

# **The Role of Mobile Devices to satisfy situational interest in informal settings**

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## **Abstract**

This article introduces a work in progress that is planned as a dissertation in psychology [This dissertation is part of the project “Lernen im Museum: Die Rolle von Medien für die Resituierung von Exponaten” [Learning in museum: The role of media in embedding of exhibits] funded by the “pact for research and innovation” of the German Federal Ministry of Education and Research. It is an interdisciplinary project of the Knowledge Media Research Center (Tuebingen), the “Deutsches Museum” (Munich) and the Institute for Science Education (Kiel).]. Subject of dissertation is the role of mobile devices to meet situational interest in museums: can immediate satisfaction of situational interest and/or a record of activities during moments of situational interest lead to positive learning outcomes like knowledge acquisition, knowledge exchange and the development of individual interest? While the dissertation deals with situational interest in museums, it is hoped that due to the close relationship between learning in museums and learning in other informal settings (e.g. high autonomy of the learner, no formal evaluation, fleeting situational interest) the proposed

technology to satisfy situational interest and access/collect information may be useful for lifelong learning in general.

# 1 Theoretical Background

## 1.1 Introduction

Museums provide an interesting setting for learning and the development of interest: Visitors to exhibitions usually are heterogeneous regarding age, individual interest, and prior knowledge (Falk & Adelman, 2003). However, learning in museums is not a guaranteed result of a visit. The visitors usually want to see all exhibits, resulting in the “hurried visitor problem” (Hsi & Fait, 2005 [The authors have also compared exhibits to an “all you can eat buffet with too many choices for the typical museum visitor to sample” (Hsi & Fait, 2005).]): The average time per exhibit is extremely short (about 30 sec). This is combined with a “cultural window shopping” attitude that leads to insufficient time and effort for elaboration of content and decryption of the didactic principles behind an exhibit (Treinen, 1988). Even if an exhibit catches the attention of visitors the provided information by the museum itself is probably unrelated to or unsatisfactory for the highly specific situational interest of an unique visitor. It is simply not possible to capture all aspects in breadth and depth at the object itself with non-digital media. Media terminals cannot be placed in front of every exhibit. Therefore mobile devices (e.g. audio guides) are often used, allowing a direct reference to the exhibit itself. It is argued in this dissertation that mobile devices have the additional advantage of allowing the transformation of situational interest to actual information seeking behaviour.

Due to the fleeting nature of situational interest (Csikszentmihalyi & Hermanson, 1995) such information seeking behaviour would probably not occur at a later time, like when using a media terminal at some other place in the museum.

However, even if additional information is available, the amount of possibly interesting information could overwhelm the visitors, making it difficult to remember much of it afterwards (for an example see Tinker, Staudt & Walton, 2002). Even if mobile guides are offered, the information is often not available outside of the museum. This is even true for digital media, which is mobile itself, and could simply be transferred electronically to the visitors (e.g. by eMail, a personalized webpage, USB-/CD-Storage devices).

A possible solution seems to be the use of a mobile device (PDA). With a PDA it is possible to access vast information sources, get a detailed log of the interesting activity during the museum visit (e.g. on a website), and collect personally relevant cues for continued post-visit activity. The information source needs to have the necessary breadth and depth to provide information for nearly all the aspects a visitor may find interesting and allow the selection of information for personal storage and use. Wikipedia, the worlds largest encyclopaedia, fulfils these requirements. It is available for free, uses the GNU Free Documentation License and can even be downloaded to a large memory card for offline scenarios. Additionally, it is constantly expanded and improved, allows the visitors make changes themselves [A previous idea for a dissertation and possible future development consisted of using a museumspecific Wiki as information source and exchange medium for visitors during the museum visit.

However, it was dubious whether visitors would actually want to edit this Wiki in the museum, since their reference books would not be available, the PDAs make user input difficult and the visitor is under severe time constraints.] and it is available in 250 languages (List of Wikipedias, 2006), although with (equally) vast differences in the amount of available articles [While in November 2006 only the English Wikipedia has more than 1 million entries, 12 have more than 100.000 entries which should be large enough to (at least

temporarily) satisfy most interest.]. This idea is similar to the Semapedia project (Rondeau & Wiechers, 2005) where physical objects are linked to entries in the Wikipedia, but without the need for physical tags at the exhibit which would probably not correspond to the specific interest a visitor has.

## **1.2 Situational Interest**

Interest is usually defined by its special relation to a specific (physical or abstract) object, consisting of a cognitive, emotional and valuating aspect. Interest as a trait (individual/dispositional interest) is part of the personality of a person, i.e. it is a relatively enduring preference for certain topics, subject areas or activities (e.g. an enduring interest in Phoenician art). Interest as a state is a momentary experience of the person with two possible triggers: Existing dispositional interest can be realized in a concrete situation (actualized interest, e.g. while seeing an Phoenician artefact the long standing interest in Phoenician art is remembered). Another trigger is an object itself that attracts enough attention by its characteristics that may or may not last longer than ones exposure to this object (situational interest, one sees a Phoenician artefact and suddenly becomes interested in learning more about it) (Krapp, 1992).

Interest is especially relevant for learning due to its many beneficial consequences (for an overview see: Wild, Krapp & Winteler, 1992): Learning performance increases, even if intelligence and prior knowledge are controlled for. More elaborate strategies of learning are used (since the learner aims to master the subject instead of passing the exam). With repeated exposure situational interest can become dispositional interest. Furthermore the possibility exists that interest becomes epistemic (i.e. it expands and grows which leads to greater knowledge and skill). This is of high relevance in a museum, since this setting provides little formal or extrinsic motivational factors.



According to the self-determination theory by Deci and Ryan (e.g. Ryan & Deci, 2000) competence, relatedness and autonomy are the basis of interest. Csikszentmihalyi and Hermanson (1995) regard interest as part of intrinsic motivation which requires a certain amount of novelty, surprisingness, complexity and ambiguity. Museums provide ideal grounds for interest to occur, however, whether this interest can be actualized and preserved past the visit is doubtful: It often is not satisfied in the museum and preoccupation with the topic after the visit is rare.

### **1.3 Interest Trails**

The idea of giving the visitors a list of their interest related activities is based on “learning trails” (Peterson & Levene, 2003; Walker, 2006). Walker’s learning trails allow documentation of specific objects including audio recordings and photographs and access to the information after the visit for reflection and the creation of a tour.

Similar concepts are also implemented in different variations in museums and science centers like the “Exploratorium” in San Francisco (Fleck, Frid, Kindberg, O'Brien-Strain, Rajani & Spasojevic, 2002; Hsi & Fait, 2005): Visitors’ activities are captured on web pages and can be accessed and commented during and after the visit. Such trails are supposed to have a positive effect on informal, life-long learning, but were rarely empirically examined for their assumed psychological benefits.

In this dissertation an interest trail is proposed expanding the idea of learning trails by explicit and implicit indicators of interest. While information about all exhibits is available, the visitors can bookmark/tag especially those that are interesting for themselves, enrich them by information they found interesting during the visit and record personal notes. A log of the inquiry is automatically generated when the visitor researches in front of interesting objects (i.e. accesses articles in Wikipedia or available information texts). General information about the visit itself and images from the exhibition are also included.

This serves as support for information processing: while the visitors determine what is interesting for them (by their behavior in the exhibition), the system encodes, saves and facilitates access to this information – it also functions as a mirror of visitors' behavior. Further augmentations like the aggregation of specific topics over different exhibits are possible (e.g. by pattern recognition or embedded tags).

## **1.4 Knowledge Exchange**

Visitor studies have shown the importance of conversation (i.e. verbal knowledge exchange) for learning in museums and lasting memories of the visit (e.g. Allen, 2002). However this knowledge is often kept private and is rarely discussed (Treinen, 1988). While interactions with partners, children or in groups are possible and probable, interaction with strangers is rare, even when an exhibit is specifically designed to instigate it (Hindmarsh, Heath, vom Lehn & Cleverly, 2002). A reason for this may be a possible norm of a museum that often implies silent reflection and silent dialogue with the exhibit.

Outside of the museum discussion can probably only occur if the content of the visit is at least partly accessible, which is not always the case (for an example see Tinker, Staudt & Walton, 2002). Here the interest trail may help and serve as cue [Comparable to a slideshow evening with friends and family members after long vacations, where countless photos serve as very effective and nearly infallible cues of holiday memories.] to personally relevant, i.e. interesting and likely to be discussed, exhibits.

Another indirect way of knowledge exchange may be the participation in a Wiki. Visitors with similar interests may exchange information about exhibits if this tool is available and has a direct access from their personal visit. Since interesting texts should be included in the interest trail, they can also be reduced to a header and linked to the corresponding page in a exhibit specific Wiki. This would allow visitors to access the information and edit/discuss it from their home computers. If the interest trail is stored on the personal user page, the visitors

have a reason to visit the page. They also already have their login account and are familiar with the subject. The barriers to participate in Wiki should be very low. This dissertation also aims to examine this possibility.

### ***1.5 Summary and proposed scenario***

Visitor learning in museums is voluntary and thorough formal elaboration of knowledge is limited or non-existent. Under these circumstances, situational interest, a fleeting desire for more or deeper information triggered by and active only in a specific situation, and knowledge exchange through conversations become major factors for learning. They are likely to facilitate elaboration, knowledge acquisition and the development of (stable) individual interest. Visitors are able to immediately “bookmark” interesting objects and available information texts for closer consideration at a later time (text and pictures) and browse in the largest available encyclopaedia (Wikipedia). This should lead to more elaboration and knowledge acquisition. The information is available after the visit to the museum via an interest trail on a Wiki. This serves as memory cues and gives the visitors connection opportunities to pick up the situational interest of the museum visit for specific objects/aspects of the exhibits. They can continue to deepen their interest, possibly resulting in dispositional interest.

## **2 Research Questions**

This dissertation will analyze the following two research questions, both in a laboratory and a field setting.

### ***2.1 Situational Interest***

Does the immediate satisfaction of situational interest (here: through mobile devices) lead to deeper processing and/or knowledge exchange compared to delayed or no satisfaction of situational interest?

## **2.2 Interest Trail**

Does the availability of an interest trail (list of objects the visitor found interesting during his visit) facilitate the elaboration and knowledge exchange after the visit compared to a complete list of all available exhibits (virtual catalogue) or no list at all?

## **3 Planned Studies**

Two studies are planned to examine these questions.

### **3.1 Laboratory Study – Focus: *situational interest***

The first study will be conducted in a laboratory exhibition. Data is currently gathered and preliminary results of the first study are expected in time of the conference.

#### **3.1.1 Material**

The study takes place in the Nano-Dialogue exhibition in the Knowledge Media Research Center in Tuebingen. Pocket Loox 720 PDAs are used with Opera Browser and a website (using SQL and PHP) allowing visitors to virtually navigate the exhibit and bookmark interesting objects and (in some conditions) have access to additional information (see figures 1 and 2). Logfiles of user action and video recordings of behaviour observation (see figure 3 and 4) are used for the study.



Figure 1: Visitor with PDA – the current exhibition wall is represented on the screen, allowing visitors to select interesting objects to bookmark them or receive more information about them (including access to Wikipedia).



Figure 2: View on the PDA Screen – objects in white borders can be bookmarked/lead to more information, including a link to Wikipedia.

### 3.1.2 Design

120 subjects in total are randomized to six different experimental conditions (see table 1).

Table 1: Research design

		interest trail after the visit	
		available	not available
access to	immediately	1	2
further/deeper	delayed	3	4
information	none	5	6

Subjects in condition 1 and 2 visit the exhibition with a PDA to “bookmark” interesting objects and have immediate access to deeper information on the PDA and via Wikipedia (see figure 5). Subjects in condition 3 and 4 can also “bookmark” interesting objects but access to deeper information is only possible at the end of the exhibition. Subjects in condition 5 and 6 can only use the PDA to “bookmark” interesting objects but have no access to deeper information at all.

After the visit subjects of condition 1, 3 and 5 have access to their interest trail, subjects of condition 2, 4 and 6 do not have their interest trail available. The control groups 5 and 6 will serve as a baseline and give insight if satisfied situational interest leads to information satiation and an illusion of knowledge which may inhibit post-visit activity.

### **3.1.3 Procedure**

Participants receive a questionnaire two weeks before visiting the exhibition, measuring the frequency of their museum visits and their individual interest in technology in general and nanotechnology in particular. 20 subjects per condition are asked to visit the exhibition at their own pace. The functionality of the PDA is explained to them regarding the experimental condition they are in. Since the PDA uses a browser and a website, problems (involuntary closing of the program, loss of network access) are expected and dealt with by a researcher assistant. During the visit all actions of the visitors with the PDA are recorded by logfiles and watched by the researcher (see figure 4). The visitors are also recorded by four surveillance cameras capturing each exhibition wall (see figure 3).

After the visit the participants receive a questionnaire (tests of knowledge, interest, media skills, questions regarding problems with the PDA, home/work access to the internet, etc.) and are interviewed regarding the exhibition. They also receive a flyer with a short description of the exhibition and a weblink to a Wiki which contains the complete material of the exhibition.



For conditions 1, 3 and 5 this link leads to their personal user page where their interest trail is available (see figure 6 for an example), for condition 2, 4 and 6 no interest trail is available and the link leads to the main page.

The Wiki is kept under surveillance to measure visitor usage, especially interest trail access and knowledge exchange through participation in the Wiki.

A follow-up questionnaire is sent to the participants after three weeks which measures individual interest, knowledge, post-visit activity and knowledge exchange (e.g. discussion of exhibition after visit).



Figure 3: View of the researcher on the first display: Image of the four surveillance cameras in the exhibition, each monitoring one of the four walls. Images are also recorded, making an in depth analysis of visitor behaviour possible.



The screenshot shows a web browser window displaying a management interface for research subjects. The browser's address bar shows a local host URL. The main content area is divided into four quadrants:

- Top Left:** A photograph of a museum display wall with various informational panels. Below the photo are navigation arrows and the text "zur Übersicht".
- Top Right:** A control panel titled "Statusinformationen für Vp: 15 Bed.: 1". It includes a date and time, a "Neue Vp" button, a dropdown menu for "VP wechseln" (set to 15), fields for "Code" and "Passwort" with a "C/P ändern" button, a "Nachricht" field with a "Textnachricht" button, and links for "Send to" and "Send to special".
- Bottom Left:** A log file titled "Vpn Log of Vp 15" showing a list of system events with timestamps and file names (e.g., control.php, display.php). Below the log is a binary representation of the log content using '1' and '0' characters.
- Bottom Right:** A large, empty text area for entering notes, with an "Absenden" button below it.

Figure 4: View of the researcher on the second display: Top left frame: Image the study subject sees on her PDA (filled in green: visited; filled in yellow: bookmarked), Lower left frame: last eleven entries of the log file of the current research subject; Top right frame: select research subject, send messages and remote update of PDA screen (possible to simulate a location sensitive PDA); Lower right frame: field for notes of researcher regarding the research subject – saved in log file.

zurück zur Wand	Hintergrund- wissen
Exponat merken (Bild/Text)	Chancen und Risiken
Suche in Wikipedia	gesellschaftliche Auswirkungen

Figure 5: Available information in conditions 1 and 2 (immediately) and 3 and 4 (delayed) for each exhibit: Left side top-down: back to the exhibition wall; remember exhibit (bookmark) and search in Wikipedia; Right-side top-down: Background Information, Chances and Risks and Influences on Society (each leading to a short, easy to read text written for the exhibit at hand).

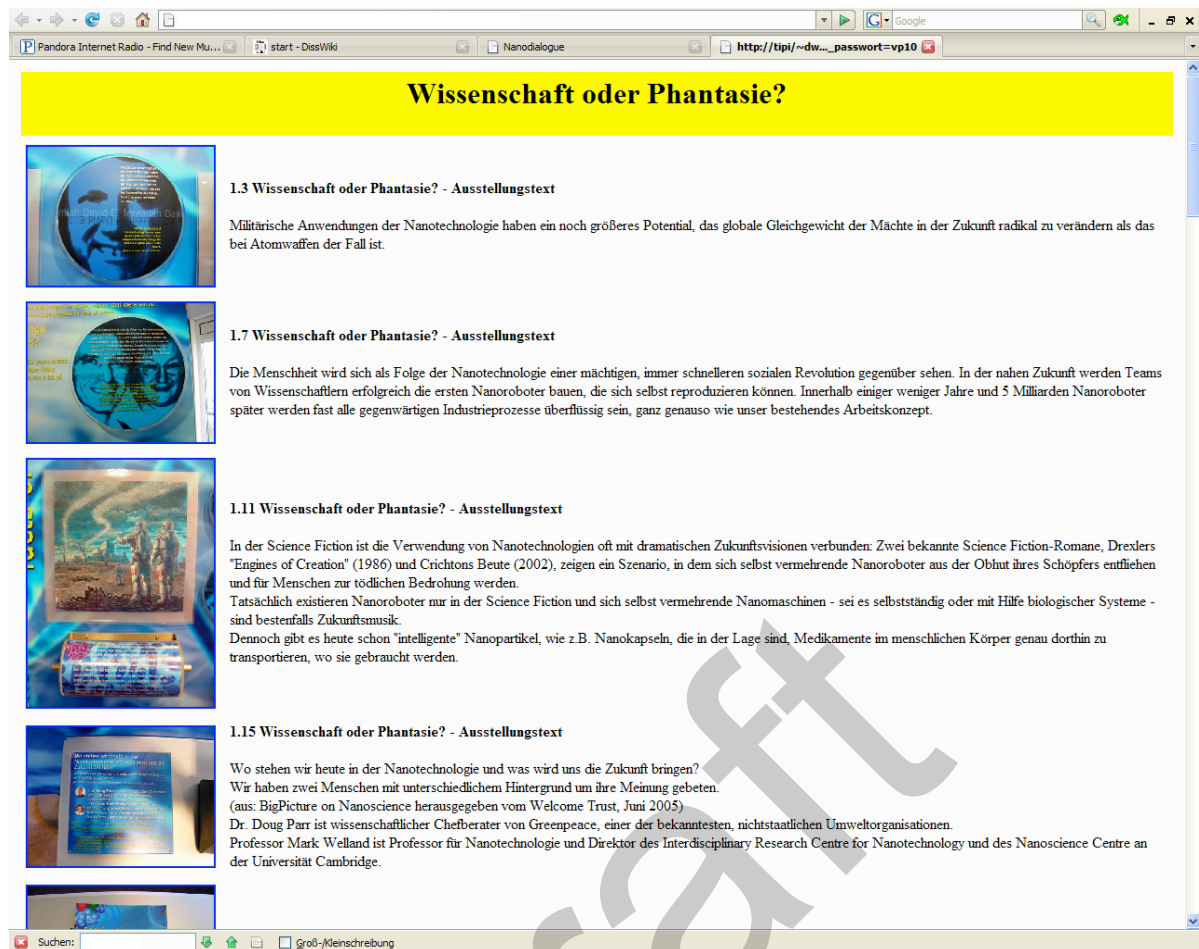


Figure 6: Interest Trail: Bookmarked objects are displayed and available for the visitor (here: print version).

### 3.1.4 Analysis

Situational and individual interest, knowledge acquisition and exchange, and other post-visit activities are compared between the six conditions. In addition to self-reports of post-visit activity logfiles of the Nano-Dialogue Wiki are used to measure retrieval of interest trail and general information and knowledge exchange through changes in the Wiki itself.

## **3.2 Field Study – Focus: real-life implications in naturalistic setting**

If positive aspects of immediate satisfaction of situational interest are shown through study 1 a second study will be conducted in the field. This study aims to maximize external validity through testing the system in a real exhibition with real visitors.

### **3.2.1 Material**

The study will use the next planned location of the Nano-Dialogue exhibition in the “Deutsches Museum” in Bonn. It is intended to use a specifically designed program. Visitors should be able to use a stable program on the mobile device with minimal intervention by the experimenter necessary. It will also be network independent.

### **3.2.2 Design**

Study 2 will replicate the design of study 1 albeit in a natural setting.

### **3.2.3 Procedure**

If visitors are willing to participate in the study they receive a PDA and are given instructions how to handle the functions available in their condition. After the visit the participants receive a questionnaire, are interviewed and receive a flyer with a link to the exhibition Wiki: In condition 1, 3 and 5 this link leads to their personal user page with their interest trail. For condition 2, 4, and 6 it leads to the main page of the Wiki with no available interest trail. The Wiki is kept under surveillance to measure usage, especially interest trail access and knowledge exchange through participation in the Wiki.

A follow-up questionnaire is sent to the participants four weeks after the visit which measures individual interest, knowledge, post-visit activity and knowledge exchange.

### **3.2.4 Analysis**

The analysis follows study 1.

## 4 Contribution to IMCL

With the high range of visitors' ages museums provide a good opportunity to examine tools that support lifelong learning. While PDAs will not be financially possible to be used in all museums, PDAs as property of the visitor, however, will probably become more and more common. Typical PDA functionality merges with cellphones (becoming smartphones) and even today, some smartphones have similar properties as a typical PDA. Access to vast information will also become more common. WLAN-“Hotspots” are spreading and for offline settings the whole Wikipedia can be downloaded. The German version is available in sizes from 330 MB to 2 GB, depending on the amount of articles and images included (Bley, 2006).

While this dissertation is concerned with situational interest in museums the principles apply to other settings as well. It has a high real-life relevance in supporting effective lifelong learning “anytime, anyplace”: If hypothesis 1 can be supported, the situational interest in daily learning activities could easily be supported by an installed version of Wikipedia on a large memory card. If hypothesis 2 can be supported, the proposed stand-alone system for study 2 would enable users not only to access information in Wikipedia, but also to keep an interest trail of their daily activities. This would give them structure and remind them of the subjects they found interesting [A personal Wiki may be used to collect data about activities of situational interest and to take general notes. While Wikis became known for enabling collaborative work, they were also proposed by Leuf and Cunningham as Personal Information Manager (PIM, see Leuf & Cunningham, 2001, p. 83).]. It would be a valuable knowledge acquisition tool for lifelong learning activities.

While it will not be possible to have a working stand alone model of the technology available at the conference, the website-based program is finished and in use. Preliminary results from

the first study – if they support the hypotheses – should be proof of concept and an interesting starting point for discussion.

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