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Exploring new ways to zoom in maps

Yiyan Li [a]*, Guillaume Touya [a]

[a] *Univ Gustave Eiffel, ENSG, IGN, LASTIG, F-77420 Champs-sur-Marne, France, yiyan.li@ign.fr,guillaume.touya@ign.fr*

* Corresponding author

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Abstract:

In the cartographic navigation process, enhancing the efficiency of panning and zooming operations is crucial for users trying to locate their target. Due to the changes in maps at different zoom levels, and the reduction of the visualised extent during a zoom-in, the map user often lacks visual cues to indicate where exactly the current map view is located compared to the previous one.This lack of visual cues causes disorientation and cognitive load (Touya and Berli, 2023). The disorientation is even more important as the jump in zoom levels achieved by the zoom is large (Touya and Berli, 2023).However,the existing zooming interactions fail to help to reduce the disorientation. To solve these disorientation problems, as map designers, we can change the map to enhance the potential visual cues, or we can change how we interact with the map; this paper explores the latter option. We think that there are several ways to change the zooming interactions in the current interactive web maps: (1) adjusting or reducing the speed of zooming animations can help users grasp the ongoing changes (van Wijk and Nuij, 2004); (2) incorporating navigational cues during the zooming animation highlights the ongoing changes; (3) finally, we can constrain or guide the zoom instead of giving a free control to the user. There were propositions of such controlled zoom such as GravNav (Javed et al., 2012) or BIGNav (Liu et al., 2017). GravNav adds a gravity effect that attracts the zoom to important locations or zoom levels, while BIGNav learns the map use habits of the user in the first moments, and then guides the zoom to the places or zoom levels that the user often visits. All these options are interesting and we should evaluate how much they can mitigate disorientation and cognitive load, in particular during big zooms. In the remainder of the paper, we present one way to control or guide the zoom that we called SimZoom, as it uses the similarity between map views to stop the zoom.

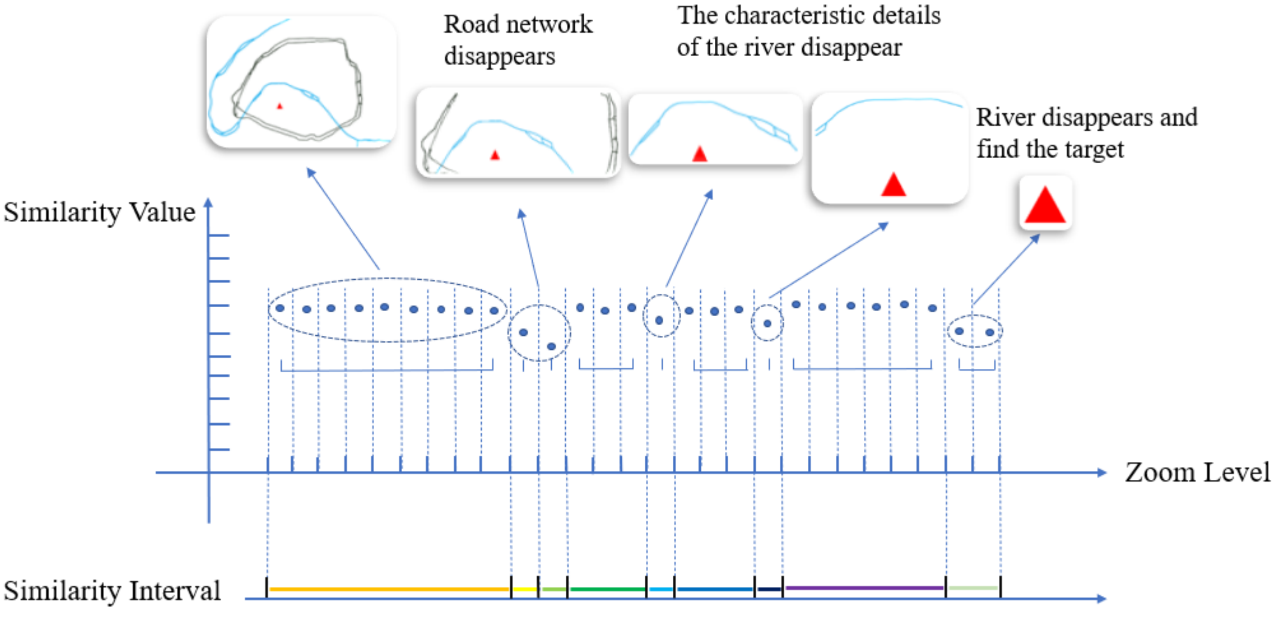

Figure 1. Form similarity interval in zooming process.

The principles of SimZoom are based on the concept of similarity interval between successive map views. Occasionally, several successive map views after a zoom operation are similar as they retain common global features related to orientation, topology, and position of the main landmarks of the map. However, sometimes, these features are no longer or only partly visible after a zoom, Therefore, we consider that the map has switched to a different similarity interval. We argue that a zoom should not jump to a different similarity interval, and SimZoom would stop the zoom at the last scale

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of the similarity interval. Figure 1 illustrates this idea with a case centred on Paris, France, At the beginning of the zoom levels, the main landmarks are retained, and more generally, The map content remains similar: these zoom levels maintain approximately the same similarity value, and can be more easily skipped during a zoom. But as zoom levels increase, the map view begins to change, e.g. when the Paris ring road gradually disappears, it is regarded as one new similarity interval. In this similarity interval, the scales show Paris proper, where the general shape of the Seine River forms the main landmark. At larger scales, the river is no longer completely visible and those scales belong to another similarity interval. In this case, we want to stop the zoom before the maps become dissimilar, because the dissimilarity can be a cause of disorientation.

To design SimZoom, we need a better understanding of the perception of similarity between map views, to be able to measure it (Xu et al., 2021). We designed a user survey to understand the map views that users perceive as similar or dissimilar (Figure 2). We also plan to design a user study about the actual behaviour of interactive web map users, to understand how much or how often they use small or big zooms, to adjust our propositions of new ways to zoom in maps to the actual habits of map users.

Figure 2. The Arc de Triomphe at two consecutive scales in OpenStreetMap (©OpenStreetMap contributors).

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