

MAP DESIGN VS. SEMIOLOGIE GRAPHIQUE. REFLECTIONS ON TWO CURRENTS OF CARTOGRAPHIC THEORY

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INTRODUCTION: CARTOGRAPHY IN THE POST-WAR PERIOD

The period which followed the Second World War was felt by many as an era of profound change in cartography. It was even considered as a “second reformation”, comparable with the Renaissance disruption. This feeling was based on the increasing number and variety of maps which were produced for the public administrations or for the people. It was also based on the development of cartography as a discipline, with institutions such as scientific societies, bulletins, congresses, universities or high school courses. We can also point out the importance of the period for cartographic theory. There had been theoretical contributions before, such as Maximilian Eckert’s treatise, *Die Kartenwissenschaft* (1921 and 1925), but the post-war period was characterized by crucial works, by Arthur Robinson and Jacques Bertin, which initiated two long-lasting currents of thought in cartography : map design and semiology of graphics.

In this conference, I briefly present them and examine their common points and differences. I also question their relative separation, which can be interpreted in terms of cultural barriers, of scientific processes and of institutional organizations. I finally explore their respective influence, and underline the backwardness of French research in cartography, which delayed starting the essential adaptation of semiology of graphics to the digital revolution.

TWO SEMINAL WORKS

I consider 1952 as a symbolic date for cartographic theory, with the publication in the United States of Arthur H. Robinson’s book, *The Look of Maps*, and the release in France of Bertin’s early “graphical researches”. As is well known, Robinson insisted in his book on what he thought to be the core of cartography, the graphical elements. Drawing on the work of a few predecessors, he proposed to test the legibility of lines, letters, colours, symbols and other graphic features of a map. Bertin wrote the same year a chapter in a collective study about the sociology of Paris, *Paris et l’agglomération parisienne*. His main intention was “to sum up the graphic expression in a few simple rules, confirmed by experience, with a little technique and critical mind added. Bertin gave in this text a first description of the visual variables (which were only three at that time) and of their properties.

Robinson’s and Bertin’s works gave rise to currents of research respectively known as map design or cognitive map-design and semiology of graphics. The expansion of these theoretical movements cannot be studied in details within this conference. I’ll only notice that they were particularly influential in the 1960s and 1970s, and then declined. In the United States, it seems that research credits were reoriented from map design to GIS. In France, after Jacques Bertin’s retirement in 1985, his laboratory collapsed, and soon disappeared.

Map design and semiology of graphics have several points in common. First of all, they both focused on the elements of the map, the signs, which were considered to compose a system, a true language. Second, they organised the map production around what could be called a new paradigm: efficiency. Actually, the “efficiency paradigm” was not totally new. It appears that map-makers before 1950 were sometimes concerned with “clarity” or “legibility”. The fact remains that accuracy and completeness were the essential principles, before the inter-war period. The statement of efficiency was connected with a new interest towards the map-reader. Robinson or Bertin drew upon the Shannon and Weaver communication model (1948-49) and they both encompassed the receiver in the process of map making and paid attention to his capabilities. Maps should convey information, and were thus considered as “cognitive devices” (Montello, 2002). Bertin, for instance, assimilated the perception of an image to a series of questions regarding the information, and he defined the best graphic construction as the one which answered the most quickly to these questions. Robinson and Bertin concurred (as their followers) in the idea that there should be a “bon usage”, a good use of graphic signs, a possibility to establish rules for map-design decisions. Finally, we note that they both considered the social and cultural context to be irrelevant.

Beyond these common points, there were important differences between the two trends. Robinson’s book initiated experimental research, on isolated elements of thematic maps, such as proportional circles, lines or shades. The idea, which had been applied earlier to diagrams, was to make psycho-physical tests on

these diverse features of the map. Through measurements, cartographers could explore the relative efficiency of different symbols or the difference between the information mapped and the information actually transmitted, reduce the “noise” and thus improve the communication. This has been described as a functionalist approach (Perkins, 2009). In Bertin’s laboratory, the researchers also developed empirical methods, but they didn’t carry out systematic observations or experiments. Most of their results relied on intuitions or on a “craft” approach of map-making. When the *Sémiologie graphique* was translated in English, in 1983, several American cartographers were stunned to read a book with almost no references or footnotes, nor any experimental basis. On the contrary, Bertin’s semiology of graphics appeared as an ambitious and comprehensive theory, a groundbreaking contribution to the formalization of the graphic language. It was conceived in a laboratory created in the Mecca of human sciences in France, the EHESS (School of High Studies in Social Sciences) and was considerably influenced by the intellectual agitation of the period about semiotics and structuralism. Following the example of linguistic and literary semiotics, Bertin strictly distinguished the signified from the signifier, the information from the graphic means (“les moyens du système graphique”). He also conceived the image as a structure which corresponds with the structure of data. Bertin did not place his reflection at signs level, but at a higher level: the subjacent relations between signs: the visual variables. Besides, he clearly stated in his treatise (Bertin, 1967, 1973) the construction rules (from the data to the map), but was more vague with regard to the legibility rules (from the data to the map-reader), which were the key for an efficient perception (Orhan, 1994).

There were also academic differences to be noticed. At a time of institutionalization of cartography, Robinson’s work was echoed in several departments of geography, and later of cartography, as separate graduate programs were developed. In the United States, map design stood as an academic topic for almost thirty years, a sub-discipline of cartography, which concerned numerous scholars and led to dozens of books, articles, PhDs.

In France, Bertin’s laboratory was a small structure. Through courses and seminars, it certainly diffused semiology of graphics among students and researchers, but Bertin’s ideas appeared more like a set of unchanging rules rather than matters of research, and little was made to extend or improve them. Cartography, in France, had long been subsumed to geography, and for geographers “la graphique” was above all else considered as a tool, to present and eventually process the data.

A characteristic example of this opposition is the subject of class intervals and shading for a choropleth map; it led to a great number of controversial studies in the United States, but was disposed of in a few paragraphs in the *Sémiologie Graphique*. The first thorough study on this topic dated only 1987 (Cauvin, Raymond, Serradj, 1987).

THE QUESTION OF RECIPROCAL INFLUENCE

What were the mutual relationships between northern-American movement of map design and French semiology of graphics? North-American cartographic theories could have influenced French scholars through academic exchanges. A few French scholars who made several stays in North-American universities, such as Sylvie Rimbart, Jean-Claude Müller, Colette Cauvin, could have been the mainspring for cognitive map-design in France. However, they were before all interested in the quantitative revolution of “New Geography” or in the beginnings of computer assisted methods for cartography. Of course, young assistant professors were aware of the movement of cognitive map-design, through their readings, but Bertin’s theories exerted such an overwhelming influence that their curiosity did not result in concrete researches. The idea to measure the results of tests regarding cartographic elements didn’t occur in French cartographic literature before the 1990s (Chappuis, de Golbéry, Orhan, 1992).

What about the opposite? To what extent did Bertin influence American cartographic theory, before and after 1983, when his *Sémiologie graphique* was translated? The 1967 and 1973 French edition probably circulated in the United States, but such a dense and complex book was tough to read and to understand. We know for sure that several cartographers read it or used it around 1970, such as Arthur Robinson, Waldo Tobler, and George Jenks. Besides, Bertin’s ideas circulated among cartographers through lighter texts, notably the articles he wrote for the *International Yearbook of Cartography*. However, the semiological approach was irrelevant to the American cartographic tradition, and Bertin’s influence remained cursory. After the translation of a lesser book in 1981, *La graphique et le traitement graphique de l’information*, then the 1983 translation of the *Sémiologie graphique*, Bertin’s ideas met a larger audience. The basic system of the visual variables had been mentioned by Robinson in the 1970s, and later included it in his *Elements of cartography* (Robinson & al., 1984), which was then the most popular of the cartography textbooks in use in the United States. A few attempts were also made to apply Bertin’s methods of graphic information-processing (Barbara Buttenfield at Madison). However, it was probably too late, and cartographers did not discern the potential of the book for the future.

My theory (still to be discussed) is that American cartographers more or less missed the appointment with Bertin's theories. Because of linguistic barriers and epistemological as well as methodological differences, Bertin's semiology of graphics had a limited influence before the beginnings of the 1980s, except for the organizing concept of the visual variables. The 1981 and 1983 translations occurred probably too late. Statistical methods were favoured by geographers and cartographers. Concerns shifted from map design to digital maps and GIS. Bertin's aesthetics seemed to belong to antiquity, as well as his methods. In his review for the AAAG journal, Monmonier dismissed the book for its "mid 1960s perspective" and mocked at Bertin's illustrations which belonged to the "pen and ink and zip-a-tone variety" (Monmonier, 1985). The revaluation of Bertin's work in cartography and GIS sciences dated only from the 1990s and the first thorough discussion about his theories is undertaken by MacEachren, in 1995. Statisticians and later specialists in InfoVis (Information Visualization) were clearly more aware of the importance of semiology of graphics and its potential for future research. Thus, the translation of Bertin's main book was made on the initiative of Albert Biderman and Howard Wainer, two statisticians, who included it as a deliverable in an NSF grant on "Social Graphics", and there was afterwards a continuous trend of interest among statisticians towards Bertin. In particular, he had a strong "cultural" influence of on Leland Wilkinson's Grammar of Graphics, now incorporated as the basis for the new graphics engine in SPSS (nViZn platform) and translated into the R ggplot2 package by Hadley Wickham.

TODAY ADAPTABILITY

Even if the cognitive map-design trend weakened in the 1980s, anglo-saxon map-design remained a crucial branch of cartography, as attested by the regular publication of textbooks on the subject (Dent, Tyner). It later showed its adaptability to the technical changes that were going on in cartography, when several authors took up the theme of design in association with maps on screens, maps made with GIS softwares, animated maps, etc. Several textbooks in English about map design have been specifically intended for GIS users (Brewer, Krygier & Wood, Peterson). In France, several people expressed the wish that semiology of graphics could be adapted to the digital era, such as Laurini, in 1998, who called for a "sémiologie infographique" (semiology of infographics). However, the updating of Bertin's work has hardly been addressed in our country. To show respect for the "semiologie of graphique" is also to set a new agenda: pointing out its limits and going beyond.