COMPARISON OF USER PERFORMANCE WITH INTERACTIVE AND STATIC 3D VISUALIZATION – PILOT STUDY

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MOTIVATION

Interactive 3D visualizations of spatial data are currently available and popular through various applications such as Google Earth, ArcScene, etc. Several scientific studies have focused on user performance with 3D visualization, but static perspective views are used as stimuli in most of them. The main objective of this paper is to try to identify potential differences in user performance with static 3D visualizations (perspective views) and 3D interactive visualizations.

This research is as an exploratory study. Experiment has been designed as between-subject. Custom testing tool based on open web technologies was used for the experiment. The test battery consists from initial questionnaire, one training task and four experimental tasks. Selection of the highest point and determination of visibility from the top of the mountain were used as experimental tasks. Speed and accuracy of each task performance of participants were recorded. Movement and actions in a virtual environment were also recorded in case of the interactive variant.

EXPERIMENT

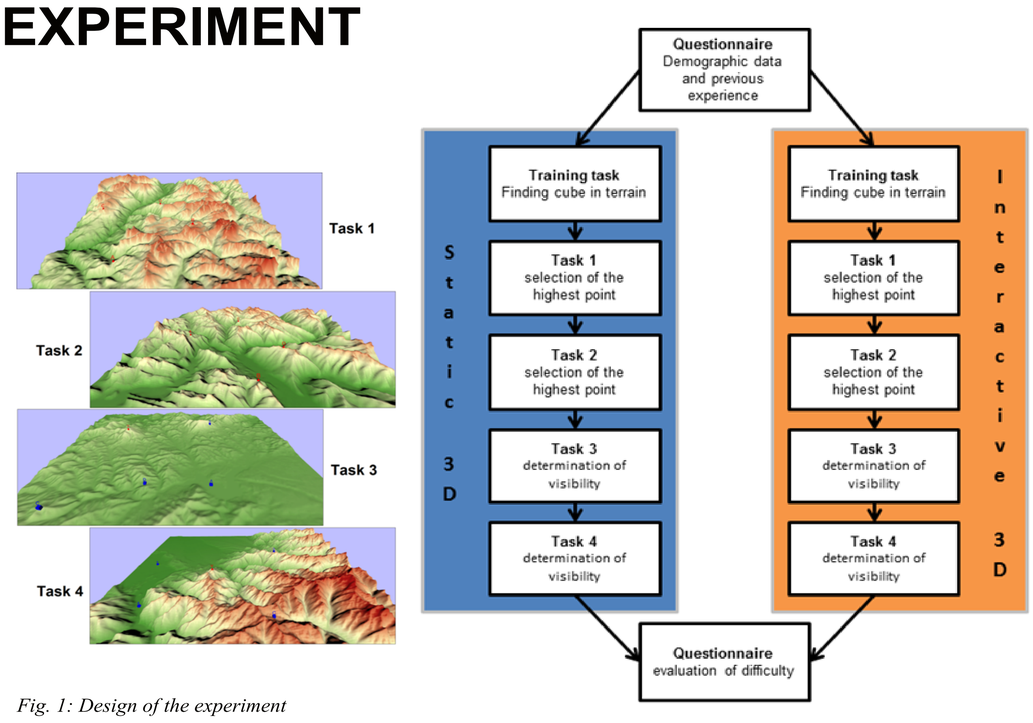


Fig. 1: Design of the experiment

The group of participants included 22 volunteers – participants in the action "Researchers Night". There were 17 males and 5 females with an average age of 23.5 years. All participants had some previous experience with computerized 3D visualization applications, but none of them was an expert.

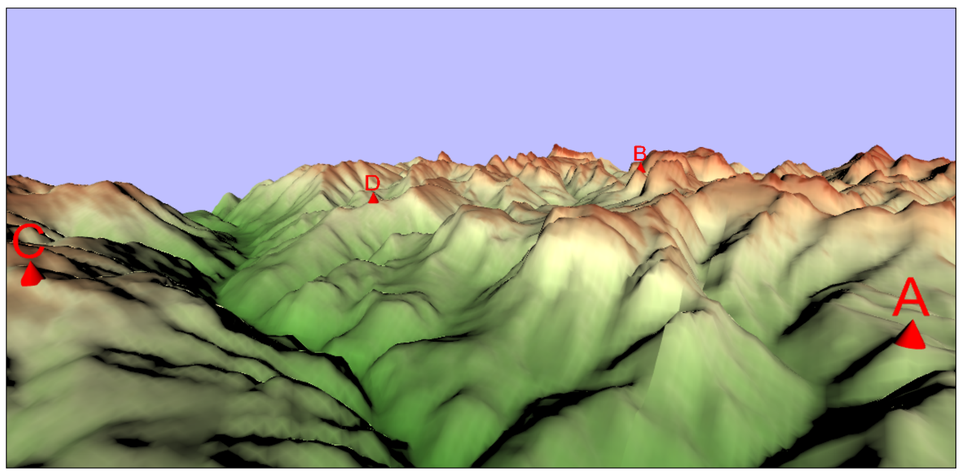


Fig. 2: Testing tool interface (task 1, interactive variant)

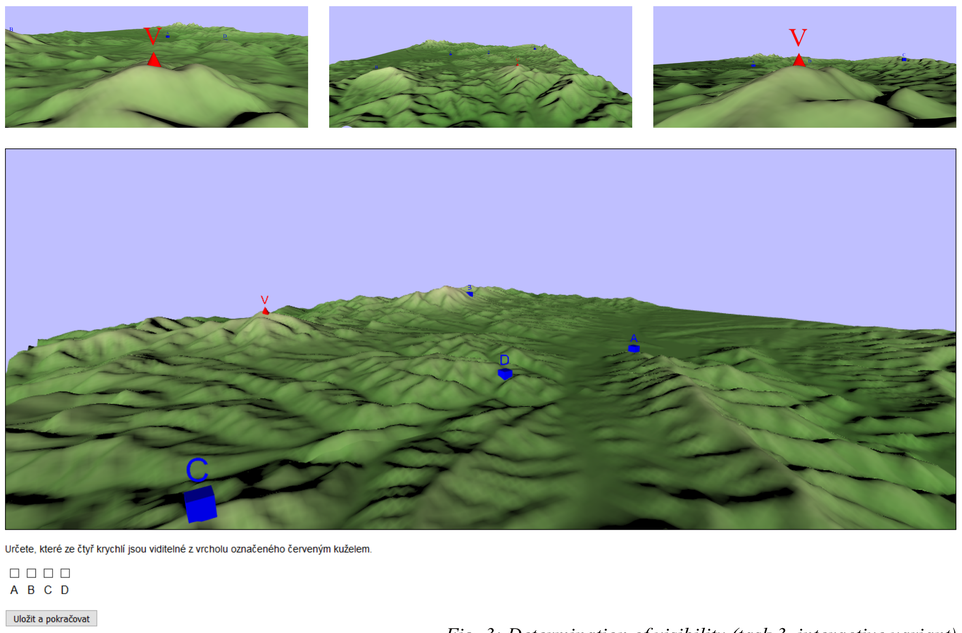


Fig. 3: Determination of visibility (task 3, interactive variant)

*Technologies: HTML, JavaScript, PHP and **X3DOM***
Data for stimuli: SRTM
Software for data preparation: ArcGIS 10.2

RESULTS

Fig. 4: Average correctness in percentage. The correct answers are considered those which are entirely correct.

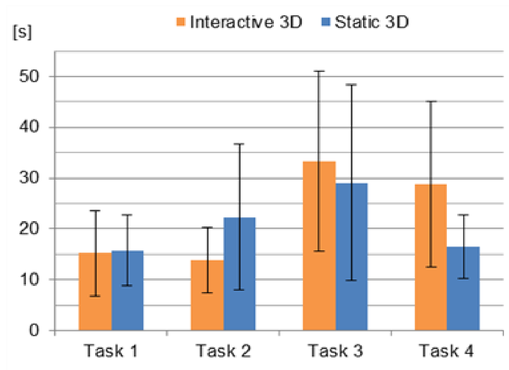


Fig. 5: Average speeds (lengths) and standard deviations of task performance

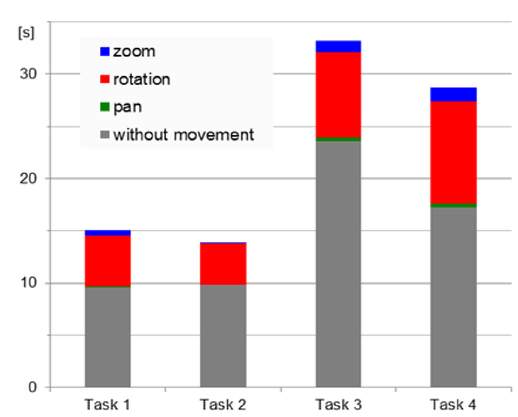
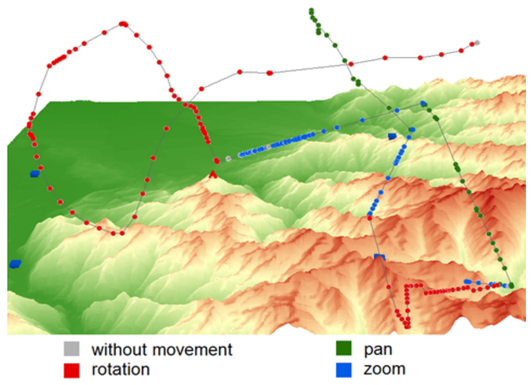


Fig. 6: Average duration of use of individual types of movement

We looked at the proportion of individual types of movement during the tasks performance particularly regarding the user strategies. Longer time intervals without an action were often detected at the beginning of the task performance.

Fig. 7: Example of trajectory visualization

The data about actions in the interactive 3D visualization can be further analysed and visualized as a trajectory or as a sequence of movements Overall distances travelled by the participants in a virtual environment can be also calculated.



CONCLUSIONS

The main aim of this study was to identify differences in user performance with static perspective views and interactive 3D visualizations. In general, the participants working with static perspective views reached better results. They made fewer errors and were also faster. Another type of errors the users made may suggest different approaches (strategies) during task performance (static: omission errors; interactive: commission errors).

The results of the static 3D experiments cannot be transferred to interactive GIS applications. We consider interactive 3D visualization as richer in terms of information and more computationally demanding on users, which is reflected in a higher error rate. We expect that interactive 3D visualization will be more useful for professionals and for complex tasks in particular.

Due to considerable variability of correctness and duration of users' performances in particular (both in the static and in interactive variant), it will be necessary to focus on differences between different groups of users in the subsequent research. Regarding the interactive 3D visualization, it would be an interesting and challenging task not only to monitor correctness of answers and speed, but also user's strategies and cues used by the users for decision making. For this purpose, it will be beneficial to use mixed research design, which combines advantages of quantitative and qualitative methods.

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