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# Map reading strategies comparison using eye-movement data

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**Keywords:** eye-tracking, eye-movements, comparison, scanpath, expert, novice

## Abstract:

Eye-tracking has been considered as a valuable tool for examination, evaluation and optimisation of cartographic outputs. As was summarised by Krassanakis and Cybulski (2019), cartographic eye-tracking research might be divided into five areas. This submission aims to two of them - the development of analysis tools and methods and analysis of map users' expertise.

Many ways and methods of eye-movement data analysis and visualisation exist. One specific group of analytical methods is beneficial for the investigation of map reading behaviour. This group is called Scanpath Comparison and it analyses, compares, and quantifies the similarity (or difference) of different user groups' map-reading strategies. Map users are often classified based on their expertise. Scanpath Comparison methods might help to describe experts' strategy and quantify the similarity of these experts and novices.

This contribution will introduce two methods of Scanpath Comparison. Emphasis will be placed on the comparison of one-to-many (1:n) users. The first method (ScanGraph) is based on string-edit-distance and is described in Doležalová and Popelka (2016). The similarity between participants is calculated using Levenshtein distance, Needleman-Wunsch algorithm or Damerau-Levenshtein distance. The results are displayed in the form of a simple graph. Usually, the groups of similar participants are displayed as cliques of this graph. However, for the 1:n analysis, the resulting matrix with similarity values between participants is used instead. The second method is called Multimatch and was originally introduced by Jarodzka et al. (2010) and later modified by Wagner et al. (2019). The drawback of their solution is that only one pair of users can be compared. This method was adopted, and the similarity between all participants was calculated using batch processing. For the visualisation of the results, the environment of ScanGraph was used, so the multimatch calculation results are displayed as a graph.

These two methods will be presented on the example of two case studies. In the first one, one geography teacher's strategy was compared to the strategies of all his students. In the second study, the map author's map reading strategy was compared with strategies of common map readers. The results of both methods helped us to calculate the average similarity between expert (teacher, author) and novices (students, readers) and highlight the most similar or most different individuals. During the workshop, we would like to discuss our approach and its suitability for map reading behaviour analysis.

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