Geog 461 Learning Objective Outline

LOO 25 Future Directions for GIS-based Decision Support

25.1 How well is GIS technology addressing growth management and sustainability concerns and what might we expect in the future? Nyerges and Jankowski *GISDS* Chapter 10. Conclusions about GIS-based Decision Support in Urban-Regional Environments Section 10.4 Overall Implications for GIS Activity

There is no doubt that GIS can support growth management and sustainability management at this time. However, full support for all analysis and management is not yet possible for most commercial GIS. It is a matter of marketplace recognition, which is still to come. We develop the capabilities of GIS to address growth and sustainability management in using database management, spatial analysis, and mapping/geovisualization technologies.

Integrated database management is possible. Establishing links among planning, improvement programming and project implementation databases is certainly possible given the current technology. The challenge is to get different parts of organizations to collaborate on their database designs, as each decision situation has its own decision requirements.

The biggest obstacle for growth management is characterizing change over time, but it is possible to design databases that consider temporal dimension. In chapter 2 we discussed a nuanced workflow process developed by Steinitz and his colleagues (2003).

a) Representation model development is undoubtedly a GIS-based activity, as databases are foundational to GIS work. Integrated databases are the trend and rage these days, as it makes sense to inter-connect what were once "data silos" to more enterprise solutions in data warehouses, and even federated distributed data management solutions.

b) Process model however might be better implemented through other specialized software since most GIS software has not yet been designed to address temporal data processing issues. Spatio-temporal modeling, e.g., land use change overall multiple increments of time, can be done as time slices, but the analysis is actually more static with the process shown as a visual animation.

c) Scenario, change, and impact modeling are readily performed using GIS software.

d) Decision modeling, however, is still somewhat of a challenge, as once again the algorithms are somewhat specialized and GIS vendors have not yet fully adopted a variety of them for application.

Applications to support planning, programming, and project implementation decision situations exist and will grow. GIS, as an information technology, and particularly a decision support technology in a broad sense is expanding in a number of ways. Building on data management, spatial analysis, and map visualization technologies, with other technologies is also very popular.

Monitoring events in support of real-time GIS is becoming an important application. Events could be habitat ecosystem characteristics and/or people related events like real-time traffic congestion. This might be called operational activities, that which occurs day to day. Sending works to the field to fix pot holes and routing their work; or picking up old refrigerators routed on a day to day basis is another.

3-D visualization software like that in the St. Mary's Georgia project - Visual Nature Studio® for creating spatially referenced photorealistic 3-D scenes from each scenario – is becoming more population because it is easy. Three-dimensional visualization software that implements smooth animation, as in "map movies", makes it easy to show change within scenarios.

Enhancing geospatial information technology to support more diverse audiences is another growth area, e.g. as in the public realm; this relies on communications technology, decision science technology as well as data management, spatial analysis, and map visualization.

25.2 How does stakeholder public participation link with advances in GIS for sustainability management?

When we broaden the topic of group decision support to public decision support then we start to address fundamental issues in the democratization of decision processes. Considerable research is underway to place GIS in participatory contexts, whether it is called participatory GIS - PGIS (Harris et al. 1995, Jankowski and Nyerges 2001) or public participation GIS - PPGIS (Nyerges 2005; Nyerges, Barndt, Brooks 1997), or community integrated GIS (Craig, Harris, and Weiner 2001).

Regardless of the label, individuals as part of the public and groups within the public are often marginalized in public decision processes. When examining an ability to give public voice in democracy, marginalized voice is a fairly pervasive problem. Practically speaking, the general public is constituted of many diverse groups – even if we consider the public as *whole*. The *general public* is actually a marginalized group when it comes to participation processes, as there is no single directed voice in the public.

Despite many federal, state, and local laws that require public participation, research about local governance indicates that large-group participation in publicly oriented decisions commonly involves little *meaningful participation*. Meaningful participation can be defined in terms of *access to voice* (a deliberative process) and *competence of knowledge(s)* (an analytic process) that fosters *shared understanding* about values, interests, and concerns that underlie the recommendations/choices to be offered/made by those with a stake in the decision (National Research Council 1996). Meaningful participation is a hallmark of a healthy democracy, particularly deliberative democracy in contrast to representative (make a vote) democracy.

Deliberative democracy involves empowerment wherein a reasoned discussion among people promotes shared understanding on a topic followed by consensus building. Although interest in deliberative democracy has existed for over 100 years (Gastil and Levine 2005), research and practice since the late 1980's has blossomed. Over the past decade, hundreds of deliberative democracy events of varying sizes have occurred across the world. A synthesis of case studies appears in a *Deliberative Democracy Handbook* (Gastil and Levine 2005). Several of the chapters deal with location-based issues and thus GIS could be useful. However, no chapters actually refer to GIS, a seeming disconnect and latent opportunity.

Research about *analytic-deliberative decision processes* has shown that meaningful public participation is possible and decision outcomes are improved (National Research Council 1996). The

analytic component provides technical information that ensures broad-based, competent perspectives. GIS has provided technical information in such processes as maps can represent changes in landscapes. The *deliberative component* provides an opportunity to give voice to choices about values, alternatives, and recommendations. Unfortunately, such public participation has been expensive and time consuming, and involved small to medium-sized groups (10-15 people). Working through analytic-deliberative participation in small to medium-sized groups in face-to-face settings is a start, but scaling analytic-deliberative participation out to include large groups is a challenge and scaling up as from local to regional domains is also a challenge; but scaling out and up matters.

In addition, whether groups are better supported in face-to-face settings or in asynchronous settings is still an open research question. It is often thought that face-to-face participatory settings are superior to asynchronous participatory settings. It only seems reasonable. However, Dowling and St. Louis (2000) have shown that an asynchronous nominal group process was more effective than a face-to-face nominal group process, at least in a small group setting – a challenge to anecdotal feelings about face-to-face participatory processes.

An Internet platform combining GIS (i.e., data management, spatial analysis and geovisualization) technologies, decision modeling technology, and communications technology into a geospatial portal to support an analytic-deliberative process might be one way to foster meaningful participation in large groups as well as hold down the cost to all who wish to participate.
The above statement is based on the following three observations:
(1) public participation is mandated by many federal, state, and local laws encouraging core democratic process,
(2) the Internet is growing in popularity and access is getting better even for underrepresented groups as reported in several studies, and
(3) asynchronous, structured participation methods have been shown to be at least as good and in some cases superior to face-to-face participation, then

That rationale was the basis of the U S National Science Foundation-funded research activity called the Participatory GIS for Transportation (PGIST) Project (www.pgist.org). The PGIST Project hosted a field experiment in supporting public participation in transportation decision making as a glimmer of what might be coming in web-based technologies for public decision support (www.letsimprovetransportation.org). Societal trends continue to emerge that suggest more and more people do care about the sustainability of their communities. GIS can help shed light on new directions.

The integration of geographic information across those space-time decision scales can be a practical foundation, supported by methodological and theoretical foundations in geographic information science, for addressing growth management and sustainability concerns in the 21st century. Web-based information technologies are developing so quickly that it is clear that GIS implemented with such technologies will make an even greater impact on society in the future. How such technologies get developed, deployed, and used can be influenced by those who care enough to make a difference. Individuals and communities will collectively decide.

What about other future directions?

What are the nature of the opportunities?