Participatory Modeling and Modeling Participation in Support of Transportation Improvement Decision Making


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1. Background and Research Question

We report on the first year results of a four-year (2003-2007) research project called “participatory geographic information systems for transportation” (PGIST). This project investigates the development and evaluation of geospatial information technologies for decision support of a complex decision making situation called transportation improvement programming.

Current federal (Transportation Equity Act of the 21st Century 1998) and many state transportation laws mandate public participation in at least three pervasive decision situations - long-range planning, capital improvement programming, and major investment study. Researchers note that many groups compose “diverse publics” depending on the plurality of interests in a decision, e.g., federal, state, and local government officials, private-public partnerships, community groups, interest groups, and individuals referred to as the general public and citizens (Arnstein 1969, Taylor 1998). Research about local governance points out that public participation in transportation, environmental and other publicly oriented decisions commonly involve little “meaningful participation”. We define meaningful participation as access to voice and competence of knowledge(s) that fosters shared understanding about values, interests, and concerns.
(Smith 1999, Renn, Webler, and Weidemann 1995). Recent research about “analytic-deliberative” decision processes shows that meaningful public participation is possible, and decision outcomes are improved (NRC 1996, Renn, Blattel-Mink and Kastenholz 1997). The analytic component provides technical information that ensures broad-based, competent perspectives are treated. The deliberative component provides an opportunity to interactively give voice to choices about values, alternatives, and recommendations. Unfortunately, such public participation has been expensive and time consuming, and thus involved small groups. An Internet GIS platform that supports an analytic-deliberative process might be one way to facilitate meaningful participation in large groups, while holding down the cost to all publics who wish to participate. Based on that problem context, our principal research question in this project is: *What Internet platform designs and capabilities involving participatory modeling, particularly including GIS technology, can improve public participation in “analytic-deliberative” transportation decision making within large groups?*

2. Participatory Modeling

Several participatory modeling modules compose a web portal under development.

**Agenda Designer** – Allows a process convener to interactively set an agenda for decision processes. A decision agenda will set out steps for human-computer-human interaction at four scales of participation process – decision situations, meetings, decision methods and decision techniques (described below). Each of those four scales of “decision process” will likely contain multiple steps characterized in terms of decision (choice) points and clearance (sign-off) points. Previous agendas will be captured as decision paths, an archival practice that fosters transparency of decision workflow at all four scales of participation process.

**Concerns/Value-Organizer** - Consists of *Value-Collector* and *Value-Synthesizer*. *Value-Collector* elicits community concerns and priorities. *Value-Synthesizer* will organize those concerns into values, goals, objectives, and criteria, and then render them value (hierarchy) structures. A semantic analysis of public on-line contributions will be used as a basis for synthesizing concerns/interests into value structures. Participants will be able to create value structure visualizations linked to maps portraying transportation plans, programs and projects.

**Alternative Generator** – Uses value structures within policy scenarios for generating alternatives. Policy scenarios can be compared, hence alternatives compared. Based on a scenario and alternative(s), this module computes the impacts associated with alternatives.

**Choice Modeler** – Uses the impact analyses from alternative generation to perform sensitivity trade-off analysis. Based on the trade-off analysis of costs, benefits, preferences of valued objectives, participants choose, i.e., negotiate through group-structured technique, a preferred scenario of plans and/or project is proposed.
**PicReview** – Provides asynchronous commenting on pictorial web page documents, customizable at a level of granularity chosen by a convener for discussion of the document. A facilitator collects the comments and synthesizes them, and returns them back to the participants.

We report on the design status of the modules, and suggest insights for design directions.

### 3. Modeling Participation Processes

The participatory modeling modules described above, and the decision agendas that organize decision process, will operate at four scales of participation process. As such it is important to model participation processes in a systematic way in order to write software to support “human-computer-human interaction” at the following four levels of event granularity embedded in the modules described above.

1) **Technique** - basic building blocks of analytic-deliberative interaction that occur during public participation processes e.g. voting, survey, analysis, and/or display, etc. Each technique is of course composed of primitive elements (content, structure, process, and context) that form the basis of the technique.
2) **Method** - a structured way of interacting with one or more techniques to gather ideas, organize them, select relevant information, then review and move on to the next step.
3) **Meeting** - an interaction setting which organizes the sequencing of one or more methods,
4) **Decision situation** – an interaction made up of a series of meetings to conduct the participation processes for the overall transportation improvement programming process.

A key aspect of modeling participation involves comparing and contrasting “structured participation” methods. We have focused on the following four methods: Technology of Participation (Spencer 1989), Delphi, Nominal Group (Delbecq, Van de Ven, and Gustafson 1976), and Citizen Jury (Stein/Hudson and others 1996). We report on progress we have made with modeling structured participation processes, and provide insights for future directions.

### 4. Conclusion

In the public participation GIS arena, too much of the research has been informal studies of application use. Our research about participatory decision support attempts to characterize in a systematic way the dynamics of human-computer-human interaction in complex, realistic, decision making settings. Such research must be multi-pronged regarding a balance among theory, method and substance. A gap between theory and applications creates a need to develop a more systematic understanding about how GIS software with integrated decision support techniques can be and is used within group decision processes. In the PGIST project we are striking a balance among a combination of theoretical, methodological, and substantive research domains. This balance allows us
to build evidence in a systematic way as another contribution toward our goal of developing an interdisciplinary, participatory geographic information science.

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6. References


