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Lascaux – A Hypermedia Lexicon of Metaphor Models for Scientific Imagination*

Abstract

This paper presents some results of the project "The lexicon of metaphor models as a tool for scientific imagination". This project worked with virologists in the field of HIV research, detecting established metaphor models in their thinking, accumulating them in a hypertext-lexicon, and finally letting the virologists reflect on their own models in a game-like manner in order to gain new perspectives for their current research.

1. Introduction: metaphors in the sciences

There is consensus in the research of analogy and creativity in science that analogy and metaphor play an important role in the construction and innovation of theories in science (Lakoff / Johnson 1980, Lakoff 1987, Gentner / Gentner 1983, Gilhooly / Keane / Logie / Erdos 1990, Hesse 1991). Some historical examples are:

(1) Kékulé's discovery of the cyclic structure of the benzene is connected with his legendary dream of a snake biting its own tail. By introducing the image schema of a circle he laid the foundations for aromatic chemistry (1865).
(2) Rutherford's model of the atom rests on the analogy with the model of the planetary system.
(3) The discovery of the structure of DNA by Watson and Crick was preceeded by the introduction of a new image schema: Linus Pauling postulated the helix as a structural model for proteins. This triggered research looking for such helix stuctures in DNA, which was finally found as the double helix structure of DNA (see Watson 1990: 41ff.).
(4) The discovery of the reverse transcriptase can be explained as a development of common metaphor models of molecular biology. It was the PATH model and the model of COMMUNICATION / WRITING / READING, which were used to infer via analogical reasoning that when the transcription of genetic information is possible, then the reverse transcription must be possible as well (see Liebert (in press)).

These examples demonstrate the general possibility of theory change via a metaphor in a natural evolutionary process. Is there a chance to utilize the power of metaphors consciously?

2. How to reflect on your own metaphors

The innovative impact of the use of metaphor in science led to the following idea:

If we gave researchers access to their own cognitive models, making them conscious of the metaphors they live by, then we could perhaps stimulate research processes, helping them play around within and outside of their shared metaphors.

Thus the question arose of how to get at the metaphor models of a group of virologists and how to represent them in some kind of lexicon which might serve as an input for reflection processes by the virologists themselves.

This lexicon should be able to combine pictures and language and should be used as an interactive medium in the growing field of models and machines for imagination (Johnson 1987, Lischka 1993).

In order to turn from the theoretical viewpoint to a more practical perspective I executed a program which consisted of eight steps:

(1) Choose a real science team.
(2) Go and experience this team's everyday life.
(3) Analyse the metaphors they live by.
(4) Relate the metaphors they live by to the problems they have in their research.
(5) Construct a lexicon as a tool which enables them to reflect on their own models.
(6) Let the team interact with this tool and actually reflect on their own models.
(7) Observe what reflections and reorganisation processes are taking place.
(8) Evaluate the possibilities of the reflection of one's own cognitive models by such a tool.

According to these eight steps, I have chosen a team from the field of applied tumor virology, which is researching the inhibition of replication of the AIDS–virus HIV. This science team served as a test case in order to get more evidence as to whether such a lexicon of metaphor models might be helpful in metaphorical thinking and scientific problem–solving.

For this team I acquired the appropriate data in order to construct a lexicon which is to represent their metaphorical structured system of coherence.

This lexicographical process will now be described in more detail.

3. Corpus composition, data analysis, and the construction of the lexicon

In order to get at the metaphors and problem-specific knowledge of the research team, which may be regarded as metaphors they live by, a corpus was compiled. This corpus consists of transcripts of:

(1) 10 meetings (20–25 persons, weekly, 90 minutes, 2 speakers and discussion).
(2) Guided group discussion in order to diagnose the self-image of the research team.
(3) Interviews with every researcher in order to diagnose the background knowledge and metaphorically structured concepts.
(4) Textbooks and other texts normally read by the researchers.

The next step was the analysis of the metaphors emerging from the corpus. The analysis of the corpus briefly went as follows:

- Coding source domains.
- Reconstructing the metaphor models the research team lives by.

The next step was to construct a lexicon of these metaphor models, so that the scientists could reflect on their own cognitive models. The implementation of complex cognitive models required a new approach in lexicography, cognitive lexicography, which can be defined as "constructing a lexicon by describing lexical meaning relative to cognitive models" (Liebert 1992: 203).

Of course this kind of lexicon could not have an alphabetical structure only. It should give fast access to the problems occurring in the ongoing research process and the metaphor models which were involved in it. Therefore I implemented the problems and tasks derived from the group discussions and the interviews as a projection area for different source domains. After this, these source domains of the metaphor models had to be related to these tasks and problems, and finally these complex models were implemented in ToolBook, a hypertext system running on a PC.

4. Lascaux – a hypermedia lexicon of the metaphor models of virologists

4.1 The user interface metaphor of Lascaux

All hypertext systems contain a special user interface metaphor like the desktop metaphor of Apple or the book metaphor of ToolBook. But these given metaphors are not always useful. A helpful user interface metaphor should be consistent with the experienced or imagined world of its users. In order to get a helpful user interface metaphor for the scientists they were asked in the group discussion for their self-image. From several metaphor

models I selected a collective model, RESEARCH IS PAINTING A PICTURE TOGETHER, and an individual model, RESEARCH IS LOOKING IN THE DARK WITH A FLASHLIGHT IN ORDER TO GET AT THE HIDDEN TRUTH. These two metaphors for the research process were integrated into the image of a cave. For the construction of this user interface metaphor I selected pictures of one of the oldest caves ever used by human beings, the Lascaux cave near the Dordogne valley in France. These caves did not serve as houses, but as places of art and ritual culture. Projecting our modern pictures of the cell or transport vehicles onto the background of the oldest pictures we felt would seem tantalizing, too.

4.2. The storyboard of Lascaux

The most important part in constructing a hypertext or hypermedia system is the development of a storyboard, which shows all implemented (complex) nodes and links, which together define the interactional possibilities of the application. Figure 1 shows the storyboard of Lascaux. According to the metaphor RESEARCH IS PAINTING PICTURES TOGETHER IN A CAVE, the navigation links of Lascaux are defined as WALKING IN THE CAVE (wipe link), GETTING CLOSER OR FARTHER FROM THE CAVE WALLS TO BE PAINTED (zoom link), and SUPERIMPOSING PICTURES AND WORD FIELDS FROM THE SOURCE DOMAINS ONTO THE QUESTIONS OF THE SCIENTISTS (dissolve link).

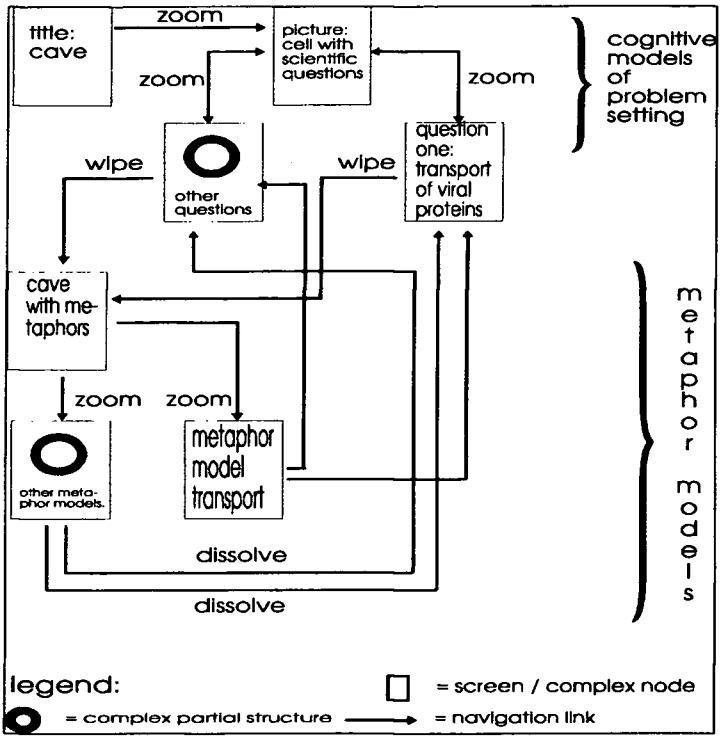

Figure 1. Storyboard of Lascaux, a hypermedia lexicon of metaphor models of virologists

5. The reflection process and its results

Lascaux was presented to a group of six of the scientists during a weekend workshop, where they reflected on their own metaphors and built new ones. Two sessions with Lascaux lasting 1 1/2 hours each and one session without Lascaux lasting 1 1/2 hours, were recorded on videotapes.

The interaction process in general can be described as follows: The hypermedia lexicon of the virologists' methaphors served as a "starter", these first periods of looking at the lexicon were followed by fast verbal interactions without observing the screen, and finally they returned to Lascaux in order to superimpose the word fields, pictorial elements and image schemas, and to fix the result of their thinking.

Some results of the first evaluation are:

(1) The more the source domains were structured, the faster they interacted and the longer the subjects continued thinking about the implemented metaphors.
(2) Source domains in which specific word fields dominated were not accepted nor were source domains in which pictures and image schemas dominated.
(3) The interactionality of present commercial hypermedia systems is not sufficient.

Often a researcher quickly tapped on the screen using his finger and said for example: "Could I have some more lines here?" But in the system one had to choose the line command from the menu, define the thickness of the line, click the beginning and the end of the line, and so on – far too slow for the fast flow of metaphorical thinking once it begun "flowing".

In order to give an idea of what Lascaux looks like, consider figure 2, which shows a complex node, from which you can navigate to the different source domains for the later superimposition on the problemsetting image. This node is an equivalent to the node "metaphors cave" in the storyboard.

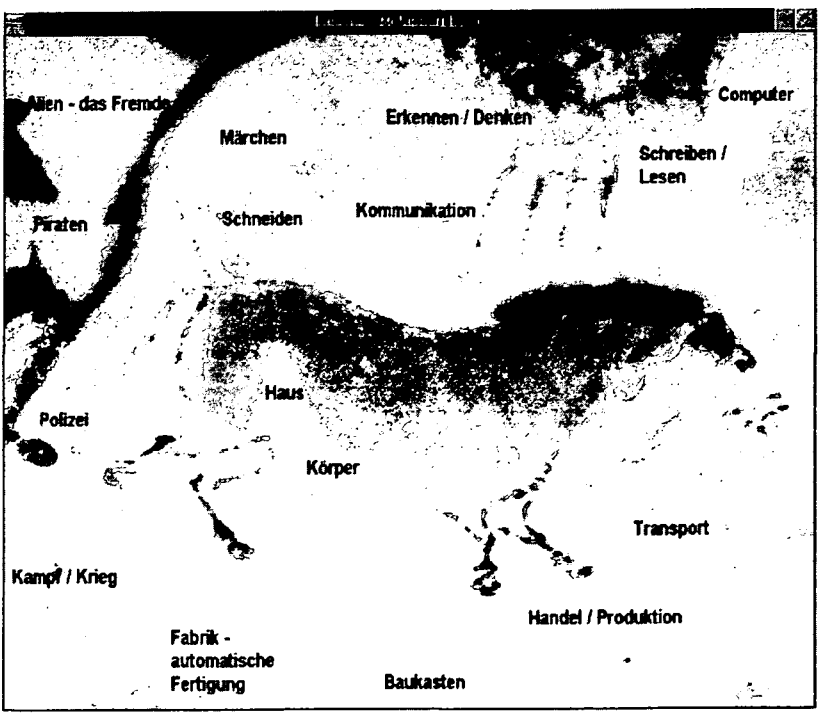

Figure 2. Selecting source domains via hotwords in a complex node of Lascaux, the "metaphors cave", for the later superimposition (original picture in 256 colors)

6. Conclusion

At present, a lexicon of metaphor models implemented in a hypermedia system may serve as a starter for metaphorical thinking processes and as a tool for saving the results of this process. But for the ongoing process of metaphorical thinking, the interactional properties of current hypermedia systems are not flexible and fast enough to keep pace with "normal speed" of human thinking in metaphors. The further evaluation of the recordings of the interactions of the virologists with Lascaux will help us in outlining what interactional properties these must be and what implied consequences there are for cognitive lexicography.

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References

Gentner, Dedre / Gentner, Donald 1983. "Flowing Water or Teeming Crowds: Mental Models of Electricity" in: D. Gentner / A. Stevens (eds.), *Mental Models*. Hillsdale, N.J..

Gilhooly / K. J., Keane, M. T. G. / Logie, R. H. / Erdos, G. (eds.) 1990. *Lines of Thinking: Reflections on the Psychology of Thought. Volume 1: Representation, Reasoning, Analogy and Decision Making*. Chichester, New York, etc..

Hesse, Friedrich W. 1991. *Analoges Problemlösen : eine Analyse kognitiver Prozesse beim analogen Problemlösen*. Weinheim: Psychologie Verl. Union (=Fortschritte der psychologischen Forschung ; 8).

Johnson, Mark 1987. *The Body in the Mind. The Bodily Basis of Reason and Imagination*. Chicago, London.

Lakoff, George 1987. *Women, Fire, and Dangerous Things. What Categories Reveal About the Mind*. Chicago.

Lakoff, George / Johnson, Mark 1980. *Metaphors we live by*. Chicago. London.

Lischka, Christoph 1993. *The Media Playhouse. Eine Umgebung zur Erforschung von Imagination in Kunst, Wissenschaft und Neuen Medien*. Flyer, Gesellschaft für Mathematik und Datenverarbeitung, Sankt Augustin.

Liebert, Wolf–Andreas 1992. *Metaphernbereiche der deutschen Alltagssprache. Kognitive Linguistik und die Perspektiven einer Kognitiven Lexikographie*. Frankfurt/M., Berlin, Bern, etc.. (Europäische Hochschulschriften, Reihe 1: Deutsche Sprache und Literatur; 1355).

Liebert, Wolf–Andreas (in press). "The Lexicon of Metaphor Models as a Mental Tool for Analogical Problemsolving in Science" in R. Dirven / J. Vanparys (eds.), *New Approaches to the Lexicon*. Frankfurt /M., Bern, Berlin: Lang.

Watson, James D. 1990. *Die Doppel–Helix. Ein persönlicher Bericht über die Entdeckung der DNA–Struktur*. Reinbeck bei Hamburg.