New Way to Use Information Technologies to Monitor Spatial Abilities

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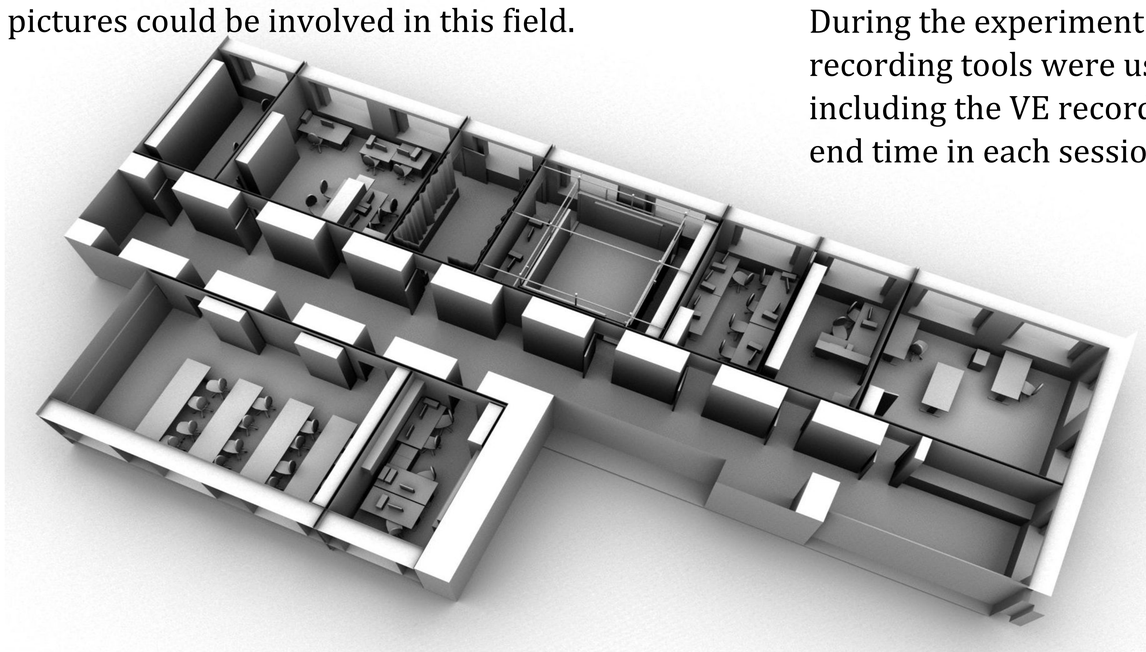
Introduction

The 3D applications, as well as virtual environments (VEs) are spreading faster and faster all around the world. It has been proved in the past that these developments play an important role in navigation training.

Our research goal is to respond to the questions of how those kinds of applications should be developed for a better understanding and mapping the cognitive processes and how panoramic pictures could be involved in this field.



3D environment (detail)

- Witmer et al. demonstrated in their study that a well-developed VE could be an effective tool for route learning.

- Koh et al. described an experiment where they gave considerable attention to the build up of cognitive map and they did not monitor the navigation behavior. The subjects were trained not only in the real world, but in an immersive VE, a nonimmersive VE and there was a fourth condition where they could see the model of the corridor from bird's eye view. According to the results, the training was as successful in the VEs as in the real world. Among the various virtual conditions the results showed no significant difference.

- Gambernini et al. argued for the importance of VEs in emergency simulations because people easily recognize emergency situations in a VE and can adapt to the new situation.

Methods

In the experimental task, participants were asked to navigate in a virtual building. During the navigation they had to find a single red cube, which was always in the same place, but the starting point was different in every subtask.

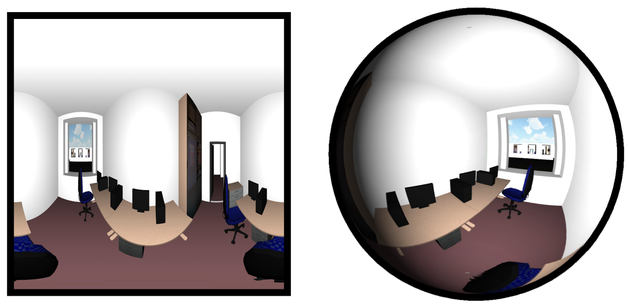
First the 3D objects were modeled and then the Virtual Panoramic Environment (VPE) was created. In VPE, participant's avatar was placed to Discrete Points (DiP) and was able to look around in 360 degrees. For "walking", the next Dip had to be selected by clicking with the mouse.

Four participants were involved in the experiment.

Data capture

During the experiment several data recording tools were used. The software including the VE recorded the start and end time in each session, the position and gaze coordinates of the avatar and the exact time when the cube was found. Webcam videos were recorded about each participant during the navigation.

Moreover, another application recorded the gaze data of the participants as well allowing us to analyze what they brought into focus on the monitor. Thus, the navigation software recorded the navigation tasks, so the execution time, route length and average speed could be precisely calculated from the data. This poster is focusing on the execution time.

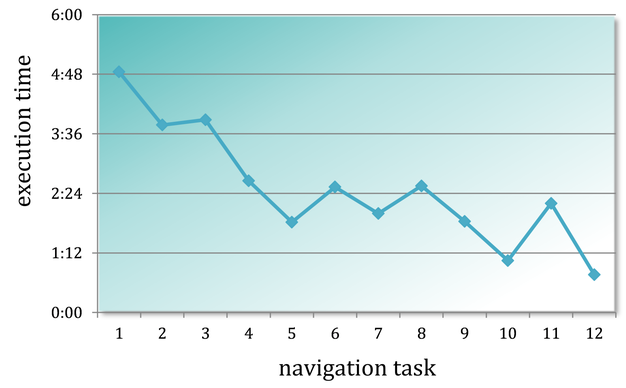


2D panoramic picture and its 3D space reprezentation

Results

The participants were asked to come in four successive days and solve three subtasks on every occasion. The time limit was set to five minutes for each subtask. The mean time of the twelve navigation tasks was calculated and is shown in the figure.

The values present that the participants were able to achive progressively better results.



During the first few subtasks it was hard to find the red cube, but at the fourth day the record time was only 15 seconds.

By the eleventh task, one of the participants was not able to find the red cube in time and that generated a higher mean value.

Conclusion

In this experiment we demonstrated that VPEs can be utilized as an effective tool for monitoring and improving spatial abilities.

We have taken the first steps in data analysing, but beside the execution time there are a lot of other factors.

Future research will need to compare the performance in VPE and in the original 3D VE navigating in "First-Person View" mode.

References

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