reflects the scheme used for the purpose. Knowledge management is able to redefine continuously the structure of the knowledge base.

6 Conclusion

What does it mean for librarians and information specialists to draw a parallel between the semantic and the cognitive relation and process? We need to identify those semantic characteristics which stimulate a similar conceptual image both in the mind of the librarian and in the mind of the user. For a fresh perspective, we need to apply an understanding of perception as well. We cannot ignore the importance of knowledge management methods.

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