Map Use - Perspectives in Geographic Undergraduate Education

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The author introduces junior-level students with no background to various tasks involving maps, computer mapping and GIS as part of a project called UrbanWorld. A concern is how to evaluate the student's learning as well as the products the students produce, whether on paper or electronically. Three challenges are posed to the cartographic community. What can we offer in terms of map reading strategies? Do we have guidelines for good cartographic practice and helpful hints about map design? What research has there been on the complexities of the individualistic analysis and decision-making that are major elements of the spatial reasoning process?

INTRODUCTION

I address the question of 'what do we want to know about map use, map users, map use environments' in only one context, that of geography undergraduate education. The particular context for me is an upper division course in urban geography. It is a course undergoing major revision from a lecture format to an active, authentic learning environment. (1) This course has no prerequisites and therefore students may have had no exposure to cartography nor geography.

Focusing on this one situation makes the discussion more tangible and focused, especially by putting the discussion in the context of real uses of maps and spatial data, and facilitates the identification of issues and particular needs. I assume that some of the characteristics of this context will be found in other use environments such that my remarks can be seen to be general as well as specific to the pedagogic application.

A PROFILE OF THE MAP USE ENVIRONMENT

The population of users are students undertaking several different kinds of tasks involving maps as part of an assignment that guides them towards an improved understanding of a geography topic, in my case, the characteristics of metropolises. The students are cartographically naive junior-level students (from several different disciplines), having no prior work with maps, nor use of computer mapping nor GIS software.

"The students are cartographically naive junior-level students . . ."

The students are required to do four main kinds of cartographic tasks:

- interpret maps already made for topics such as demographic characteristics and land use,
- make thematic maps as part of a process of analyzing geographic patterns of demographics, housing, or other conditions,
- make thematic maps representing quite specific requirements for an assignment, for example factors influencing transit use for the catchment area of a rail station, and
- express ideas about mapped geographic distributions as schematic mental maps, for example the spatial patterns in a metropolis of different social groups.

As part of their work students encounter many kinds of maps and types of spatial data. Some tasks involve count data, such as the number of elderly (who may be regarded as one element of the transit dependent population), and sometimes norming to percentages or densities, espe-

cially where the spatial units, be they blocks, block-groups, or tracts, are quite varied in size. An appreciation for the spatial variations in land use is facilitated by visualization of land value surfaces or other devices to reveal gradients of change. Flow and network maps are important for showing transit facilities, and for gravity model predictions. Choropleth maps resulting from the calculation of composite indicators are important for conveying the geographic distribution of transit captives.

The map use tasks are quite varied; students have to quickly appreciate what types and scales of maps are appropriate for given situations as well as elements of bias, perception, alternative representations, data quality, and so on. But the user environment has additional important characteristics: the likelihood that many maps will be made in a short period in the digital environment; that the intent of making maps is to facilitate map data analysis; and that all activities are part of a spatial reasoning process. Students are asked to make conclusions or present evidence for solving a problem. Map interpretation and data analysis are of higher priority than map creation as an end-product, although students are required to create maps to represent some aspects of data and those which are expressions of their own ideas.

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AN ADDITIONAL DIMENSION OF EVALUATION

There is, though, a complication. The map use is undertaken in a setting which requires evaluation of student learning. For the pedagogic context the instructor must:

1. evaluate the specific products created by the student, either hard-copy maps or electronic versions;
2. evaluate the student progress in learning the geographic content, but because this involves use and creation of maps and working with spatial data, then it becomes necessary to
3. assess the contamination of the learning progress by any inability on the part of the student to acquire the necessary practical cartographic skills.

For the first of these a practical need is a set of guidelines, or even standards, to assess map design in a context. For the second of these there is no explicit cartographic concern, but for the last it is necessary to evaluate progress with the acquisition of map use and map creation skills.

This general concern is motivated by the requirements of a real project, funded by the United States Department of Education, called UrbanWorld. (2) It is a project to create an active learning environment, engaging students in map data analysis as they learn urban geography with the aid of digital resources. Given that the funding is from the Education Department, through the Fund for the Improvement of Post-Secondary Education, there is a requirement to do formative and summative evaluations.

"Urban World . . . is a project to create an active learning environment, engaging students in map data analysis . . ."

There is, therefore, consideration of how to undertake student performance assessment. It is quite interesting and intriguing to note to an audience of cartographers, who will readily appreciate the vocational value of a record of cartographic products kept in a folder, that the idea of a portfolio is increasingly favored by educational assessors as a vehicle for performance assessment. (3) A portfolio is a purposeful assembly of student work that tells the story of student achievement or growth. Not all work is saved or evaluated, but enough, perhaps chosen to meet different purposes, that reveals the level of attainment with specific skills, and the progress through the semester between the entry and exit skill levels. The portfolio is more than an aid to revealing skills to prospective employers; it is used as an integral part of the instruction and evaluation process. As

such it is believed to be a novelty for most geography classes; a literature search has not revealed any other instances of the use of portfolios.

SOME REAL NEEDS

As I move into the implementation of my different learning environment, UrbanWorld, I see three areas where I say to cartographers that I need help. First of all, how do I establish initial levels of visualization and spatial reasoning skills, and monitor progress in building these skills? Is there any standard battery of tests that I can use? What research is there that might help, for example research on map reading strategies, as well as research about the receptivity of students to interactive mapping. My own searches have not revealed any authenticated sets of test questions for visualization and spatial skills for a geography context. Therefore, for my own immediate purposes I have begun the creation of an on-line instrument to collect background information via a series of maps and connected questions, evaluating simple skills like measuring distance, identifying steep gradients, or comparing maps.

"I see three areas where I say to cartographers that I need help."

Second, the project will create a knowledge base that students can draw on as a resource, either under specific directions or using their own initiative, to obtain guidance as to what kind of map to make, what data preparation might be necessary, or which operational procedures, e.g. software tools, are needed. As part of this I seek guidance as to the existence of a collection of examples of good cartographic practice, and helpful hints about map design. Perhaps the on-line system will in time have intelligent assistants, or resources can be tapped via the World Wide Web.

Third, I see the need for a record-keeping process, a way to capture some of the "back-of-the-head" rules used in the process of working with the maps, whether with an element of formality associated with hypothesis testing or more intuitive learning by trial and error. Such metadata are important contextual information at different stages of the spatial reasoning process. What research has there been on the complexities of the individualistic analysis and decision-making that are major elements of the spatial reasoning process?

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SUMMARY

My remarks about what we want to know about map use, map users, and map use environments have emphasized the particulars of what may be a somewhat specialized use domain. Yet this context has led me to raise a number of issues and issue some challenges which in time may lead to interesting research avenues. There are both practical and intellectual matters. For the practical, for my UrbanWorld project this means ascertaining what exists today regarding standard tests for assessing map use skills and the creation of portfolios. From an intellectual viewpoint it means striving to understand the complexities of map use as part of a spatial reasoning process supported by a digital environment where the geographic content is the critical element, but for which the practical cartographic skills must be adequate for the task at hand.

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FOOTNOTES

[1]Among many publications on active learning, I refer to only a bibliography by James Eison, Ellen Stevens, and Charles Bonwell, The Center for Teaching Enhancement, University of South Florida, Tampa, FL, February 1994, "Involving College and University Students Through Active Learning."

[2]Details about UrbanWorld can be found in Derek Thompson et.al., "Towards a framework for learning with geographical information systems: the case for UrbanWorld, a hypermap learning environment based on GIS," forthcoming in *Transactions in GIS*, 1997, 2(2).

[3]Two short articles oriented to the practice of portfolio-based performance assessment are: Judith A. Aster, Vikki Spandel, and Ruth Culham, "Portfolios for Assessment and Instruction," *ERIC Digest* (EDO-CG-95-10), 1995; and Richard J. Stiggins, "Design and Development of Performance Assessments," an instructional module from the National Council on Measurement in Education, Fall 1987, pp. 33-40.