Designing for New Urban Futures: Is GIS the Right Tool for the Job? Reconsidering the Implicit Assumptions of GIS Design & Urban Informatics

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Summary:
Review of the historical conditions that informed the early days of GIS development suggest GIS contains an array of implicit assumptions that contain its capability, bound user cognition, and limit urban futures. This research aims to uncover those assumptions and identify new strategies to conceive of GIS, and effectively, open cities to new possibilities.

Urban histories around the world document extensive accounts of poorly designed socio-technical interventions to facilitate socio-economic stability and development. A consistent thread in these histories is the role of military institutions, advocating their own urban ideologies and imposing them upon populations for security and resilience. In the United States, the rise of cybernetics and the Department of Defense held a significant sway in the Cold War era urban planning. Wiener's theories on systems feed back, interactions, self-regulation and management were infused into computer research for mapping, modeling and simulation. Fundamentals of military decision making were codified by institutions such as MIT's MediaLab and RAND to be adapted by urban professionals. (Light 2003; Steenson 2014).

By the early 1960s, the profession of Urban Planning began to see itself as a systems science for urban renewal and pioneering efforts could be found using data-driven information systems to produce computational simulations of urban environments. It was believed that every complex urban problem could be defined in narrow terms and deconstructed, modeled, and manipulated by the methodologies of Design Science. These approaches are well documented by the Design Methods movement, from Alexander's *Notes on Synthesis of Form to* Jones's *Design Methods* (Alexander 1964; Jones 1970).

Concurrently, in 1966, computational Geographic Information Systems (GIS) were in development, tools by which discrete data could be visualized and layered on a geographic map to display spatial distributions. Contemporary GIS platforms are largely attributed to the work of an architect at North Western University in Chicago, Howard Fisher, who later relocated to Harvard Laboratory of Computer Graphics in 1965 (Chrisman, 2006). Yet there is no clear history for GIS development, and much of the work was shaped by military endeavors to advance intelligence extraction and visualization of aerial photography and satellite imagery.

Today GIS has permeated a wide array of disciplines to include environmental sciences, public policy, health services, and more recently, has begun to appear within humanities research. Nonetheless, the world continues to struggle with profound problems.There has been a turn in urban planning culture since the 1970s away from cybernetics and the methods movement, with open doors to public participation and non-rational methods, but there has been no achieved consensus on how to factor bottom-up social process into GIS. This disconnect prompts a question, is there a misalignment between geospatial technologies that were initially conceived by, and designed for, military purposes that are today widely applied to urban environments. If this is true, and we conceive of GIS in a new light, do we then open the world to new urban futures?

This paper examines the socio-historical relationship between military objectives, cybernetics and urban governance that gave rise to contemporary GIS and to a body of consequential assumptions implicit in the design of GIS software. In an attempt to open new possibilities for GIS design, I also introduce Horst Rittel's research on *wicked problems* and non-expert information systems, which research sought to counteract the methods movement in the 1960s and 70s. Building on Rittel's work, proposals are made on how to change the interaction design and cognitive architecture of GIS. The goal is to open a window for researchers to examine the utility, design, and cognitive architecture of GIS in a new light.

One outcome is to design GIS interfaces in relation to social processes of change and for information systems to better embody the shifting terrain of new and changing data ecologies (Walker, 2010). This may not necessarily require new organizational schema (such as in relational database architecture) but conceptualizing the physical procedures in which users engage a GIS. Ultimately GIS does not meed to function as a technocratic tool for analysts, but can function as an experiential interface, to create a sense of place through social engagement and digital culture. Ideally, GIS can serve as more than a tool for discrete data analysis, but function as an infrastructure for socio-materially hybrid spaces in an unfolding urban future.

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