

Rethinking dynamic visual variables: towards a framework of dynamic semiology

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Abstract— So far, Bertin's visual variables were elaborated on the assumption that a map is an "image" that cannot be animated. With the use of computer technologies, such as animation and interactivity, this assumption came to be questioned and a new semiology was created in order to better visualize the spatio-temporal changes.

Index Terms— Semiotic, geovisualization, animation, map design, spatio-temporal modelling.



BACKGROUND AND OBJECTIVES

The representation of spatio-temporal changes is a real methodological problem for classical static cartography. The notion of "rational image" advanced by Bertin (1967) essentially implies that a map cannot be animated and does not accept any motion. This was challenged, however, by the use of new technologies in the cartographic process and the development of new "dynamic" visual variables (Hyward, 1984, Gersmehl, 1990, Dibiasi, 1992, Peterson, 1994 and MacEachren, 1995). These variables allow for a better visualization of spatio-temporal changes.

In this paper, we will first sketch out a critical analysis of the literature on dynamic semiology. We will then put forward an attempt of redefinition of dynamic visual variables along with a number of supporting illustrations. The third section will be devoted to a discussion of the results of this new approach.

1 APPROACH AND METHODS

1.1 Critical analysis of "dynamic visual variables" literature

The review of research on dynamic visual variables reveals the absence of a clear-cut definition of this notion. They are only defined, implicitly, by opposition to classical static variables. It is when we try to implement illustrative examples of these variables that we realize that they are mostly rather technical devices. They do not always allow for a better appreciation of a given spatio-temporal change. We retain, in the framework of our analysis, the following variables: duration, frequency, rate of change, order, synchronization, which are the most well-known variables.

1.2 Redefining "dynamic visual variables"

The complexity of spatio-temporal visualization is related essentially to the difficulty of modeling time. Dynamic visual variables ought to help understand the changes and hence include the multiple temporal dimensions. Our approach is organized along the answer to the following questions: What is the relationship between the classical visual variables and the dynamic visual variables? What is the effect of the introduction of motion on the classical visual variables? Does this make them dynamic?

The Dynamic visual variables proposed include:

- **The change rhythm**: the speed of the animation must show the change magnitude.
- **The proportionality variable**: the duration of the animation scene should be proportionately related to the real time duration. At the same time the intervals must reflect the regularity or lack of regularity of real time phenomena.

-Trajectory variable: It enables us to retrace the evolution of a given phenomenon

2 DISCUSSION AND PERSPECTIVES

The topic of dynamic visual variables must be approached as a component of the dynamic map design. Indeed, interactive tools allow a better explorative visualization of spatio-temporal changes. The challenge is how to implement an appropriate design based on the coherence and the complementarity between animation scenarios and interactive tools.

ACKNOWLEDGMENTS

The authors wish to thank "Cartomouv research group" of CNRS team 8504 Géographie-cités which is the framework of our reflexions.

SELECTED REFERENCES

- [1] N. Andrienko, G. Andrienko, "Interactive visual tools to explore spatio-temporal variation," *Proceedings of the working conference on Advanced visual interface*, pp. 129-132, Gallipoli Italy, 2004.
- [2] J. Bertin *Sémiologie graphique. Les diagrammes, les réseaux et les cartes*. Mouton, Gauthier-Villars, Paris, 1967.
- [3] C. Blok, "Dynamic visualization variables in animation to support monitoring of spatial phenomena," PhD. Dissertation, University Utrecht, 2005.
- [4] C. Blok., "Dynamic visualization in a developing framework for the representation of geographic data," *Cybergeo European Journal of Geography*, 2000. Available at <http://cybergeo.revues.org/index509.html>
- [5] C. Cauvin, F. Escobar, A. Serradj, *Cartographie thématique volume 5 : des voies nouvelles à explorer (in french)*. Edition Hermes, Paris, 2008.
- [6] D. Dibiasi, A.M. MacEachren, J.B. Krygier, C. Reeves, "Animation and the role of map design in scientific visualization," *Cartography and geographic information systems*, vol. 19, n° 4, pp. 201-214, 1992.
- [7] A., Koussoulakou, M.J., Kraak "Spatio-temporal maps and cartographic communication," *The Cartographic Journal*, vol. 29, n°2, pp. 101-108, 1992.
- [8] A.M. MacEachren. *How maps work. Representation, visualization and design*. The Guilford Press, New York, 1995.

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