Demonstration of a Discussion Terminal for Knowledge Acquisition and Opinion Formation in Science Museums

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Abstract: There is a trend for active visitor engagement at science museums: Visitors' opinions about science topics are often integrated into exhibitions, today. Modern discussion-based installations are described in this paper. In particular, we present a computer-mediated discussion terminal which was designed to mediate and encourage elaboration on and opinion exchange about the topic nanotechnology as one of the most explosive science topics nowadays. It is supposed to foster critical thinking, knowledge acquisition, and opinion formation at science museums. The rationale behind and assumptions about the impact of this discussion terminal are explicated.

Science Museums and Public Understanding of Science

Oppenheimer has already stated 1968 that there is an increasing need to develop public understanding of science and technology, and today - due to rapid growth of new technologies - this need is even increasing. Informal learning in science museums can be a major contributor in promoting public understanding of science as museums are one central medium in communicating scientific ideas and presenting relevant objects (Durant, 1992). In addressing current socio-scientific issues science museums are challenged to present the ambiguity and controversy of these topics and to support visitors in developing reflective and critical thinking. Boyd (1998, p. 214) considers the modern science museum as a "marketplace of multiple points of view, a forum where controversy can be aired". However, museums might not only provide information about competing viewpoints and sources but also place visitors into the centre of the debate by giving them an own voice: Cameron (2003, p. 21) states that "the key issue in the reformation of museums is the audience participation in debates". Thus, museums face the challenge to develop new installations which emphasize visitors' involvement, challenge their views, and foster opinion formation about current scientific issues.

Modern Discussion-Based Installations for Active Visitor Engagement

The idea to collect visitors' impressions about an exhibition and its content is not new: Guest books are common practice to provide space for personal opinions. However, modern technologies offer new opportunities to integrate these personal opinions into an exhibition and to engage visitors in discussion and debate about presented issues. Some interesting new installations have been developed in the last years which provide "talk-back" areas where visitors can express their feelings or opinions about the exhibition and find out what other people think. At Deutsches Museum (Munich, Germany), an asynchronous discussion terminal was implemented into an exhibition about stem cell research where visitors could listen to various expert statements, type an own statement into the forum, and read through others' statements (cp. fig. 1a). Visitor research showed that this terminal was used quite intensively but also identified a lack of quality of visitors' statements. This field observation hints to the need for research how to explicitly support elaboration on relevant information to raise quality of opinion expression.

Figure 1 shows design proposals (© Kaiser Matthies, Berlin) for a new exhibition about nanotechnology (NT) at Deutsches Museum. Visitors' personal visions about their future life with nanotechnological applications and their opinion about chances and risks will be video-recorded and integrated into the exhibition as "nano visions". Other visitors can view various videos and learn about others' opinion about NT and its implications for daily life. Figure 1b shows a discussion area which was designed to gather visitors' personal statements and votings with regard to concrete controversial questions. These votings will be aggregated and displayed on large screens to provide an overall feedback about all visitors' opinions (cp. fig. 1b). Similarly, the London Science Museum projects controversial questions on a large table and visitors can vote by pressing the buttons 'yes' or 'no' (cp. fig. 1d). The displayed results might then serve as a starting point for f2f-discussion. Such installations follow the current trend to personalize exhibition context, to evoke emotions, to actively involve museum visitors, and promote critical and reflective thinking at science museums (Pedretti, 2006). The question whether museums really accomplish this will be addressed in our research about the potential of discussion terminals at science museums.
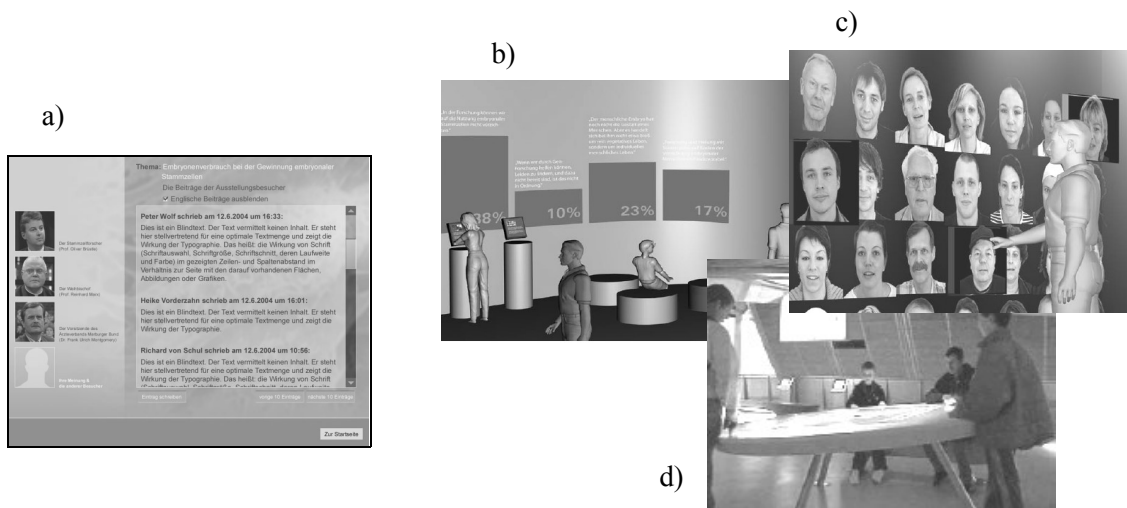
Figure 1: Examples for new discussion-based installations
(Deutsches Museum, Munich, Germany, 1a - 1c; London Science Museum, 1d)

A Discussion Terminal Informed by (Socio-) Cognitive Theories

The idea of scaffolding systematic and deep processing of relevant information about risks and potentials of NT and thereby enhance critical thinking and opinion formation of museum visitors is central to our research: A discussion terminal has been designed which considers relevant pre-requisites that information processing theories (e.g., ELM, Petty, & Cacioppo, 1986; HSM, Eagly, & Chaiken, 1993) have identified, namely, involvement, and availability of relevant information. The discussion terminal will be integrated into an exhibition about NT, and visitors have the opportunity to elaborate on relevant information and write down their own opinion about NT, and read through others' statements. Furthermore, they will get specific feedback on others' opinion about NT.

Different types of cognitive mechanisms are assumed to lead to deeper elaboration of content and belief-based opinion formation when visitors interact with the discussion terminal:

1. *Active participation, involvement, and personal relevance*. The discussion terminal increases visitors' involvement by asking for their personal opinion and by challenging this personal opinion by social comparison with others' opinions. Writing down one's personal opinion should result in higher motivation and involvement and also support reflection and abstraction (e.g., Petty, & Cacioppo, 1986).

2. *Salience of multiple perspectives*. A main objective of the discussion terminal is to support bottom-up processes of opinion formation by increased salience of available and relevant arguments from various perspectives (Rosenberg, 1956). Expert statements might be presented as these are necessary information about NT required for critical evaluation of this new technology. To support critical thinking, these expert statements could be rated by visitors with regard to agreement and relevance (cp. figure 2a). This should help to identify relevant attributes of NT and should therefore scaffold belief-based, thoughtful opinion formation. Alternatively - and probably more adequate for the museum context - one could imagine a game-based activity like a drag and drop-quiz where visitors have to assign the experts to their statements (cp. figure 2b).

3. *Social comparison information and opinion exchange*. Social influences are important for individual opinion formation and information processing as according to social comparison theory people tend to evaluate their own opinion by using similar others as models (Suls, Martin, & Wheeler, 2004). The discussion terminal offers new possibilities to support communication and debate between visitors - independent from their time of visit. Therefore, this research project considers the impact of reported opinions of other visitors on individual cognition. An awareness tool is used that summarizes others' opinions and displays one's own opinion in comparison to others'. In addition to this specific social comparison information, all individual statements can be accessed, too. Congruent feedback might increase visitors' confidence in their opinion. Conflicting feedback elicits a cognitive conflict or makes it salient. This conflict should elicit further activities at the discussion terminal and within the exhibition (Buchs, Butera, Mugny, & Darnon, 2004; Lowry & Johnson, 1981). Visitors might, for example, read through others' statements to learn about their arguments, too ("Why do they think that?").
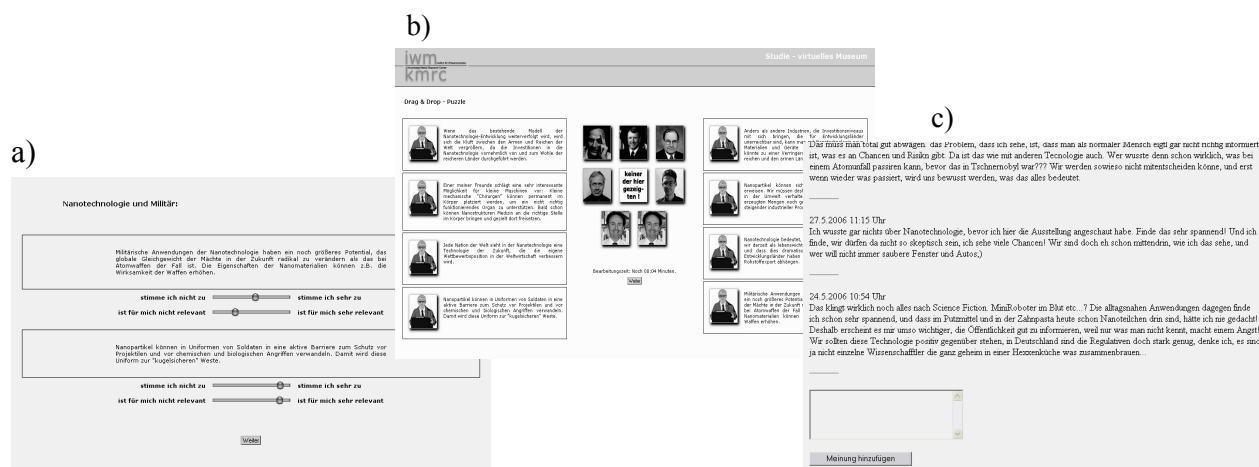
Figure 2: A discussion terminal for knowledge acquisition
and opinion formation at science museums

Impact of a Discussion Terminal on Knowledge Acquisition and Opinion Formation

It is assumed that salience of controversial arguments, possibility to express one's own opinion, and social comparison information are all crucial factors for both learning and opinion formation. Elaboration on information should be deeper when these factors are implemented. Visitors should gain most (attitude-relevant) knowledge, remember more relevant arguments and have more sophisticated opinions about NT if the discussion terminal presents relevant information and gives the opportunity to write down one's own opinion. Salience of arguments might support acquisition of attitude relevant knowledge as relevant information is presented at the discussion terminal. Belief-based opinion formation on basis of presented arguments should be more likely which would result in more adequate and sound-standing attitudes towards NT. Social comparison information and opinion exchange should further stimulate elaboration of arguments and evaluation of visitor's own opinion, especially if a cognitive conflict between one's own opinion and others' opinions is elicited. An experimental study was developed to test these assumptions.

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