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## IN THE PRESENCE OF THE PAST. A FIELD TRIAL EVALUATION OF A SITUATED SIMULATION DESIGN RECONSTRUCTING A VIKING SHIP BURIAL SCENE

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The call for this conference asks the following question: Media inspirations for learning – What makes the impact? Obviously, media inform learning in a multitude of ways, and most of them are informal. In this paper we report on a project (INVENTIO) where we aim to invent and create digital genres, for use in contexts of learning. Based on the convergence of mobility, wireless broadband, advanced graphic capabilities and positioning/orientation technology, we have conducted a field trial with a prototype of a new genre for use in education and learning. Consequently, we make some of the impact between emerging media and learning ourselves, as active researchers. One such prototyped genre currently being designed is what we tentatively have called a 'situated simulation' [1].

A situated simulation requires a broadband (3G) smartphone with substantial graphics capabilities, GPS-positioning features, accelerometer and electronic compass (magnetometer). In a situated simulation there is approximate identity between the users visual perception of the real physical environment and the users visual perspective into a 3D graphics environment as it is represented on the screen. The relative congruity between the real and the virtual is obtained by letting the camera position and movement in the 3D environment be determined by the positioning and orientation hardware. As the user moves in real space the perspective inside the virtual space changes accordingly. A situated simulation is closely related to mixed and augmented reality. While mixed reality, including mobile augmented reality (MAR) is characterized by different combinations of virtual and real representations along the reality-virtuality continuum [2], a situated simulation is a 'clean screen' solution where there is a distinct (although minor) difference between the virtual perspective via the device and the real perspective of the user. Current versions of the system run on Apple's iPhone 3GS (other platforms are under consideration).

In this paper we report on a field trial evaluation of a situated simulation reconstructing the Oseberg Viking Ship as it may have looked in the year 834, just before the grave mound was erected. This multimodal simulation consists of a 3D environment with 3D objects, natural sounds, written text and audio narration related to various positions and objects in the environment.



Figure 1 The Oseberg situated simulation in use, October 2009. The user is positioned next to the mound and observes the reconstructed ship from South-West while directing the phone towards the centre of the mound.



Figure 2 When positioned almost on top of the mound the user is viewing the ship from above, and activates a 'balloon' link to get a detail view of one of the objects.

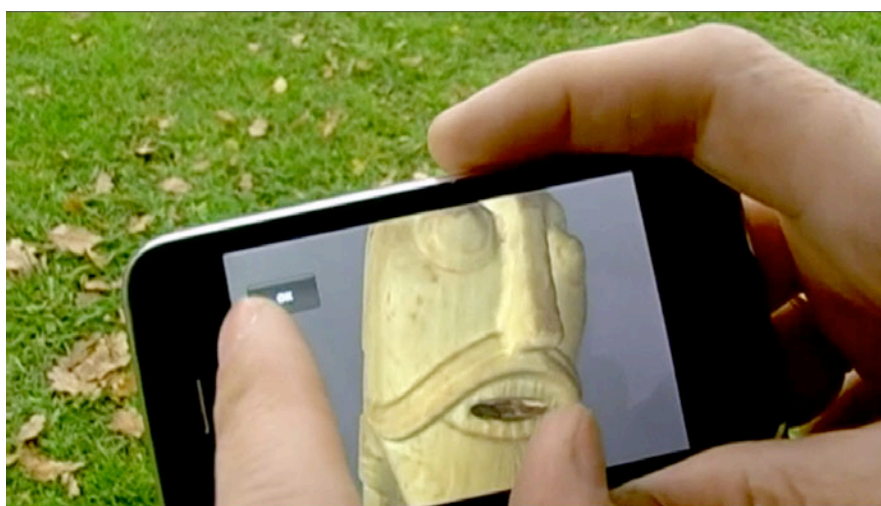


Figure 3 Using the pinch-technique to increase the size of the 3D-object, a 3D scanning of a copy of one of the wood carved viking portraits. The object can be rotated using the tip of a finger.

### Field trial: The Oseberg Simulation

So far three situated simulations have been implemented as prototypes: reconstruction of the Oseberg Viking Ship; Mission Dolores, San Francisco's oldest building anno 1790; and The San Francisco Earthquake and Fire 1906. Our first small-scale field trial reported here took place in October 2009 at the site of the Oseberg Viking Ship grave mound 100 km south of Oslo. The Oseberg prototype was then extended to a full reconstruction of the ship and its content in a 3D virtual environment, which could be accessed and studied at the actual site.

The trial involved groups of high-school students from the area. Twenty-six high-school students (12 boys and 14 girls) at the age of 14 and 15 participated in the field trial. The students were mainly selected due to the location of the school, close to the site. The area is semi-rural and consists of working class/middle class households. The standard of living is relatively high, even for Norwegian conditions. Socio-economically, these young people can be considered as quite average Norwegian youths.

During the field-trial some of the students were observed and filmed. After the field-trial, the students were requested to fill out a questionnaire form, composed by open questions as well as multiple choice questions. Many of the questions ask for free comments about the students' experiences, view-points, suggestions, etc.

Each question and comment were then analysed in order to identify both the central tendency as well as the relative distribution of each topic. Due to the limited number of informants, this was done manually.

## **The students and their competence**

With the exception of one male student, all possessed their own mobile telephone, and they were experienced mobile phone users. On average they had used a mobile for five years. Some very few had just acquired their own mobile, while some had used a mobile since they were seven years old. There is a distinct preference for Sony/Ericsson phones among the students. While three students had an iPod Touch, no-one possessed their own iPhone. Other relatively common types of portable terminals were Playstation Portable, and Nintendo. Nearly half the group did not possess any other mobile terminal than their mobile telephone. But almost all had their Internet-connected lap-top, and the few who did not, had access to the family's computer.

Computers were used on a regular basis by the entire group, and they all used their computers more than 5 hours each week. Nine of the 26 student reported that they used their computer more than 20 hours each week. Seven of the students used their computer between 10 and 20 hours each week. Computers were used for many purposes, the most frequently being homework, chat and games. Somewhat surprisingly, only two students mentioned Facebook activity and none of their web 2.0/social network sites were mentioned. Among those who mentioned games, action-games like Call of Duty, Counter Strike, Red Alert and Tribal Wars were the usual games played by the boys. The main gender difference was that the girls were less interested in games and less than the boys possessed game consols. Whereas the majority spent much time on computer games, the girls preferred chat and other forms of Internet use. The games mentioned by some of the girls were Sims 3, card-games and a Norwegian site with many different entertainment games.

## **Oseberg experiences**

During the test, the vast majority did not experience any crash or other disruptions. In two cases the testing was interrupted by incoming call and text-message. This happened because the testing relied on iPhones borrowed from private persons. One person experienced what was interpreted as a crash.

In their testing with the Oseberg-application the majority of the high-school-students generally enjoyed using it. With terms like "cool, fun, different, interesting, instructive exciting", they expressed that the entertaining aspect of the use were very much present. When asked what they enjoyed the most and the least, some stressed entertaining features like the film feature (?). But the essential aspect of simulation were noted:

"I liked that one could see everything from the angle one was positioned in, but also everything that is inside the mound."

"That one seemingly was there, only many years back."

"It was cool because one could seemingly walk around in a 3D world."

" Nice – like being in another world!"

It was also commented that: "the best bit was that one could actually see the boat, click and hear".

"I like the images of the things in the boat".

"I like best the feeling of seeing something that is not there!"

Others stressed the sound – that one received information about the things that appeared on the screen. There were no indications that the most experienced in computer games enjoyed the simulation system more or less than those who did not have much game experience.

Some noted that the simulation may be a good method for learning, and another student said it was a nice way to learn, particularly when one is fed-up by school. Some did however experience trouble with the sound. Also several noted that the system offered too little (verbal) information. Beyond the control of the experiment itself, some complained about the wind at the testing site (it should here be noted that the test took place on a cold,

sunny October morning. Because of the bright sun and the relative dark colors of the simulation we also decided to use umbrellas to improve the display). There was no indication that heavy computer users or heavy gamers were more or less satisfied with the system than others.

## User friendliness

In general, almost everyone found the simulation and the terminal easy to understand – the whole concept was pretty easy to grasp. Some argued that the reason for this was the touch system. One noted that it was easy like a (computer)game. It was easy to know what to do if one wanted additional information (click on a 'balloon' link). One noted that it was a bit difficult in the beginning, but that it soon became easy. One noted that it was difficult to know how to restart the system when it froze. One noted that it was difficult to find the 'balloon' links, although the majority stated that it was easy to understand how the 'balloon' links worked. One noted that it was difficult to understand in the beginning, but that he or she understood when it was explained. When asked if more information is needed in the system, a clear majority stated that some more or a lot more information is needed. One suggested a small explanatory film sequence.

A few noted that it was difficult to hear what was said in the earphones, or that they simply did not function. It was also commented that it was hard to control the umbrella in the wind! The majority stated however that the sound was OK or good. One noted that the sound didn't work. In order to actually test how the background sound-landscape functioned, we asked what they heard. The majority could report on sounds from birds, water and wind- sounds that the system supplied depending on the location, to simulate a viking age setting. In addition most of the students referred to the male voice narrations related to various positions and objects. Almost all the students stated that the comments were easy to understand. Two of the twenty-six students stated that the comments were difficult to hear, due to the wind at the site. When asked if more written text ought to be implemented in the system, the majority answered negatively. However, one third of the students argued that some more textual information should be added.



Figure 4 Testing the Oseberg Simulation with umbrellas to avoid the bright direct sunlight

Also the graphics were generally positively received, however there were several reservations like that the graphics could have been better, that it was a bit Mario-ish, somewhat unfinished, good enough but worse than PC. The majority found it easy to see what happened on the screen. The main problem was the sun, which made it necessary to carry an umbrella. As mentioned the students walked in pairs, one holding the umbrella, the other operating the iPhone. This made it somewhat awkward for the umbrella-holder to follow what took place on the screen. This clearly confirmed that I-phone-based services are preferably individual and personal. In general of course, when operating location-based services, finding shade or other optimal places for use is secondary which may inhibit the usability.

The students were rather enthusiastic about the items and details that could be rotated and zoomed. They found this function instructive, and also 'nice', 'fascinating', 'cool', and 'fun'. One noted that it was - 'a bit strange, but cool after a while.' Nearly everyone confirmed that they had been able to move the details. The vast majority wanted more 3D details to manipulate in various ways.

Without exception, all the students meant that it would be a good idea to implement and mix images (photo) and video in the system in one way or another. The students presented a wide range of suggestions of how this could be done. Some suggested video clips bits of fiction to see how people looked like and about items were originally used, or other kinds of topical videos. On how the video and images were to be implemented, some suggested that appearing buttons, signs or balloons at the screen, which could be activated by touch.

A critical point in augmented reality is the always present difference between the physical and the screen realities or contexts. The two realities/contexts will always be implicitly compared or in other ways related to each other in the actual use situation. When asking the students about this difference, the student's replies were diverse. A majority stated that the difference fitted or matched well, probably referring to the functionality of location. Others simply noted the difference between the realities. Others seemed to refer to their general interpretation of the simulation stating that it was a positive experience: '...it was nice to see the Viking ship from the side and from above', 'it became more real - I think it was nice because one could see how the ship was placed in relation to me'. Another commented on the difference in lightening between the sunny site and the darker screen. One student stated that he 'did not feel he was there'. Also another student was not impressed, 'but that's because I play a lot with 3D'.

Also when asked to compare this experience with a visit to the Viking Museum in Oslo, the answers varied considerably. There is a tendency in the material that students tend to think that they would learn more at the museum, but that the social experiment at the mound was more fun or interesting. At the museum one would gain access to more detailed information, learn more about details, and examine things more closely. However on the site, the experience were experienced as more fun and interesting, less formal and dull, more rewarding and 'real'. One noted that if the graphics is improved one could possibly learn more using such a system.

## **Comparing with other media**

When comparing the learning effect of the programme with a film or an article about the same topic, the students were divided. One third of the students argued that they would have learned more by a film or an article, particularly by a film. Another third argued that they would not have learned more by a film or an article. One added that he or she would have learned more by an article because then they would have text. The remaining third did not have any clear opinion about this. One noted that a film would have worked in the same way, but 'we learned more because this was new.'

On reporting what they actually had learned during the test day by using the program, the majority stated that they had learned something. One fourth of the student stated that they had learned nothing. The remaining majority argued that they had learned about what various items looked like, what the ship looked like, how the ship was placed in the mound, that there were human sacrifices buried with the ship.

The students were also asked to describe the program and to compare it with other media. Nine of the student thought it reminded them of a computer game/3D game. The reasons for this were the nature of the graphics, the sense of a virtual world. Sims 3 was mentioned by two of the students as an example. Four students compared it to a film mainly because of the information in the headphones. One stated that it reminded of a GPS, another to a museum trick. Quite a few preferred not to answer, probably because they could not find the appropriate comparison.

All but one student answered 'yes' on the question if they thought this kind of 'augmented reality' had a future. A wide variety of possible themes and purposes for future use were suggested. Several meant that it could be used to tell or teach about history about things that don't exist anymore. Others meant that could be used to show future situations, eg. related to water rising as a consequence of climate change. Two meant that it could be used in war. Other unspecified suggestions were that it could be used to find locations of building, for tourists that are

lost. One suggested that it could be used as an instruction manual, to put an (IKEA) closet together etc. One stated that he or she 'like learning as it is – this is OK, but I think it's stupid if everything becomes like this.'

So what were the proposals from this group of young users of how we could improve the application? The general answer was 'more of everything': The students wanted more details, more items to manipulate, that the graphics was more like reality, that it had more things to do for the user, that it presented more text or other forms of information, along with more balloons, signs and film summaries. Only one student argued that no further features were needed.

All of the students concluded that they were happy with the testing, adding that it had been fun, instructive, something new, cool!, exciting. There were no gender differences in terms of experiences with the system. Thus, the girls' relative lack of computer-gaming experience did not prove to be a drawback in the use of our system.

Prior to the testing, the students were divided into two groups. Group 1 were given a brief introduction to how to use the terminals, whereas Group 2 were given no such introduction. The purpose was to test to what extent proper use could be understood intuitively. Somewhat surprisingly there were no difference in terms of user experiences. Group 2 did not consider the system more difficult to use than Group 1. This indicates the intuitive aspect of the design, as well as of the iPhone, and not least the harmonisation of the two into the user experience.

## Conclusion

The field trial demonstrated the system was relatively robust and the user interface was relatively intuitive. However it also showed that the iPhone is sensitive to bright light, which here was compensated by using umbrellas. The trial demonstrated a well-balanced interplay between the touch system of the iPhone and the design of the application. A wide range of technical features was suggested by the students, which basically entailed adding more features (sound, video, etc). The project is in the process of considering several of the suggestions proposed. The trial also indicated that the learning aspects were positive. The students reported high motivation for using the system. This result coincide with the testing and evaluation of a related mobile augmented reality system for learning developed in Japan, based on still imagery and sound [3].

Further field-trials with a revised design will explore whether the entertainment value of the system also enhance the learning value. This one-day event will be repeated several times, paralleling the technical innovation process. The responses will be documented at the sites and reported to the INVENTIO designers for discussion and new implementations. Thus we will continue to document the response from user groups, and to provide them as documentation for the actual modifications that will be implemented in the design. The output of this project will thus be the results of the field trials and their further implications for design.

We believe that the relevance and suitability of the ethnographic and phenomenological approach is the most fruitful in research on location-based genres, due to the phenomenological sensitivity to *place* as a vital factor for production of meaning. In research involving technologies that let physical and informational space oscillate, or even converge through the controlled manipulation of space-perception, the significance of space appears more evident. Also, in projects that recombine past and present place, the significance of place for action and meaning is easier to grasp. Meaning-production and action is situated in the body and its location, which informs and embeds the subject and it's meaning. Location-based media that are intended to guide the human user into invisible or unperceivable historical events or future possibilities, may, if successful, produce disruptions by exposing dramatic change through the perception of the human subject. When such devices are used to explore history, futures or eco- systems, they may not only provide pedagogical solutions, but may also open for insights that go beyond immediate experience. A key theoretical resource in understanding the combined perspectives of the Real and the Virtual is Bateson's notion of 'double descriptions' and its epistemological status [4].

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