Combining Two Datasets into a Single Map Animation

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A comparison of two independent datasets to search for correlations, either instant or lagged, or find anomalies among the behavioural phenomena represented by the datasets, is a common type of task in visual analysis. Presenting these two datasets together on a single map is a widely used method for comparison, also with temporal datasets (Blok et al. 1999). If the datasets are areas or surfaces, they are very likely to overlap each other at least partially. In that case, transparent layers are used to avoid one dataset being covered by the other one. When the transparent data layers overlap each other, a new colour is formed as a combination of the colours of the data layers. There are guidelines for selecting colours for bivariate maps (Brewer 1994) that are analogous to overlapping datasets. However, the bivariate colour schemes are designed for static maps, and there is no knowledge about how movement and variation in the geometry of the datasets affect the perception of the phenomena.

To study the functionality of the bivariate colour schemes applied to map animations of moving areas, we selected two pairs of spatio-temporal datasets for different analysis tasks and implemented map animations for them. The first data pair contained an atmospheric rain model and radar images of rainfall (Figure 1a). To enhance those areas where the model and observations do not match (a task demanded by experts on meteorology), the colours for the visualization were selected to be complementary in such a way that their combination forms a neutral grey. Both datasets were classified into three classes. The second data pair included a model of birch pollen concentrations in air and relative air humidity (Figure 1b). The colours were selected so as to be associative (yellow for pollen, blue for humidity) and their combination to form its own colour (green). High air humidity (over 70%) has proved to reduce the pollen concentrations to less than 50

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grains/m^3. These were selected as threshold boundaries of the areas that were visualized.

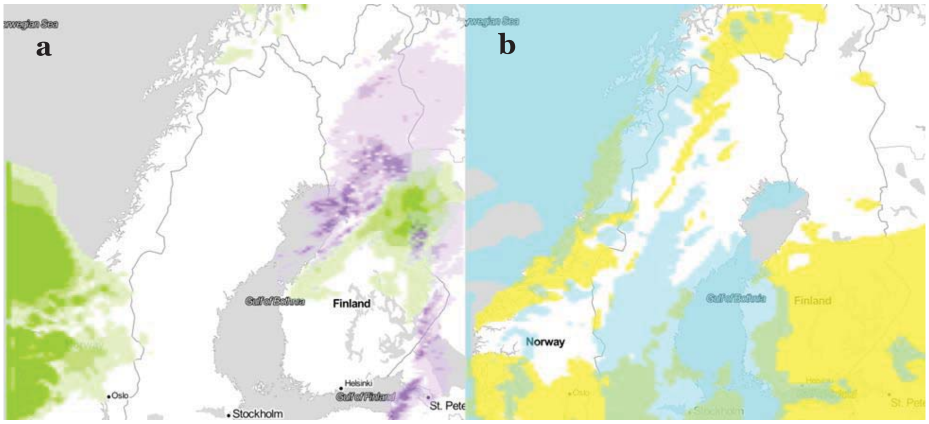

Figure 1. Screenshots of the rain model and rain radar visualization (a) and the pollen and air humidity visualization (b). In (a), the rain model (green) forms continuous areas with high intensity of rain while the radar observations (purple) are more dappled and discontinuous. In (b), the blue layer with high air humidity is spreading from the sea into the inland parts of Finland, wiping away the yellow pollen layer. The layers overlap in the green zone.

The comprehensibility of these visualizations was evaluated through interviews with three different user groups: students, GIS experts, and experts on meteorology. The groups were asked about their opinions about the selected colours and the associations they obtained from the visualizations. All the groups concluded that the neutral grey as a combination of the radar and model was not easily noticed; the interpretation of grey is particularly sensitive to its neighbouring colours, and the differences in the geometry of the datasets increased this effect. The pollen-humidity pair was also difficult to interpret because of the separate, non-predictable movement of the datasets. The green union of the datasets was seen as a third phenomenon of its own, rather than the combination of the other two. Our key finding is that the colour use guidelines designed for static maps cannot be straightforwardly applied to animated visualizations. Further studies should focus on the effects of movement behaviour, geometrical complexity, and the spatial coverage of the datasets.

References

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