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Interacting with the Virtual and with the Real in Mobile Learning

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Abstract: KEI-Time Traveler is a kind of *virtual time machine*, which needs only commercially available GPS phones. In reality, KEI-Time Traveler just shows graphical images of a past scene within a given area, viewing from the current location and with arbitrary viewing angles. Users can virtually explore the past world with this system. We applied it to junior high school students, twice. They virtually visited a world of 1938, when a severe landslide disaster occurred, but the designs of interaction with the virtual past world were different between the two fieldwork trials. By comparing the results, we discuss the interaction design and its effects on the fieldwork.

Keywords: Interaction Design, Mobile Phones, Fieldwork, Virtual World, History

1. Introduction

"KEI-Time Traveler" is a kind of browser that enables students to view the past world through the small window of a mobile phone using GPS. We used KEI-Time Traveler[1] during educational courses for junior high school students, in years 2007 and 2008. We designed a 3D model of a past world of 1938, when a landslide occurred. The past world model contained images of rocks, floods, destroyed houses, and past people: victims who needed help. Students visited the past world and learned much about it.

In this paper, we will describe evaluations on KEI-Time Traveler comparing fieldwork in the two years. In year 2008, KEI-Time Traveler had additional functions, especially on the interaction with the virtual past world. However, rich functions brought about both good and bad effects on the fieldwork.

2. Related Work

Different from other research instances[2-9], KEI-Time Traveler is a mobile *augmented reality* system, in the sense that it gives *past scenes* as augmented information of the present world. From the edutainment point of view, it is designed to provide children with enhanced experiences during the fieldwork. Technically, our system uses only commercially available mobile phones without any hardware attachment. Using such phones is appropriate for education by the cost and weight reasons. It makes it possible for children to visit a virtual past world with such familiar devices. Moreover, we adopted a 3D model-based graphic

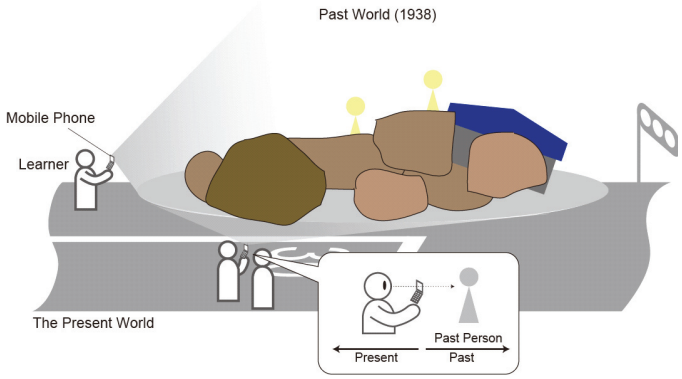

Figure 1: KEI-Time Traveler Concept

Figure 2: Sample Screenshots

generation for phones. Some researches also provided services to watch past worlds. Augurscope [10] presented past scenes, but it was a heavy system and was not evaluated in a educational setting. Past Viewer [11] also enabled people to watch past scenes at the corresponding location, but it presented movie films only at a few pre-defined locations.

A detailed description on related work is given in [1].

3. System Overview

The concept and system design of KEI-Time Traveler is given in [1]. Here we give a short description. Figure 1 depicts the concept of KEI-Time Traveler. With a mobile phone, a user can view a virtual world: a reproduction of a past world at the user's identical location. Some past people, who can talk to users through short messages, can be viewed in the past world. KEI-Time Traveler was developed as built-in software running on the phone using the Brew platform. The 3D past world model is also built into the software module running on the phone. Using Brew, it can sense the built-in GPS receiver periodically. To enable a view of the 3D model of the virtual world from arbitrary locations, KEI-Time Traveler must obtain the user's location parameters and the view angle information. Latitude and longitude values are taken from the GPS, but other parameters should be given by the user's operation.

For the content, we designed a virtual past world, representing the area when a severe landslide disaster occurred in 1938. Five houses and three people were prepared there. The three people talk to the students. Figure 2 shows some screenshots from a mobile phone. Students can observe the past world and learn about the disaster, comparing the present world with the past. The educational goal for students was to learn how heavy the past

landslide disaster was, unlike today's. The teacher intended to make them learn today's disaster prevention technologies as the next step.

4. Practice in 2007

The fieldwork activity was held on Nov. 16, 2007. The number of participating students was 34 (11 boys and 23 girls). They used KEI-Time Traveler by groups of two or three students, for about 10 minutes. By analyzing videotapes, interviews, and written papers by the students after the practice, the following results were given[1].

- Students compared the present world and the past. They observed the past world from various directions, even from the sky. They also felt empathy with the past people.
- Students liked to use mobile phones for the fieldwork, because they are familiar and portable.
- Students were very well motivated to learn the past disaster.
- Students tended to believe that the past scene was perfectly true, though it was partially imagined.

5. Practice in 2008

5.1 KEI-Time Traveler ver. 2

After the practice in year 2007, we have additionally developed some functions for the teachers' convenience and improved interactivity between students and the past world. It is called *KEI-Time Traveler ver. 2*.

1. *Text input*: students are able to leave comments at any locations in the past world, by typing on the mobile phones.
2. *Instruction messages*: the system sometimes sends messages to students to show the next place to visit.
3. *Logging functions*: students' trajectories and their text input are recorded. The recorded log can be shown to the teacher with a graphical *log viewer*.

On Nov. 17, 2008, another practice session was conducted with 12 new students (4 boys and 8 girls). They used KEI-Time Traveler ver. 2, by six groups of two students, for about 20 minutes. Before the fieldwork, we gave students the following instructions:

"*Look at the past world and input many texts. You can input anything at everywhere. Discuss the text with your partner.*"

"*You may receive messages. If you receive a message, read it and find an instruction. You don't have to pay attention to the messages unless you receive them.*"

In the following subsections, we will discuss the first two functions.

5.2 Evaluation of the Text Input Function

With the text-input function, students were able to input text through the mobile phone. They wrote what they felt and what they wanted to talk to the past people. Sometimes they reported like a newscaster. During discussing the text to input, the students thought about

the disaster and victims. It was probable that this function made students feel more empathy with the past people than the case of ver. 1.

The numbers of texts that a group of two students input were from 3 to 8, and 5.7 in average. The time they needed to compose and input texts was typically 50 to 60 seconds, 90 seconds in the longest case. Totally about 35% of the session time was used for text composition and input. When they were inputting the text, they concentrated their attention to the phone and their conversation was broken. Sometimes, they discussed which pictogram to use in the text, for a long time.

5.3 Evaluation of the Instruction Messages

An e-mail message was sent to a group of student, when they saw a past person's utterance in the virtual past world. The message directed the students to the next place in the past world that they should not miss. This function was convenient if the message was received timely.

However, this function made students lose their time, because students sometimes did not actively move and waited for the message. For example, a student said during the fieldwork, "We cannot move because we have not yet received instructions."

Students were permitted to move without waiting for messages, but they waited. Knowing that messages might come, they lost their active attitudes, more or less.

6. Discussion

Here we discuss the 2008 practice from the viewpoint of students' behavior, rather than the learning outcome.

The two functions were useful in some aspects. Students paid more attention to the past world and felt empathy with the past people, by considering texts to input. Students were able to find the next place to visit more easily by receiving an instruction message.

However, these two functions consumed the precious time of fieldwork. The text input function took about one third of the fieldwork time. The message function sometimes made children fall into a waiting mode, and also took their time, which should not be neglected.

Usually, fieldwork is not an easy event to plan for schoolteachers. Teachers must take care of the traffic and other risks outside of the school. The weather is not always fine. Teachers must obtain approvals from the school principal and parents, before the fieldwork. They may have to negotiate with other teachers who have other classes with the students, to take additional time for traveling. Finally, traveling sometimes needs money.

Because of all these reasons, the time for fieldwork should be used for tasks that cannot be done at other places. In other words, it is better if students can take longer time to observe the real world at the fieldwork. In our case, students take a long time to interact with the virtual world --- to input texts into the virtual world and to wait for messages from the virtual world.

Of course, students in the 2008 practice took some time to observe the real world and discussed the damage of disaster by comparing the past with the present. However, such discussions had been more active in the 2007 practice.

Functions to interact with the virtual world should be carefully designed considering the settings of the fieldwork. Purpose of the fieldwork, available time, number of teaching staffs, character of students, etc. should be considered in the interaction design process. If the interaction functions are rich, students would use longer time to interact with the virtual world.

7. Conclusion

KEI-Time Traveler was basically successful as a fieldwork tool to learn local history at the corresponding location. Students were able to compare the past and the present. They were well motivated. However, too much interaction with the past world loses the valuable time of fieldwork. Students' consciousness of the present and that of the past virtual world should be carefully balanced. Our next challenge should be to give a design methodology that can balance the students' interest in the present world with the interest in the past (virtual) world.

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