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Cognitive differences in navigation using allocentric cameras

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Abstract:

Navigation supported by mobile devices has expanded rapidly in recent years. Before this modality of geoservices (LBS) was restricted to vehicular navigation, but the improvement in the infrastructure of data transmission and location created the right environment for the increased use of mobile devices, especially smartphones, for use in personal navigation. Several navigation support services, such as Google Maps and Waze, are available free of charge. However, many studies have pointed out the trend of transforming personal navigation into a more relevant and immersive experience for the user. With this, the use of two-dimensional maps has provided space for the use of maps from a perspective view. In GIS, these views are known as allocentric views and are usually configured such that the whole representation is visible in the scene from a point that floats over the digital model. Navigation platforms accessed by mobile devices have been used as a first-person perspective view, called the egocentric view, as a metaphor for a user's eyes. This generates the need for the user to position their smartphone in front of their face to obtain information in the approximate geographical position. If on the one hand, research such as Dong et al (2021), van der Kuil et al (2020), Murcia-Lopez and Steed (2016), allow us to conclude that there is a reduction in the user's cognitive effort when comparing the use of the egocentric perspective to the use of the digital 2D map, on the other hand, there is some reduction of the understanding of the space as a whole due to the limitations of the line of sight and obstructions. This difficulty in obtaining terrain knowledge in the egocentric view is given by the segmented view of space in scenes whose connections are performed through the reference points on the mental map of users. In addition, the same authors pointed out that there is no efficiency gain in task accomplishment, but a gain in confidence and satisfaction, although very much linked to interaction. However, the literature has not investigated how to build three-dimensional representations, especially the configurations and analysis of metaphors when the camera is the user's eyes. In this context, it is added that the digital revolution not only affects maps in cartography, but there is also a great process of gamification that affects the way people use digital maps. In many of these games, Lidar point clouds have been used in the reconstruction of real environments as a way to compose virtual worlds, or some of them, according to the Digital Twins philosophy. When evaluating video games that use navigation in fictional environments, it is possible to notice that players have a faster learning curve in games with allocentric view than those with egocentric view. Moreover, in highly virtualized environments, beyond fantasy, players do not feel comfortable with an egocentric view. This could explain, at least in part, the preference for games from the third-person view, that is, the allocentric view. Analyzing the scenes of these games, we noticed different positions of the allocentric camera around the avatar (the character that represents the player). When the camera is placed closer to the character, there are limitations similar to the egocentric view, such as the lack of global landmarks, concatenation of different scenes in the mental map, and obstruction of the line of sight by features present in the region. When the camera is placed further away and in orientation following the line of sight of the character but with a slightly downward attitude, as in the current GIS, there is a greater amount of information represented in the scene, and the space contiguous to the line of sight of the camera is more extensive. It may facilitate spatial memory for object-to-object relations, that is, allocentric memory (Thrash et al., 2019). However, camera settings, such as the aperture angle (FOV) and the variation in scale from the user, generate different problems in the generalization of information and estimation of distances, sizes, and positions. This raises the question of how these landmarks along and off the route and the visual complexity of the scene affect user perception and short-term memory. This effect has been researched by Vidal et al. (2004), Nuhn and Timpf, (2016), Keil et al (2019). In highly complex environments, such as urban or restricted environments, these settings have the potential to prevent users of navigation support systems from having difficulties, such as self-orientation or even getting lost. Following the idea of gamification, we propose an analogy for its use in personal navigation. The goal was to evaluate whether the amount of information present could affect the understanding of a study region and the concatenation of spatial information, contributing to the construction of more efficient systems. In this proposal, a transition between outdoor/indoor urban videos was used to evaluate the change in the point of view, with changes in the position and attitude of the camera, considering the

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number and relative disposition among features taken as references by the participants compared to 2D maps. This research proposes a combined qualitative evaluation of questionnaires and sketches to verify whether there are differences in the concatenation of features used as references in short-term memory and the understanding of the area from the variation in the amount of information and generalization of the scale presented in the scene.

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