SketchMap: Supporting Children in Drawing 'Personal Environment Maps'

Pamela Ravasio[1], Vincent Tscherter[2], Masanori Sugimoto[1]
[1] Department of Frontier Informatics, Graduate School of Frontier Sciences, University of Tokyo
[2] University of Applied Educational Sciences, Solothurn Switzerland

Abstract

SketchMap is a system intended for use by primary school children in order to draw their 'personal environment maps'. This task is traditionally tackled in the course of introducing them to the fundamentals of cartography. The system integrates face-to-face and distributed collaboration scenarios that are part of this task, and offers the children a simple means to get accustomed to novel technology such as WLAN and GPS without being distracted from their learning goals.

Introduction

The field of CSCL (Computer Supported Collaborative Learning) draws from pedagogical principles [1], as well as from the insights gained from computer supported collaborative work (CSCW) and hence the world of business. As a consequence, most systems are targeted towards adults working in distributed teams in far apart locations. In pre-university levels however, the situations is entirely different. Here, collaboration usually happens in a mix of face-to-face and distributed situations, where the latter generally encompasses distances of up to a few hundred meters. Consider, as an example, the approach usually employed in primary schools to introduce children to the basics of cartography: The creation of a 'personal environment map'. During this educational activity, the pupils of a class are divided into various groups of one or more student each. Each group creates a sketch of one sector of the area around school, and once this is done, they all meet at one place to merge these sketches into a single large one.

SketchMap

SketchMap is our intent to offer a system that supports children in their task of creating a 'personal environment map', and relieves them from the problems inherent in using paper and pencil for the task (difference in scale and orientation, topological and proportional inconsistencies, varying primitives) - freeing their time and resources to concentrate on the drawing task and the discussions when merging their sketches. We further allow the children a first hands-on experience with latest generation technology such as WLAN, GPS.

SketchMap's realisation is based on 2 principles: *collaboration* and *individualisation*. While the first calls for distribution, the second does for the use of a single computer per pupil. SketchMap as a consequence, is implemented as a distributed WLAN-based client-server MVC architecture. It offers 2 different user-interfaces: One designed for drawing on small scale tablet PCs that take advantage of pen-based interaction; the other is designed for the task of merging a set of partial sketches into a single large one and is intended to run on an average computer (Illustration 1).

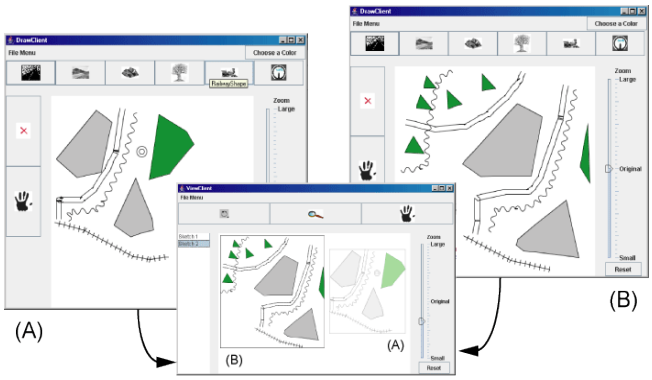

Illustration 1: SketchMap's sketch drawing ((A) and (B)) and sketch merging interface (center).

The drawing primitives offered are a simplified version (Illustration 2) - for the benefit of the children - of those employed by international Boy Scout organisations.

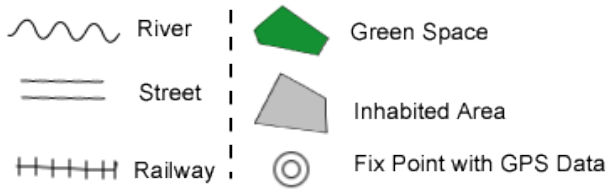

Illustration 2: SketchMap's drawing primitives

At the time of writing, SketchMap covers the possibilities also at hand when using paper and pencil procedures, and improves them by offering simple graphical operations, such as e.g. scaling and rotating entire sketches in order to make them 'fit' together. Functionality that is currently being developed targets aspects such as awareness [2] as well as topology preserving transformations based on the GPS data points which can be introduced by the children into their sketches. A further topic of our current research is the development, in collaboration with primary school teachers, of an entire teaching/learning unit suitable for use in regular primary school lessons.

Initial Experiences

During its development process, SketchMap is continuously subject to code reviews, scenario walk- throughs and expert reviews, in the manner of state-of-the-art usability procedures. These procedures will remain important due to the slowly increasing complexity of the software.

SketchMap has furthermore been the subject of a first user study with university students:

- A team of four students was first introduced to SketchMap.
- They then were given 10 minutes time to 'play' with the system (drawing and merging interface) as well as with the tablet PCs it was running on. During this

period, the examiner answered any kind of arising questions.

- Once that the participants were sufficiently confident with the system, they were asked to draw, independently of one another, a single sector of the campus' surroundings.
- At his point, a brief but intense discussion arose among the students in order to determine who would draw which sector of the area. Once the decision was taken in mutual agreement, each of them proceeded to execute the task single-handedly.
- When all had finished drawing their respective sector, the students were asked by the examiner to join in front of a normal computer and to merge their efforts by creating one single large sketch from the four now completed independent ones.
- To conclude the test and obtain user feedback, a group discussion was held, wherein the participants answered a range of questions related to usability, and task completion, and pronounced freely any kind of feedback they felt important to voice.

During the test, the examiner took note of the ongoing activities. Photographes as well as brief video sequences were also taken.

During the group discussion, the team agreed that they had intuitively understood how to work with SketchMap and its pen-based interaction approach. They underlined that the most collaboration intensive tasks were the merging task and the initial discussion on how to divide and whom to assign the various sectors. They also stated that SketchMap supported the merging task - with exception of minor usability flaws - well and that it simplified the task at hand if compared to a potential paper-and-pencil situation. The team would further like to see the granularity of the drawing primitives revised: While in their eyes everything from a tree to a field of crops classifies as 'green space', they would like to see more fine grained distinctions when it comes to man-made structures (distinguishing e.g. a tennis court and a building). They also pointed out that they would like to describe individual parts of their sketches more precisely, e.g. by attaching annotation or even camera-taken pictures or self-drawn icons to it.

The test gave us the opportunity to expose SketchMap to a near-reality task, and evaluate our implementation against the needs that arise in practical application. As a consequence, we learnt that SketchMap is already now dealing with much larger amounts of data than we had expected. As a result, it will be necessary to review the communication mechanism between clients and server in order to make the system faster, more robust and resistent to network instabilities.

Related Work

Systems that like SketchMap support both individualisation and collaboration, have in Japan mainly come into use in the 'integrated study' classroom or in educational facilities such as museums. Examples here are: [3] compared the achievements of pupils using web based training systems in combination with PDAs in the 'integrated study' classroom, outdoors, and in a social education facility. [4] presented a system that aimed at pupils collaborating in the design of a town and experience the respective environmental implications. Or [5], who developed a system in which pairs of pupils collaborated to solve a knowledge quiz about the insights they gained from the science exhibition in a museum they were visiting each individually.

Conclusion and Outlook

In this paper we have presented a tool, SketchMap, that aims at supporting primary school children in the creation of a 'personal environment' map. SketchMap combines face-to-face and distributed collaboration, while its interface relies on pen-based interaction and technologies such as WLAN and GPS.

In an first study, the users agreed on that SketchMap allowed them to easily pursue their goal; face-to-face collaboration during map merging using SketchMap was commented to be an interesting, almost exciting task, which was also proven by the vivid discussion that took place.

The upcoming version of SketchMap, which will incorporate an enhanced communication mechanism, will be used for more detailed outdoor studies. It will be of evident interest, also to compare the procedures observed in this context to those in place in a pure paper-and-pencil environment.

References

[1] T. Koschmann: Paradigm Shifts and Instructional Technology: An Introduction. In: Koschmann, T. (Ed.): CSCL: Theory and Practice of an Emerging Pradigm. Lawrence Erlbaum Associates, 1996, 1-23.

[2] P. Dourish, V. Bellotti: Awareness and coordination in shared workspaces. ACM Conference on Computer Supported Cooperative Work CSCW '92, 1992, Toronto, Canada

[3] T. Ishizuka, T. Horita, K. Takada, K. Ishihara, M. Ogawa, K. Moriya, K. Mori, Y. Nishimura, T. Yamada, S. Morishita: Development and Practical Study on Mobile Learning Environment using Personal Digital Assistants for Elementary School Children, Proceedings of ICCE 2004.

[4] M. Sugimoto, K. Hosoi, H. Hashizume: Caretta: A System for Supporting Face-to-Face Collaboration by Integrating Personal and Shared Spaces. International Conference on Computer-Human Interaction (CHI), 2004, Vienna (Austria).

[5] K. Yatani, M. Sugimoto, F. Kusonoki: Musex: A system for Supporting Children's Collaborative Learning in a Museum with PDAs. 2nd IEEE International Workshop on Wireless and Mobile Technologies in Education (WMTE'04), 2004.