How to get a fitting metaphor for a multimedia interface?

In: A. Grieco, G. Molteni, E. Occhipinti & B. Piccoli (1994) (Eds). Book of Short Papers of 4th International Conference on Work with Display Units--WWDU'94 (Volume 3, pp. D15-D17). University of Milan: Institute of Occupational Health.

How to get a fitting metaphor for a multimedia interface?

Matthias Rauterberg and Markus Hof

Work Psychology Unit, Swiss Federal Institute of Technology (ETH), Nelkenstrasse 11, CH-8092 ZURICH

ABSTRACT: A method for 'metaphor engineering' is introduced in the context of participatory multimedia design. Our hypothesis, that adults talk to children more with a metaphorical language than to other adults, was empirically verified. Six male adults (students of physics) explained 12 children (6 girls, 6 boys) and 12 adults (5 female, 7 male) two different domain problems: (1) "Why does the sound of a car change, if the car passes by?" (Doppler effect) and (2) "What happens in a bulb, if someone closes the circuit?" (Light generation.) The results of this validation procedure show, that male domain experts generate significantly more metaphorical descriptions explaining a domain problem to children or female adults than to male adults.

INTRODUCTION

The construction of hypertext systems needs several design solutions, which requires dedicated methodological support. One important design problem is finding a metaphor for the interface architecture, which is the design basis for the screen layouts and the dialogue structure [1]. This approach leads directly to the usage of multimedia technology [1] [2].

Metaphors are not 'right' or 'wrong' descriptions: rather they are 'stimulating' invitations to see a target domain in a new light. So, where do metaphors come from? As Carroll, Mack and Kellog [1] claimed, that "there is not now (and likely never will be) a discovery procedure for metaphors," we try to overcome this position. On the basis of a participatory approach we are looking for a method, which generates a metaphor by the domain expert himself. This participatory approach ensures, that the generated metaphor fits the application domain. So, we are looking for a method, which stimulates the domain expert to describe his target domain in a metaphorical language.

"In the knowledge lies the power" has become a popular maxim in the context of artificial intelligence. "In the metaphor lies the power" will become a popular maxim in the context of multimedia system design. How can we get this metaphor? In the context of optimisation of knowledge engineering methods the following observation was an interesting result: if the knowledge engineer is a woman then male experts do explain more knowledge than if the knowledge engineer is a man. Proceeding on this idea we looked for a social context in which a metaphorical language is normally used: this situation is given if adults explain something to children. First, we have to proof the 'children' idea to invent a 'metaphor engineering' method (MEM). Second, we have to develop a practical procedure to carry out this MEM. In this paper we describe an experimental investigation to proof and validate the 'children' idea.

VALIDATION PROCEDURE

Subjects: 6 male students of physics participated as domain experts. 12 children were schoolboys (N=6) and schoolgirls (N=6) of a primary school (N=8 with age among 8 and 13 years, N=4 with age among 12 and 13 years). 12 adults (male N=7, female N=5) were students of computer science or physics (N= 9, age 20-25 years) or people with an other educational background (N=3, age 40-50 years).

Tasks: Each expert has about 10 minutes explanation time for two different domains. To control sequential effects each expert has to explain both domain problems twice to 2 children and 2 adults in two different orders, so that each expert explained the two domains to 4 different 'metaphor engineers.' A total of 40 minutes explanation time per expert was recorded on video.

Target Domains: Domain experts were instructed to explain the following two domain problems: (D1) "Why does the sound of a car change, if the car passes by?" (Doppler effect); (D2) "What happens in a bulb, if someone closes the circuit?" (Light generation.)

Procedure: Factor A is 'naivety': the assumed knowledge of the 'metaphor engineers' (child, adult). Factor B is 'sex': the sex of the 'metaphor engineers' (male, female). Factor C is 'domain': two domains "Doppler effect" and "light generation."
A metaphor is defined as follows [3]: (1) If we interpret a word or a syntactical structure of words of an explanation in their ordinary, context free sense ("common sense"), then the meaning of this part of the explanation is senseless or impossible. We call this first condition the "internal incompatibility." (2) If we relate the context free interpretation of a part of an explanation to the context of the whole explanation, then the meaning of this relation is senseless or impossible. We call this second condition the "external incompatibility." We classified parts of an explanation as metaphors, if we found an internal or an external incompatibility.

Measures: 2 different trained rater (students of computer science at the ETH) analyzed 48 video sequences - one for each experimental condition- in 15 seconds' intervals. (1) The 'percentage ratio of metaphors overall' used in each explanation trial is the sum of all 15 seconds' intervals, which included the usage of any type of metaphors. (2) The 'percentage ratio of different metaphors' is the sum of all 15 sec. intervals, which included the usage only of different metaphors. (3) The ' percentage ratio of repetitions' of used metaphors is the difference between the 'percental ratio of metaphors overall' and the ‘percentage ratio of different metaphors'.

RESULTS AND CONCLUSION

Empirical validation: The percentage ratio of metaphors overall is an absolute measure to describe how much time each domain expert explains the problem to the 'metaphor engineer' with metaphorical terms. The main effect 'naivety' is significant. The domain experts use overall significantly more metaphors explaining to children (mean 37.8% of explanation time, N=24) than talking to adults (26.3%, N=24; $p \leq .016$). We can not find a significant effect belonging to the sex of the 'metaphor engineers.' On average the experts used the maximum of metaphorical terms (39.7%) talking to boys and the minimum of metaphors (19.6%) talking to men. The experts used significantly more different metaphors talking to a female person (19.6%) than talking to a male person (14.7%; $p \leq .014$). The experts used significantly more repetitions talking to a child (18.8%) than talking to an adult (11.3%; $p \leq .020$). The domain "light generation" evoked 20.7% metaphors, the domain "Doppler effect" only 13.3% ($p \leq .009$).

Multimedia interface design: What kind of metaphors is presented by the domain experts? How can we transform these metaphors to multi media design? One domain expert used the following description to explain the Doppler effect (D1): "Imagine, you stand at a highway, and you hear a car passing you: Iiiioouum!" The expert introduced the context 'highway with cars' and used an onomatopoeia to demonstrate the Doppler effect.
Another domain expert explained the domain D2 with the following metaphor: "Imagine a demonstration of people on a

large road in a city. The head reaches a narrow lane. To avoid jams in the narrow lane the people have to hurry up. They can become slower, when they reach a large road again."

Conclusion: Children are suitably to play the role of a 'metaphor engineer.' This main hypothesis was validated. If the domain experts explain their domain problems to children, then we can observe, that they repeat their introduced metaphors and do not generate new once inside the context of a metaphorical category. In many cases the domain experts prefer to change the metaphorical category. We can conclude from our data, that male adults are not appropriate to play the role of a 'metaphor engineer.'

The approach presented in this paper guarantees that the starting point of the design cycle can be optimized to find a fitting metaphor.

REFERENCES

[1] Carroll J M, Mack R L & Kellog W A (1988) Interface metaphors and user interface design. In Handbook of Human-Computer Interaction. (M. Helander, ed., pp. 45-65), North-Holland.

[2] Chauvet J-M (1991) Graphical user interfaces: metaphors we compute by. In Human Aspects in Computing: Design and Use of Interactive Systems and Work with Terminals. (H-J. Bullinger, ed., pp. 308-313), Elsevier.

[3] Lakoff G & Johnson M (1980) Metaphors we live by. The University Press.