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Justice and the Public's Involvement in Infrastructure Planning: An Analysis and Proposal

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Infrastructure Planning

Justice and the Public's Involvement in Infrastructure Planning: An Analysis and Proposal

By Ted Grossardt and Keiron Bailey

Advocating better public involvement in planning and design questions can become an empty recitation that is easy to favor, difficult to deliver, and impossible to measure. Sherry Arnstein's "Ladder of Citizen Participation" was an early metric for the quality of public participation, and is used in this paper to demonstrate the current situation in planning and design for the built environment. Many of the public involvement problems with planning and design processes and outcomes can be characterized as injustices of one sort or another. This paper connects the principles of justice as originally developed by John Rawls to Arnstein's ladder and shows how they apply in the real world. The paper demonstrates how this analysis has informed the structured public involvement protocol developed and deployed by the authors.

The specific processes developed for each project are efficient, robust, democratic, and able to accommodate large numbers of participants. They combine visualization sampling strategies, electronic keypad systems, and preference data modeling strategies to capture and document participants' preferences. Citizen feedback gathered at many meetings shows a consistently high satisfaction with these processes. Likewise, the utility to the planning and design professionals is also high, as the public's preference data feeds the planning and design process in a direct way. A case study of public involvement in major bridge design is highlighted.

Sherry Arnstein's (1969) "Ladder of Citizen Participation" has been used by the authors to quantitatively show that both the public and professionals have the same level of expectations for public involvement. Further, they agree these expectations are not being met, a situation the authors term the "Arnstein Gap." However, the public also has a significantly lower opinion than the professionals regarding the degree to which these expectations are being met. Thus there is the need for a closer examination of public involvement processes.

Technology and, especially, visualization have been employed to address this gap, but a more fundamental analysis of justice is necessary to enable a useful application of technology. Rawlsian justice posits three facets of justice: (1) access, or who is included in the process; (2) distributional, that is, the distribution of costs and benefits; and (3) procedural justice, or how decisions are made. Environmental justice typically focuses on distributional justice questions due to the intuitive appeal of measurement, but procedural justice questions are more difficult to address. Typical public planning processes include justice problems of all three types. For example, access is discouraged either formally by the use of advisory panels or informally by dysfunctional meeting strategies; distributional justice is compromised by professionals' control of the measurement and thus definition of the problem, and procedural justice is limited by restricting public choices to narrow ranges of options.

As one method of addressing this three-part challenge, the authors pose structured public involvement as a protocol integrating dialogic processes, visualization technologies, and decision support modeling. Visualization tools are used to increase the public's comprehension of the nature of the problem being addressed, and may range from photographs to renderings to virtual reality to Geographic Information Systems (GIS). Decision support modeling is used to capture input gathered anonymously from participants using electronic keypad systems, aiding democratic and efficient input. Dialogic process tools are used to design each meeting to respond to the particular questions being answered and ensure that the technology is used in the most efficient and effective manner.

An example is the recently completed, yearlong public involvement stage of the Ohio River Bridges design, in and near Louisville, Kentucky. Working with the engineering and design firms, the authors designed and executed a yearlong iterative process of gathering and modeling citizens' aesthetic preferences for bridge designs in a complex urban environment. Out of a possible range of more than 200 designs, the authors used fuzzy set analysis of the aesthetic preference data gathered in public meetings to help the design team move from 30 designs, to 12, to six, and then to three finalists. At each stage, the newer designs were improved with the input from the prior round of public meetings. The input process helped designers understand which specific combinations of design properties contributed to either higher or lower aesthetic preference. This information was integrated with other considerations of cost, maintenance, and constructability to arrive at the current three finalists. The public's satisfaction with the overall process also was solicited. The mean public satisfaction rating of the bridge design process was 8 on a scale of 1 to 10, which is consistent with prior work by the authors.

High public approval ratings of public infrastructure design processes are good evidence of a fair and equitable process. The authors encourage others to examine their processes in light of Rawls's principles, and especially to begin documenting the public's opinion of the processes, with an eye toward continuous improvement in this critical area of public involvement in planning and design.

INTRODUCTION

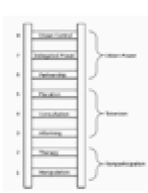
In 1969, planner Sherry Arnstein proposed an eight-step scale characterizing levels of public involvement in planning (see Figure 1).

Arnstein's Ladder has remained current (Maier 2001, Wondolleck et al. 1996, Brenneis and M'Gonigle 1992, McCoy et al. 1994) and is still a subject of debate (Laurini 2001:24). However, there are no direct measurements of Arnstein's Ladder in the literature. Accordingly, since 2003 the authors have used Arnstein's Ladder at public meetings as an index for measuring perceptions of citizen involvement. Referencing Arnstein's Ladder (see Figure 1) these two questions are asked:

1. In your experience, how would you characterize public participation in transportation planning and design processes using this Ladder?

2. Where should public participation in transportation planning and design processes be located?

Responses are gathered on a scale of 1 to 8 through an electronic polling system that allows responses to be collected anonymously and in real time. More than 500 citizens from various forums in Kentucky, Indiana, and Arizona have responded. At the Transportation Research Board's 2006 Annual Meeting, 59 transportation professionals also were surveyed using the same protocol (Figure 2).



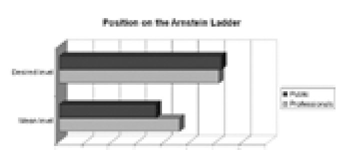


Figure 1
Arnstein's Ladder of Citizen Participation

Figure 2
The Arnstein Gap

Source: Arnstein, S. 1969. "The Ladder of Citizen Participation."*Journal of the Institute of American Planners* 35, 4: 216-224. Used with permission.

These data indicate a strong agreement that both citizens and professionals expect the same degree of "partnership." They also show that citizens recognize the technical role of engineers and planners. Conversely, professionals and academics often assume (fear) that the most desirable condition is the top rung of "citizen control" (Vanderwal 1999; Campbell and Marshall 2000: 321). These data suggest that fear is unfounded.

Note, however, the deficit between "desired" and "mean" ratings generally. We call this difference the "Arnstein Gap" (Bailey and Grossardt 2006:339). The Arnstein Gap is a heuristic metric to measure existing quality deficit of public involvement by characterizing a complex set of issues in a single, easily comprehensible index. The Arnstein Gap indicates that citizens desire a planning and design system that is more directly responsive to public needs.

Comparing the professionals' opinions with the public's opinion also shows that professionals consider their public participation processes more effective than the public does (4.5 vs. 3.5). An unpaired t-test of this difference provides a 95 percent statistical confidence that the measured difference in judgment is significant. Clearly, professionals are not doing as well as the public would like, nor even as well as they think they are.

THE USES OF TECHNOLOGY

More than 30 years ago, the Transportation Research Board (TRB) published a group of papers exploring the potential for computer visualization to improve the quality of public involvement in transportation planning. In that issue, Arnstein and Winder (1975, 44-48) presciently discussed a series of problems with citizen participation that were likely *not* substantially improved by visualization tools. These problems included, among others: which citizens participate, accountability of transportation officials, equity of benefits and disbenefits, and citizen distrust.

Over the intervening years, the advantages of visualization as a means of presenting design and larger-scale planning options have been documented extensively in transit design options (Cervero and Bosselman 1998) and in transportation more broadly (Landphair and Larsen 1996, 1993). These advantages include easier comprehension and information density and accessibility compared with written specifications and codes (Hughes 1993, 1998). However, these sorts of advantages do little to address the more persistent and fundamental issues raised by Arnstein and many others after her.

We propose to carefully examine the challenge of improved citizen participation in the context of current planning and design processes. We embrace the potential of technologies in this endeavor but believe they must be integrated with a careful analysis of exactly which problems of participation are being solved and how, and with what compromises. We proceed with this analysis, not from the standpoint of the technologies, but from the standpoint of the citizen, and what we believe should be the touchstone of all public involvement: fairness and justice.

DIMENSIONS OF JUSTICE

The analysis of justice itself can seem slippery and contextual. We will rely here on John Rawls's "A Theory of Justice," which proposed three foundational dimensions of justice: access to justice (who should be included in the deliberations); distributional justice (who gets how much); and procedural justice (how do we decide who gets how much) (1971:74-77). His work has spawned much subsequent analysis, including reformulations of the principles (Hay 1995; Trinder et al. 1991; Ikeme 2003), and even anthropological parallels (Trawick 2002: 192).

Frequently, however, only distributional justice is highlighted, with questions of access and procedural justice left unaddressed or somewhat murky (Forkenbrock and Schweitzer 1999; Pfeffer et al. 2002; Roberts 2003). Researchers have focused their attention on the deployment of various concepts of scale in struggles over equity and justice, especially in the context of environmental justice (Silvern 1999; Kurtz 2003; Williams 1999; Harwood 2003; Deverman 2003). They have worked on ways to more finely measure the spatial and social extent of distributive impacts (Most, Sengupta, and Burgener 2004; Jerret et al. 2001; Larson and Claussen 2004), combined with alternative methods of analyzing the impacts, such as cost-benefit processes (Schweitzer and Valenzuela Jr. 2004).

Distributional justice analyses allow a more straightforward technical and quantitative analysis involving reproducible processes and thus results for researchers. Conversely, "measuring" the justice or fairness of a decision process is much more problematic (Perrons and Skyers 2003; Syme and Nancarrow 2002; Lowry, Adler and Milner 1997; Reynolds and Shelley 1985). In some cases, the issues and definitions of procedural justice are forefronted (Hillman 2005; Maguire and Allan 2003). Even this work, however, typically focuses more on defining principles than on measuring outcomes.

Some experimental research into this specific question suggests that individuals' judgments about equity and fairness have perhaps *more* to do with procedural issues than with distributional outcomes, calling into question the wisdom of continued emphasis on distributional analyses (Molm, Peterson and Takahashi 2003). Consequently, we believe it is important for the planning and design professional to consider all three facets of Rawls's justice argument in analyzing various strategies for public involvement (Figure 3).

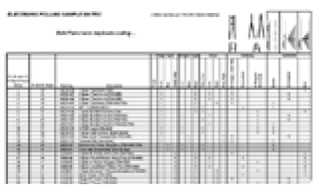


Figure 3
Bridge Samples and Their Design Parameter Values

Access

Large public meetings ironically pose serious access questions for the majority who attend. The typical open microphone arrangement allows accomplished public speakers to dominate the meeting, effectively excluding others. Conversely, a series of smaller meetings consumes so much of participants' free time that it excludes many with jobs or children. Sometimes an advisory panel is appointed, limiting participation by fiat. To meet basic access requirements, public meeting input processes need to be scrupulously democratic, straightforward, easily understandable, and time-efficient. However, access to the decision process involves more than just the ability to participate in public meetings. The very formulation of the "problem" can limit who is eligible to participate. Professionals often make determinations about the initial nature and scale of a problem (e.g., "congestion"), that leaves the definition of solutions and participants constrained.

Distributional Justice

Distributional justice is often the implied rationale for many transportation projects. For example, roadways are widened to relieve traffic congestion, the most congested first (Marye 1940, TRB 1975). That is, those suffering the most traffic congestion are claimed to be unfairly impacted. Similar arguments can be constructed regarding high crash rates, high noise levels, high air pollution levels, etc. As noted above, the environmental justice literature is replete with examples of maldistributions of impacts. Furthermore, the studies conducted by professionals that "justify" the need for a project may be very far off the mark as well, not always by accident (Flyvbjerg 2005).

Procedural Justice

Finally, leaving aside the prior problems, the method of arriving at solutions also is frequently severely circumscribed. A few alternatives are offered by professionals, often arrayed so that their preferred solution appears to be the best technical solution. The general public may suspect that the range of possible solutions is being limited but cannot confirm it. Furthermore, constructing the solution process as a process of adversarial bargaining over alternatives, instead of joint problem solving, actually may foster mistrust and lower satisfaction with the outcome, regardless of its distributive justice merits (Molm, Peterson and Takahashi 2003). In the end, the entire problem-solution continuum can become formulaic, maximizing the consolidation of decision-making power and minimizing the possibility of justice (Bevan et al. 2006).

This is an admittedly brief analysis of some of the typical problems of public involvement. All of these circumstances detailed here operate within a much larger context of public choice that is beyond the scope of this paper. These observations apply regardless of the particular public choice theory one ascribes to, though (see, for example, Altshuler and Luberoff 2003: 45-74).

However, the Arnstein Ladder data suggest that it is not necessary for this situation to arise. Citizens share similar expectations with professionals and elected officials about the level of their involvement. Especially where local cultural landscape aesthetics are concerned, there is no technical "best" solution, and the professional or the elected official is no more qualified than any other participant. And even where the nature of the problem is highly technical, it is seldom exclusively so.

ARTICULATING THE DIMENSIONS OF JUSTICE WITH PUBLIC INVOLVEMENT

To design a just public involvement process, then, it is necessary to translate abstract dimensions of justice into specific operating principles around which the process should be designed. This justice framework then shapes both the principles of public involvement, i.e., the short-term goals for the project at hand with respect to volume, quality, diversity, and use of information input, and long-term goals of the public involvement processes that reach beyond determining the location, shape, and other physical attributes of the infrastructure (Frewer 1999).

The Arnstein Ladder data above indicate that a certain level of technical expertise and control is both useful and desirable. Civil engineers, planners, architects, and other qualified professionals must establish design parameters around which a problem can be solved. They must define minimum levels of safety and service, for example. Also, the feasible option range, or design envelope, must be shown to the public so they can participate meaningfully. Finally, public input must be acquired in a form or language that the designers can understand and apply.

Thus public involvement will best realize the triple challenge of Rawlsian Justice when the following points are addressed:

1. Solicit participation from as many representative stakeholder groups and members of the public as practical.
2. Facilitate participation of disadvantaged groups through distributed outreach and reproducible, portable process.
3. Establish the design envelope. This requires an explanation of the legal and financial bounds to the problem (i.e., the domain beyond which the options cease).
4. Establish an agreed-upon decision-making process among all participants.
5. Identify and include all criteria of significance to all parties.
6. Provide transparency in method and data collection.
7. Respect participants' time and input.

TECHNOLOGY AND PUBLIC DIALOG

A key consideration in public participation is the degree of reflexivity with which visualization methods are used to facilitate dialog between stakeholders and professionals. Since planning and public involvement now commonly use visualization of various kinds, it is important to understand how they can be integrated more intelligently. These technologies should perform a dialogic function, in the sense of communicating values between citizens and professionals. They also must function as tools to elicit inter-stakeholder dialog that otherwise is hard to encourage.

We use the term "structured public involvement" (or SPI) (Bailey and Grossardt 2002) to describe a protocol combining dialogic tools, a range of visualization technologies, and decision support systems to support citizen participation. The aim of SPI is to increase public satisfaction with infrastructure design process and product. SPI assumes that engineers, planners, and designers are the technical experts, but that citizens best know their own cultural, spatial, and social preferences, and those should be incorporated into the design process.

SPI is a reflexive, iterative, and distributed protocol integrating large-group input into complex built environment questions. It is a set of linked dialogic processes featuring a reflexive use of visualization and decision-support tools that allow professionals to better access public planning or design preferences. SPI is not a single process applied to all design problem types; rather, it is the set of guidelines for selecting specific dialogic processes and decision support tools for a given problem. It relies on active participation by professionals to help select the specific processes, tools, and techniques to best respond to the question at hand.

A CASE STUDY OF SPI PROTOCOL APPLIED TO BRIDGE DESIGN

While this protocol has been used on a variety of problems, we will use a brief case study of an ongoing project to illuminate how it is activated. The research team was tasked with supporting the public involvement input into the design of two new bridges over the Ohio River in and near Louisville, Kentucky. The entire project is currently one of the largest public infrastructure projects in the country. The metro area of Louisville includes more than one million people and two states. Our challenge was to develop an SPI protocol that would accommodate large numbers of the public and provide useful design guidance to the bridge engineers and architects. This guidance would be gathered very early in the design process, and then incorporated into a publicly iterated process of developing a final set of three designs to be presented to an executive selection committee. Thus the requirements were:

- Design and execute a robust, repeatable method for capturing the aesthetic bridge preferences of a large and diverse, non-technical audience;
- Translate those preferences into a set of guidelines in a language useful to engineers and architects; and
- Revisit and refine those preferences with the public as the bridge designs became fewer and more detailed.

We did so by working out a "design language" in collaboration with the design professionals. This language was a set of parameters describing the unique design properties of bridges, arrayed so as to distinguish between designs. In this case, after several consultations with the designers, we settled on five parameters:

1. Structural Type: Arch or Cable Stay
2. Visual Complexity: Very Low, Low, Medium, and High
3. Superstructure Shape: "A" shaped, Intermediate, and "H" shaped
4. Superstructure Height: Low, Medium, and High
5. Symmetry, or Visual Balance across the river: Low, Med, High or "Complete"

Any bridge design appropriate to this context could be "located" by reference to these five parameters. For example, one bridge design might be a low basket-handle-shaped arch on one side of the river with single vertical hangers and single horizontal braces. It would be considered an arch of low complexity with "A" shaped superstructure, low height, and low symmetry. Similarly many bridge types could be "coded." In fact, the total number of possible combinations exceeds 200.

Clearly the general public cannot be expected to evaluate 200 different visual designs. It would require several hours, and the results would be suspect due to fatigue. However, it is possible to use fuzzy set theory (FST) to allow for a smaller subset to be visually sampled and to derive preferences for other combinations of parameters not specifically sampled. This methodology previously has been used in designing transit-oriented development and highway design (Bailey, Brumm and Grossardt 2001; Bailey, Grossardt and Pride-Wells, forthcoming).

In this case, the problem of many different potential design configurations was reduced to a sample of about 30 unique bridge designs. Each was "coded" for its set of design properties (see Figure 3). These samples then were visually rendered and presented for evaluation at a series of public meetings around the Louisville metro area. Participants used anonymous electronic keypads to provide instantaneous ratings of visual preference for each sample, where "1" was "not appealing at all" and "10" meant "extremely appealing." The ratings of each sample were displayed immediately, so that all participants could see the results as the evening progressed. After all the ratings were completed, those most appealing, least appealing, and with the greatest disparity in ratings were revisited, and public comments about their specific strengths and weaknesses were recorded to help the design team further understand the citizens' aesthetic judgments.

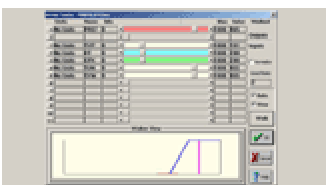


Figure 4
Sample Fuzzy Set
Model Output Point

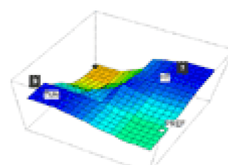


Figure 5
Preference Surface

The citizen preference and design parameter coding data then were modeled using a fuzzy set-based modeling software that allows visual inspection of the results. This created a mathematical "model" of relative levels of public aesthetic preference for all the possible combinations of design parameters within the domain of the design context. The team analyzed the results and used the output to inform the subsequent designs created by the engineering firm.

For example, Figure 4 shows a particular combination of parameters for a bridge sample that exhibited high public aesthetic preference. Preference "PREF" is nearly 865 out of a possible 1,000, or approximately 9 out of 10. The bridge sample itself is defined through the numeric codes as typology "TYP" = arch; height "HT" = low; complexity "CPX" = low; shape "TUN" = "A" or closed; and symmetry "SYM" = high. This particular combination corresponds to a sample that was presented to the public.

However, by virtue of gathering information about a larger range of bridge samples, we can interrogate not just this point, but the preference surface surrounding this point so as to better understand the interplay of preference and design properties. This same "point" (9) and the surrounding surface is shown in Figure 5.

This viewing method shows how the level of preference changes for interactions between superstructure shape "A" through "H" (on the left side) and superstructure height "Lo" through "Hi" (on the right side). Bridge type is fixed at "Arch," Complexity is fixed at "Low," and Symmetry is fixed at "High." Thus this shows high preference at location "9" corresponding to the point described in the prior graphic, but also shows the preference dropping as the shape approaches "H" and remains low in height. Aesthetic preference improves for an "H" shape if it becomes taller (Hi), as at "?".

In meetings with the bridge designers, other combinations of bridge properties were queried to evaluate their aesthetic appeal, balanced against the factors of cost, constructability, and long-term maintenance. From that meeting emerged the first 12 designs, all modifications of the original sample set, which were then more fully articulated and modeled. From these, six were chosen to be reevaluated in another round of public meetings, this time with more views, fly-throughs, and separate scoring of each design from three different perspectives. Visual strengths and weaknesses of each design were identified through solicitation of comments on each design from the public, and the design team modified the designs, if possible, or eliminated them as candidate designs if the negative aspects could not be rectified.

Currently, the field of possible designs has been narrowed to three, none of which came directly from the original sample of 30. These three were not developed solely on the basis of their visual appeal, however. Rather, they represent designs that are the best possible combinations of design factors within the problem context, with full integration of aesthetic preference into that problem set.

Finally, in addition to an analysis of the specific ways that the principles of justice are addressed in any given process, it is also appropriate to allow citizens to directly express their satisfaction with a given process. Figure 6 shows our results from a variety of such process evaluations, including each meeting from the case study presented here.

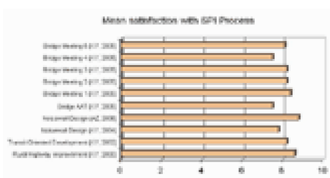


Figure 6
Mean Satisfaction with SPI Process

We believe this is a fundamental metric that can be used both to check the degree to which citizens agree that their justice requirements are being met, and to confirm in retrospect the legitimacy of a public built environment project. We urge other practitioners of public involvement to build explicit evaluation methods into their processes that will similarly measure citizen satisfaction with their involvement.

CONCLUSION

Creating an environment where citizens are treated justly in the context of large complex planning and design problems requires more than good intentions. It demands a methodical examination of the principles that should be met, and a careful, even meticulous, approach to the specific processes that will best realize often conflicting objectives. We hope this paper has helped explicate those goals more clearly and has demonstrated one approach to realizing them. We intend for this to show how technology can be used productively when these principles are clearly understood and methodically planned for. We do not intend to become advocates for technology used in ignorance of these principles, because it has the strong potential to do damage to them. We encourage the reader to consider how one might best realize these principles of justice, given the particular problem context and resources available at any given time, and not to assume that more technology equals greater justice.

Ted Grossardt is the program manager of the Community Transportation Innovation Academy (www.cti-academy.org), a research and education initiative of the University of Kentucky Transportation Center and the University of Louisville dedicated to improving the efficiency and

effectiveness of transportation decision making. He is also director of the Transportation Systems Management Graduate Certificate program at the University of Kentucky. This program introduces graduate students from civil engineering, geography, public administration, landscape architecture, and historic preservation to the major issues facing transportation professionals today.

Grossardt and his colleagues, Keiron Bailey of the University of Arizona and John Ripy of the University of Kentucky Transportation Center, collaborate with researchers at the University of Kentucky, the University of Louisville, and Wichita State University and at a variety of professional firms, in the fields of civil engineering, historic preservation, landscape architecture, geography, and electrical engineering, on complex public infrastructure planning and design questions. They have used their Structured Public Involvement (SPI™) protocol in a collaboration of facilitation, visualization technologies, and decision support science to bear on questions as diverse as highway and power line routing, highway design, transit-oriented district design, soundwall design, land use and transportation integration, and bridge design. He and his team have presented research results from his team's work at conferences of the Association of American Geographers, the Community Design Association Conference at Harvard, GIS in Transportation, Public Participation in GIS, numerous Transportation Research Board sessions, and a variety of other state and regional conferences on infrastructure planning and design. Their work is published in the Transportation Research Record, Socio-Economic Planning Sciences, *and the* Journal of Geographic Information and Decision Analysis.

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