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Maps / Geovisualization

The fundamental purpose of maps/geovisualization is to effectively communicate spatial information with the readers. Therefore, a map should be assessed by its efficacy in presenting the information to its specific audience. There are unavoidable distortions when condensing real-world spatial information to project that onto a map. Distortions can be essential if they help highlight the critical information, and can be detrimental if they obscure that critical information. There are three general types of spatial information to be represented on a map: point, line, and surface. I will discuss how each interacts with distortions.

A map needs to pinpoint the locations of places, and these are "points" on a map. These points need to be easily found, so they are often represented by different visual features (e.g., color and texture) from the background, sometimes resulting in a "pop-out" effect (Wolfe, 1994). An easy way to represent such points would be dots. However, when certain locations need be emphasized, modifications become necessary. For example, political maps often plot national capitals with a larger dot even when the capitals are sometimes smaller in population size (e.g. Ottawa). This distortion makes sense if the information to emphasize in the map is the political status.

When points connect, they become lines. Lines are effective in representing boundaries and contours. Lines do not physically exist along these boundaries or contours, and drawing them is a distortion of the physical world. However, the lateral inhibition of the visual system creates the perception of "lines" (i.e. Mach bands) along the boundary of two surfaces with different luminance (Ratliff, 1965). Thus, lines running along two different surfaces are consistent with this aspect of perception. On the other hand, lines become awkward and difficult to visually interpret if the two surfaces are painted with the same colour and texture (see this example, Bourke & Mclaren, 1992).

When lines connect, they enclose surfaces. Surfaces convey information such as the shape and size of regions on a map. I will discuss a type of surface map closely related to scientific research: heat maps. Heat maps are widely used to depict tracking results of activities such as brain signals and movement. In a typical heat map, regions of high activities or correlations are coloured in red (Wilkeinson & Friendly, 2009). However, perceived colours are more consistent with categorical variables (Wong, 2010); yet tracking results are typically continuous variables which are better represented by luminance. Why are tracking results "distorted" to fit into a colour scheme, especially when changes in luminance are also salient (Theeuwes, 1995)? The reason can be largely cultural as colours such as red and yellow represent the word "heat" (thus more robust activities) more intuitively. Given the effectiveness of luminance, it is still important to keep luminance correlated with colour in a heat map. For example, if regions of low activities were represented by blue hues with low luminance, high activities should be represented by red hues with high luminance.

From the previous examples, we can see that: 1) Distortions in a map can be advantageous in emphasizing objects of abstract significance, such as national capitals. 2) They can be effective with understandable drawbacks. For example, colour heat maps are more intuitive to readers while sacrificing consistency with the type of data. 3) If not used carefully, distortions can be confusing and ineffective. To conclude, as a vision scientist, the pros and cons of a specific mapping distortion needs to be thoroughly evaluated to effectively visualize and communicate the spatial information.

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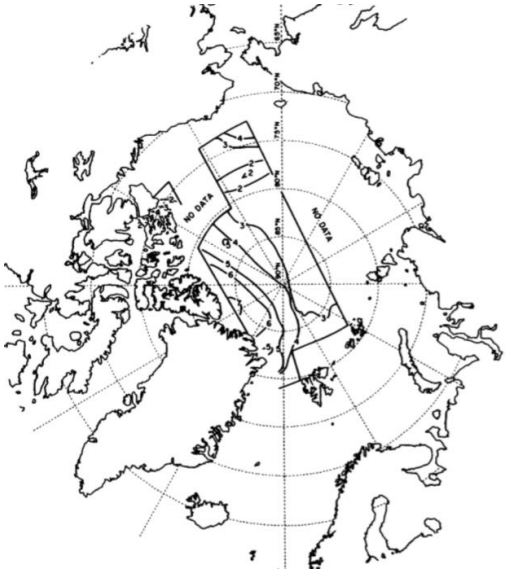

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