Virtual Gutenberg's Printing Press

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Abstract

The exhibit installation "Virtual Gutenberg's Printing Press" helps people to understand the Gutenberg's invention using State-of-the-Art augmented reality technology. The functionality of the Gutenberg's printing press is shown in a user-friendly way, with presentation technology completely hidden from visitor experience and using real objects as user interface. Visitors can simulate the book printing using only real world objects such as tweezers, letter case, coloring unit, and printing press. The installation consists of three main stations – setting, coloring and printing. Additionally there is a huge display in front of the stations showing the whole process using stereo projection. The main idea is to show the people, living in an information era, the principle of the invention that made it possible to widely distribute information for the first time – the book printing.

Introduction

Augmented reality is a sub field of virtual reality where virtual and real worlds are combined in order to use the strengths of both sides. It is often used in industry applications, but it's potential for educational and presentation purposes is not exploited very often so far in public installations. A big advantage of augmented reality is that users remain aware of their real environment. The virtual part of the mixed environment is used to add information, which would be far more complicated to do in some other way, enriching the surrounding reality.

As part of the event series "Gutenberg – Man of the Millennium" [1] in year 2000 together with the FHS Mainz an interactive augmented reality installation "Virtual Gutenberg's Printing Press" was implemented. This installation puts the interaction interface into reality and the visual feedback of one's actions in the virtual space.

Real tweezers, chase, letter case, coloring unit and a printing press are used as interface to communicate with the computer system needed to create the visual feedback. The computer itself totally vanishes from the perspective of a visitor. In this way, people who would never use a keyboard or mouse in an exhibition are more likely to be attracted to use the installation with its natural interface. Furthermore, it is almost instantly clear to the visitors what they are supposed to do, it is not necessary to explain the users how to use the system. This installation uses results from a previous work on general user interaction devices for 3D augmented reality environments [2].

The whole system consists of three stations: a setting, a coloring and a printing station, and a large display screen for the stereo projection. The stations are made of wood and represent the real part of the system. The virtual part of the system is projected on the huge screen in front of the users using stereo projection. Stereo projection is a well-known technique that makes it possible to display objects appearing to be three-dimensional, such as if they would float in front of the screen. In order to perceive the 3D effect, visitors have to wear simple polarizing glasses. Projecting the virtual part onto a big screen the experience can be shared among a group of people, rather than building an experience for a single user only. In order to make it easier for the users to get the sense of space in the virtual world, representations of the real objects are projected as well. Furthermore, more visitors can use the whole system simultaneously; a user setting a word at the setting station does not exclude another user from coloring already set text at the coloring station.
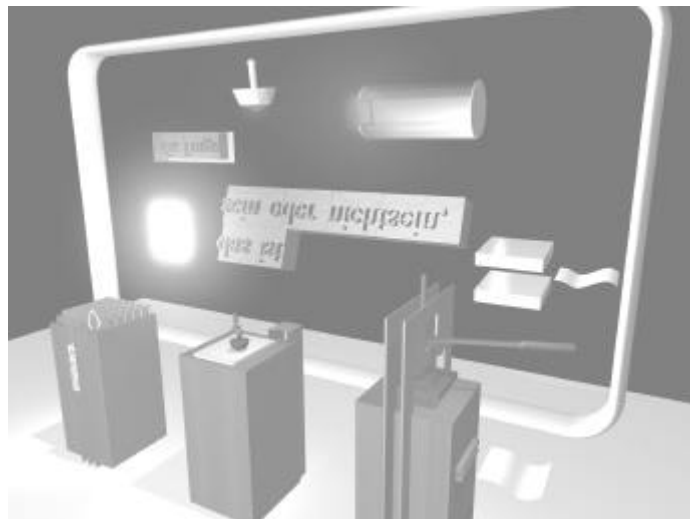

Figure 1 Virtual printing press

Virtual Printing Press

The installation "Virtual Gutenberg's Printing Press" represents the main principle of book printing. Basic steps in the book printing setting, coloring and printing are simulated on three stations. All stations are real world objects with obvious functions that can easily be recognized. The actual design does not correspond to the original Gutenberg's printing workshop. The placement of the stations follows the logical flow of the printing. **Error! Reference source not found.** shows a model of three stations and projection screen in front of them.

Setting Words

The first station simulates the setting, the initial step in book printing. The letter case is simplified compared to the original Gutenberg's letter case and only its function of storing the letters is kept. Our letter case, shown in Figure 2, contains actually no letters. There are only signs of letters that are supposed to be in the cases. There is a tweezers and a chase at the station. The tweezers are used to pick the letters and the chase holds the picked letters. As soon as the user grabs with the tweezers in a specific empty letter case, the tweezers shown on the screen hold that letter. Note that there is a real tweezers, but there is no real letter.

The chase has its representation on the screen as well. As soon as user releases the tweezers near the chase the letter drops on the chase. Of course, if the tweezers is released without the chase beneath the letter will drop "on the floor" and will be lost.

As soon as the text setting is finished the chase has to be brought to the coloring station. At this next station the chase has to be turned over so that virtual letters "drop" on the coloring plate.
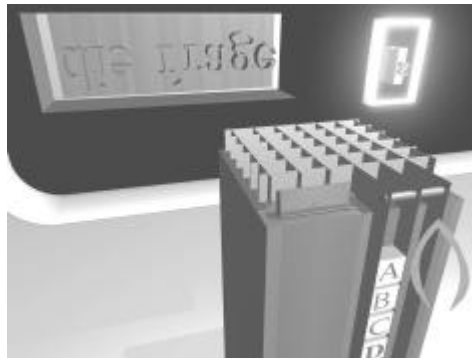
Figure 2 The Setting Station

Coloring

Just as in Gutenberg's printing process, the letters ought to be colored before paper is pressed onto the set letters. At the coloring station the visitor can choose the color of the ink and color the text using a real coloring tool. The whole text has to be colored in order to see all letters on the printed page. The whole process is simulated so far that the more ink is put at the certain part the more saturated the color will be. The colors can be mixed, just as real inks. The coloring process can be observed on the display, giving an immediate feedback to the user which parts of the text are colored and which are still not. The model of the coloring station is shown in Figure 3.
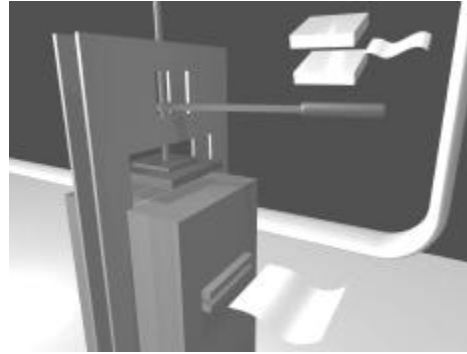
Printing

Finally, after the text is set and colored it can be printed. The printing station is designed after Gutenberg's press, but is reduced to show only it's function principle (Figure 4). Visitors understand immediately that they have to pull the press lever in order to print.

After the lever is pulled, a laser printer built into the station prints the text set at the setting station and colored at the coloring station and outputs a real sheet of paper.

Figure 3 The Coloring Station

Figure 4 The Printing Station

Implementation

The whole installation consists of three interaction stations exclusively made for this purpose. The system is running on an SGI Octane rendering two channels for stereoscopic back-projection using two polarized LCD projectors. User interface elements such as the tweezers, the chase, and the coloring device are tracked in position and orientation using Polhemus magnetic tracking technology. All tracking data and button events (printing press event) are collected and served by a separate PC. The software itself is based on the novel "Studierstube" 3D API environment [3] and is real-time rendered using Open Inventor.

On design issue was the portability of the system due to a planned traveling exhibition all over Europe in cooperation with FHS-Mainz, Germany. The "Virtual Gutenberg's Printing Press" installation was shown in Mainz, Berlin, Vienna, Paris, Dijon, Brussels, and is going to be shown in St. Petersburg as well. More than 21.000 users have visited the installation in the different cities. Figure 5 shows a group of visitors using the system at the exhibition in Mainz.

Figure 5 Visitors in Mainz exhibition

Conclusion

The installation "Virtual Gutenberg's Printing Press" shows how augmented reality technology can be applied to educate and entertain visitors in a public exhibit. The haptics of real world objects address the problem of using purely virtual presentation methods. Such a user interface implemented with not computer specific looking input devices was reported to be very intuitive and easy to use. Most visitors did not hesitate to use the system and all of them really had fun using it. On the other hand the virtual presentation using 3D stereoscopic projection methods gives the freedom of abstract interpretation and clearly defined storytelling.

The Gutenberg's printing process was chosen, because the invention of book printing made it possible to spread information fast and to many people simultaneously. Today's information technology is actually exactly the same, spreading information fast among many users. The scales for "fast" and "many" may have shifted during centuries, but the underlying principle of constructing textual information by placing letter after letter forming words, sentences, and pages remains the same, giving the basis of today's word processing.

Acknowledgements

Bibliography

1. Alexander Kehry, Heike Oeldorf, „**die virtuelle druckwerkstatt**", in *village Gutenberg Gutenbergs Technik und die multimediale Welt*, Katalog zur Austellung in Gutenberg Pavillon Mainz 14. April bis 14. Mai 2000.
2. Zs. Szalavári and M. Gervautz, **The Personal Interaction Panel - A Two Handed Interface for Augmented Reality**, in *Computer Graphics Forum (Proceedings of EUROGRAPHICS'97)*, 16(3):335-346, 1997.
3. Szalavári, Zs., Schmalstieg, D., Fuhrmann, A., Gervautz, M., **"Studierstube" – An Environment for Collaboration in Augmented Reality**, in *Journal of the Virtual Reality Society – Virtual Reality – Systems, Development and Applications*, 3(1):37-49., 1998.