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Navigational learning in virtual environments that are designed to improve memory– Individual and group differences based on spatial abilities and age

Ismini E. Lokka, Arzu Çöltekin

ismini-eleni.lokka@geo.uzh.ch, arzu.coltekin@geo.uzh.ch

Even though the technological developments now provide many different kinds of real time navigational aids with improved digital maps, navigation is still a difficult task for many people and this level of difficulty varies across different abilities and age groups. Virtual environments (VEs) simulate the real world, and by using them as 'spatial labs' we can understand their strengths and limitations as training devices to help users with differing abilities and characteristics as they learn a pre-given route. A central question is if all VEs (e.g., with different visualization designs) work well as training devices for all kinds of users (e.g., regardless individual and group differences)? Specifically, we examine if people with varying spatial abilities in different age groups require the same visual input to assist their navigational learning, or if we can modify the visual information in VEs, so all kind of users memorize the route effectively.

Within the frame of this project, we expose younger (20-30 years old) and older (65-75 years old) participants in three different VEs. These VEs vary in the amount of visual information they include; that is, we present an abstract (no photo-textures), a realistic (fully photo-textured), and a mixed VE (which is a 'combination' of the abstract and realistic VEs) (Lokka and Coltekin 2016; 2017; accepted). We evaluate the knowledge participants acquired during a virtual walkthrough by asking them to solve visual, spatial, visuo-spatial memory and sketching tasks. We show that for tasks addressing *route knowledge*, the recall accuracy pattern for the three VEs is identical for participants with individual differences (e.g., age and spatial abilities): Overall, participants perform better with the mixed VE. When it comes to *survey knowledge*, however, the pattern for the two age groups changes. Acquiring survey knowledge is a more difficult task for older participants, that is, we observe significant differences in the performance of the older and younger participants. Interestingly, our preliminary analyses suggest that a VE with less visual information (abstract VE) might not impair the performance in survey knowledge acquisition for the older participants as much as it does for the younger participants.

Overall we observe that individual factors, in this case, age and spatial abilities affect the performance in spatial knowledge acquisition in all VEs; younger participants overall outperform the older, and high-spatial participants overall outperform the low-spatial. More importantly, however, by managing the amount of information (in our case, amount of realism) presented in the VEs, we can increase the route recall accuracy for all participants.

A full-paper developed from this abstract is published here:

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