Analyzing Eye-Tracking Information in Visualization and Data Space: from Where on the Screen to What on the Screen

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Abstract— Eye-tracking data is currently analyzed in the image space that gaze coordinates were recorded in, generally with the help of overlays such as heatmaps or scanpaths, or with the help of manually defined areas of interest (AOI). Such analyses, which focus predominantly on where on the screen users are looking, require significant manual input and are not feasible for studies involving many subjects, long sessions, and heavily interactive visual stimuli. Alternatively, we show that it is feasible to collect and analyze eye-tracking input in data space. Specifically, the visual layout of visualizations that can be instrumented is known at rendering time, and thus can be used to relate gaze coordinates to visualization and data objects that users view, in real time. We demonstrate the effectiveness of this approach by showing that data collected using this methodology from ten users working with an interactive visualization, was well aligned with the tasks that those users were asked to solve, and similar to annotation data produced by four human coders. Moreover, we introduced an algorithm that, given our instrumented visualization, could translate gaze-coordinates into viewed objects with greater accuracy than simply binning gazes into dynamically defined AOIs. Finally, we discuss the challenges, opportunities, and benefits of analyzing eye-tracking in visualization and data space.

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