International Cartographic Association
Association Cartographique Internationale

From the abstract to maps and landscapes: a metageovisualisation perspective

Antoni B. Moore [a,*]

[a] *University of Otago, Dunedin, New Zealand, tony.moore@otago.ac.nz*

* Corresponding author

Keywords: metacartography, spatialisation, conceptual traverses

Abstract:

The concept of metacartography was introduced by William Bunge in his book "Theoretical Geography" (1962). For him it was an activity of setting the "boundaries" of cartography by exploring traverses from the map to the premap (i.e. "…other devices, such as photographs, pictures, graphs, language …"), and of most interest to him and fellow researchers at the time, from the map to mathematics. These traverses were performed, for example, along lines of scale, generalisation distortion, abstraction and "psychological accuracy" (premaps), alternatively topology, dimensionality, and distance (mathematics). The traverse activity quite simply started with an example that was definitely map-like, then progressively presenting other examples that had less and less of the map in them, noting when the change to premap or mathematical example occurred (e.g. for the scale traverse: Map of a city; Map of a campus in the city; Representation of a university building on the campus (premap); Representation of a nail in the building (premap)). This metacartography activity and its results were then to provide context for Bunge's manifesto for a mathematically-led geography, a foundation of the "quantitative revolution" in the discipline that has led to the Cartographic and GI Science of today.

In geovisualisation currently, we are faced with increasingly abstract, realistic and artistic elements that have massively expanded the conceptual space for visual representations of geography. It seems as though the time is ripe to explore the boundaries of geovisualisation, an updating of Bunge's metacartography that is called here metageovisualisation. While such an activity would seem limiting, the "stepping back" from the subject to afford an "omni-optic" view is in fact freeing: "…rather than restricting maps, the subject [metacartography] tends to broaden maps to their greatest possible limits." Stepping back again from this meta-level of activity, this revisiting of research in the early days of quantitative geography and computer cartography is an activity proposed by Goodchild (1992) in his setting out of GIScience.

There are three identified rich areas of development for geovisualisation. Abstract representations are concise, having simplicity of visual communication. Realistic representations are enabled by mixed reality technologies, offering immersive communication with 'new' experiences such as embodiment. And art is a flexible medium which in its visual form is able to flexibly communicate geographic concepts in space and time. Together, they can be made to form a conceptual cube, the ART cube (Moore, 2015), a structure with Map => Abstract, Map => Realism and Map => arT as the axes, through which to enact metageovisualisations i.e. to explore what is representationally possible.

In particular, we explore the traverse from the spatially abstract (non-spatial data) to maps and landscapes (Figure 1a). In other words, this is spatialisation, "…a data transformation … based on spatial metaphors … generating cognitively adequate graphic representations" (Fabrikant and Skupin, 2005). Specifically, we have a band-musician graph of the Dunedin Sound of the 1970s to the 1990s, a significant music scene in New Zealand at the time (Figure 1b). A possible transformation scheme for the spatialisation is one that is naturally or geomorphologically plausible in the transformation from abstract to spatial. To this end, we present two alternative process-based methodologies (Moore, 2022) - mountain building and young volcano - for the transformation to plausible landscape (Figure 1c). Band temporal attributes are transformed into height (representing how early / late they are in the timeline) and area (representing their length of existence) of mountains in the spatialized landscape, while the link element of bands to musicians will be conveyed through a network metaphor.

Abstracts of the International Cartographic Association, 6, 171, 2023.
31st International Cartographic Conference (ICC 2023), 13–18 August 2023, Cape Town, South Africa.
https://doi.org/10.5194/ica-abs-6-171-2023

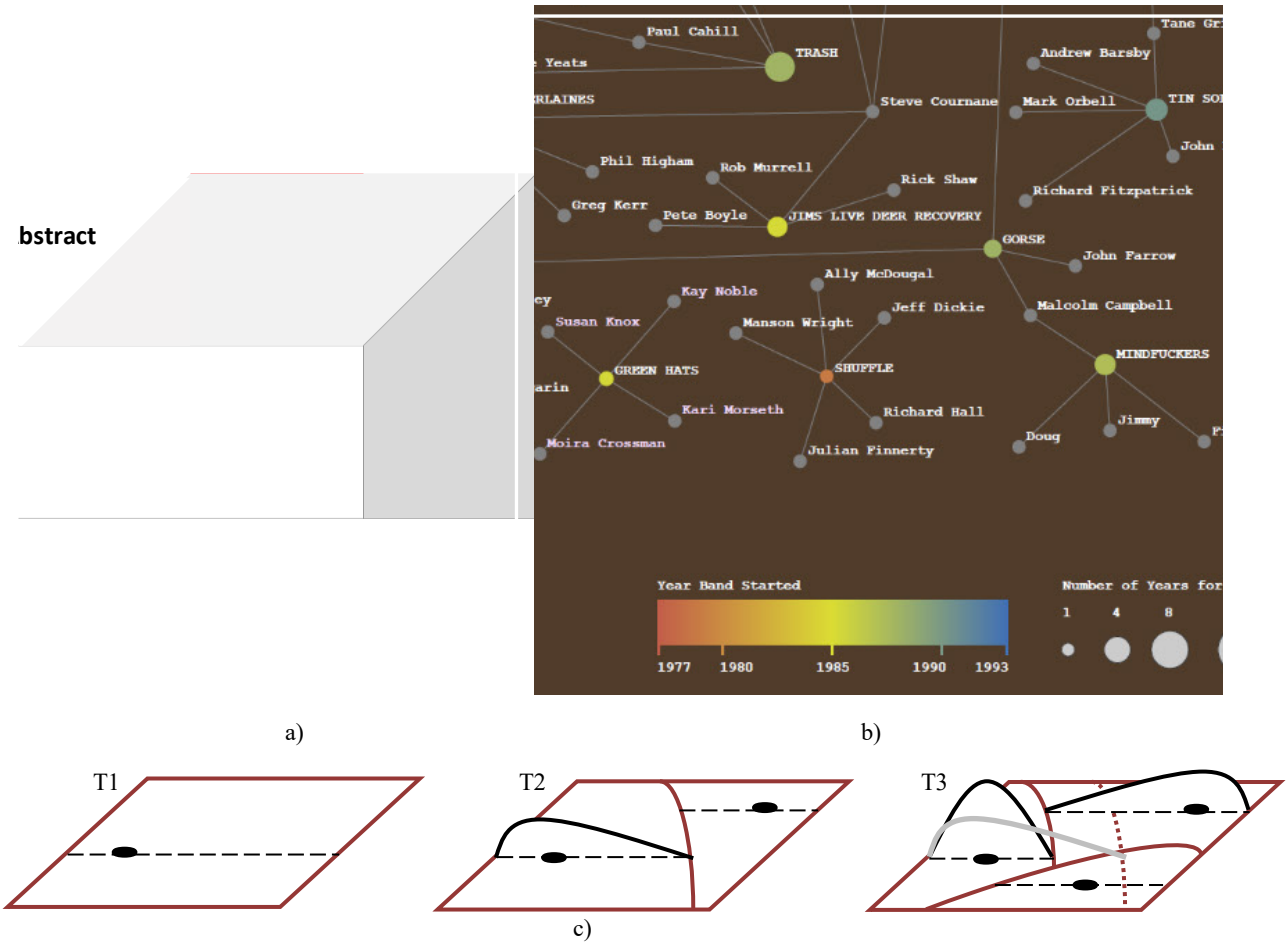

Figure 1. a) The ART conceptual cube illustrating spatialisation traverses from abstract to map and from abstract to landscape. b) Part of a graph of bands and musicians of the Dunedin Sound, a spatially abstract dataset to be spatialised. c) Three initial stages in spatialisation by mountain building, transforming bands into mountains

In Figure 1c, at Time 1 (T1), initialization of the first band at the beginning of the timeline occurs as a point in abstract space, with a one on one correspondence with the equivalent band node in Figure 1b. At time T2, "mountain growth" of the first band and initialization of the second band to form in the timeline happens, each band occupying their Voronoi areas (multiplicatively weighted by number of years in existence so far. By time T3, further growth of the first band (T2 mountain profile in grey; T2 Voronoi extent as a dotted boundary), initial growth of the second band, and initialization of a third band has occurred.

Through this example, we have the detailed algorithmic description of a specific visualization, but we also have the view at the meta-level, that of a conceptual traverse from the geographically abstract (bands and musicians) to the explicitly spatial (maps / landscapes). This metageovisualisation facilitates the exploration of alternatives, such as tweaking the example spatialization more towards the realistic (e.g. adding orthophoto rendering or virtual immersion) or artistic (e.g. adding paint or cartoon effect, or given the theme of the example, enabling interaction to trigger a localized music layer based on the output of these bands).

References

Bunge, W. 1962. *Theoretical Geography*. Sweden: Gleerup.

Fabrikant, S and Skupin, A. 2005. Cognitively Plausible Information Visualization. In: J Dykes, A M MacEachren and M-J Kraak (eds.) *Exploring Geovisualization*. Amsterdam: Elsevier, 667-690.

Goodchild, M F. 1992. Geographical Information Science. *International Journal of Geographical Information Systems*, 6:1, 31-45.

Moore, A B. 2015. Abstract, artistic and realistic representations and interactions with Big Data. 2015 ICC Pre-Conference Workshop: "Envisioning the Future of Cartographic Research", Curitiba, Brazil, 21st August 2015.

Moore, A B. 2022. Towards a Geomorphologically-Plausible Spatialization of Graph Data. *Proceedings AutoCarto 2022, Redlands, CA, USA, 2nd to 4th November 2022.*

https://doi.org/10.5194/ica-abs-6-171-2023