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Virtual environments designed to improve route-learning performance: A focus on age and visuospatial abilities

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Despite the sophisticated real time navigational aids and ubiquity of digital maps, navigation is still a difficult task for many people. The *level* of this difficulty varies based on individual and group differences, such as people’s visuospatial abilities and their age. To examine such differences, it is common to use Virtual Environments (VEs) as ‘spatial labs’. Broadly, we are interested in understanding the strengths and limitations of VEs as cognitive training devices. More specifically, we investigate if and how much three differently-designed VEs help people with differing visuospatial abilities in two age groups as they learn a given route.

The two age groups consist of younger (20-30 years old) and older (65-75 years old) participants. Both groups work with all three VEs. The three VEs vary primarily in the amount of visual information they include; that is, we present an abstract VE with no photo-textures, a realistic VE that is fully photo-textured, and a mixed VE which is a deliberately designed ‘combination’ of the abstract and realistic VEs, which we call MixedVE (Lokka and Coltekin 2016; 2017). We evaluate the visuospatial knowledge participants acquired during a virtual drive-through by asking them to solve visual, spatial, visuospatial memory tasks as well as drawing sketches of the route. Participants solved these tasks first immediately after experiencing the simulated drive-through, then again a week later to understand what has been retained in their memory after some time passed in a delayed recall stage.

Overall, we observe that age and spatial abilities strongly affect the performance in visuospatial knowledge acquisition in all VEs. Younger participants overall outperform the older, and high-spatial participants overall outperform the low-spatial. Most importantly, however, by carefully managing the amount of realism and integrating knowledge from landmark theories into the design of our MixedVE, we can increase the route recall accuracy for all participants. This pattern remains consistent across age and abilities, and interestingly, persists in the delayed recall stage; thus demonstrating its potential as a memory training device for navigation.

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