

“Ground Truthing” Policy

Using Participatory Map-Making to Connect Citizens and Decision Makers

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Citizen participation has become an increasingly important component of development planning and environmental decision-making worldwide. Stakeholders are becoming more and more effective at derailing projects that are not perceived as responsive to local concerns and needs—one notorious example is the ongoing controversy over siting wind power off Nantucket Sound. If a planning process isn't seen as transparent, citizens are likely to oppose a project, regardless of its actual costs or benefits. As a result, encouraging public participation has become a high priority for funding institutions, government agencies, planners, and politicians in recent years.

Although new approaches to advance citizen engagement have emerged, participants still typically represent only a small subset of the larger affected population. As a result, the success of new projects increasingly depends on effective communication of participatory efforts and their results to a wider public. Within this broad agenda, reasons for seeking greater public involvement include raising awareness, incorporating public values, improving decisions, and building consensus.

One increasingly common way of engaging citizens and communities is to use mapping and spatial information technologies, such as geographic information systems (GIS). Mapping in this context refers broadly to any method used to elicit and record spatial data. Examples range from hand-drawn sketches to group chalk drawings to community “3D” physical and computer models. In all of these cases, mapping comprises not just a set of tools but the participatory process of gathering spatial information and making maps.

Map-making has become more popular with the growing recognition that many development and environment-re-

lated projects are inherently based on spatial information: the locations of key resources, people, and problems are central to the decisions being made. But little attention has been paid to whether maps are effective for eliciting information about peoples' priorities, perceptions, and preferences—and then communicating this information to wider audiences.

To address this gap, I worked with colleagues at Carnegie Mellon University to design and conduct a series of mapping surveys and interviews to evaluate if and how mapping can be used to facilitate public participation in development planning and environmental decision-making. In the remote-sensing field, the term “ground truthing” is used to describe the process of verifying a satellite image with what is already known about the location on the ground. We set out to do the same here, working with hand-drawn maps instead of pictures from space to verify local perceptions and contexts.

The first part of this study involved interviewing individuals and having them draw maps of their communities and environments. We then integrated their “data” (the location of homes, businesses, parks, significant places, etc.) into a standard GIS database and developed digital versions of each individual participatory map for evaluation by different audiences and groups. In the final stage, we looked to see if and how versions of these maps are understood by individuals who are not familiar with either the map-making process or the area being mapped. Reaching a wider public requires both direct participants (map makers) and indirect participants (map viewers)—this study evaluates both groups.

Public Participation in Pittsburgh

Our study group was made up of 32 individuals from several neighborhoods in Pittsburgh, Pennsylvania. In one-on-one interviews, we asked participants to create maps of how they

perceived their community. Using colored markers on 18" × 24" pieces of paper, each began by drawing a symbol for his or her home at the center of the page and continued by adding frequent routes and destinations in response to a sequence of interview questions. Symbols were selected by each mapmaker to best represent and communicate his or her personal associations with different types of places. Participants then added landmarks, places of special significance, and positive and negative spaces on their maps. Map features and symbols were not limited to physical spaces, but also marked local issues, community benefits, and areas of concerns. For example, various participants' maps included symbols for attributes such as diversity, crime, the rising price of public transportation, abandoned housing, accessibility, and "walkability." Throughout the interview, map makers added information to their maps to describe their activities, their interests, and their perceptions of their communities.

Figure 1 is an example of the type of map generated using this process. The colors on the map are associated with different categories of questions: black represents general activities and destinations, blue indicates places of special

significance, orange illustrates descriptive landmarks or locally important markers, red defines any negative places or areas, and green marks positive spaces or things participants would like to change.

As a final step in the mapping interview, participants were asked to draw a red line around all the places that they felt were part of their community. Results of the study show that not only does the geographic definition of community vary among community members, but the perceived boundaries do not correspond with typical, artificial boundaries such as zip codes, census tracts, or other superimposed divisions. Given that individuals' definitions of community and stakeholders' needs for information vary so drastically, communicating with a broad audience requires an acknowledgment of their diverse frames of reference in order to make new development decisions locally relevant, understood, and accepted.

Integrating Mapping Methods

The next part of our study focused on integrating these maps into GIS to bring together the myriad types of information

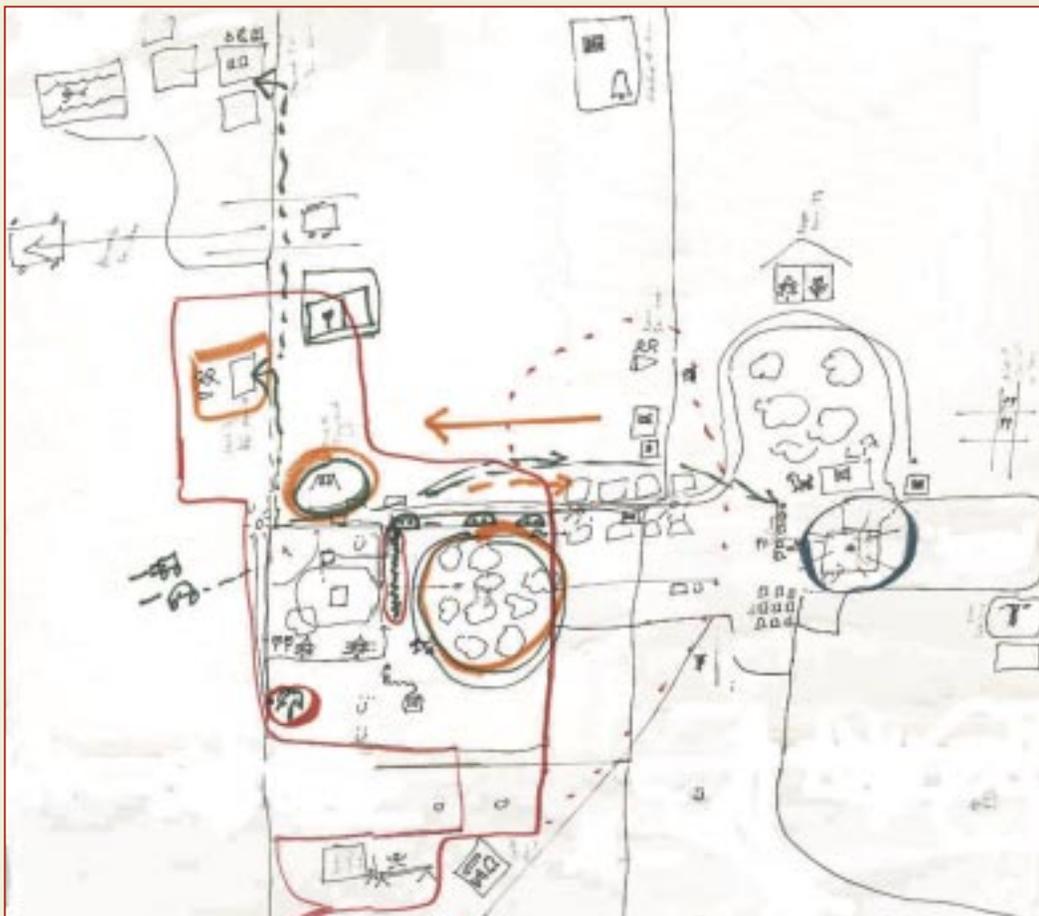


Figure 1.
Participatory map made by a female resident of an urban neighborhood in Pittsburgh.

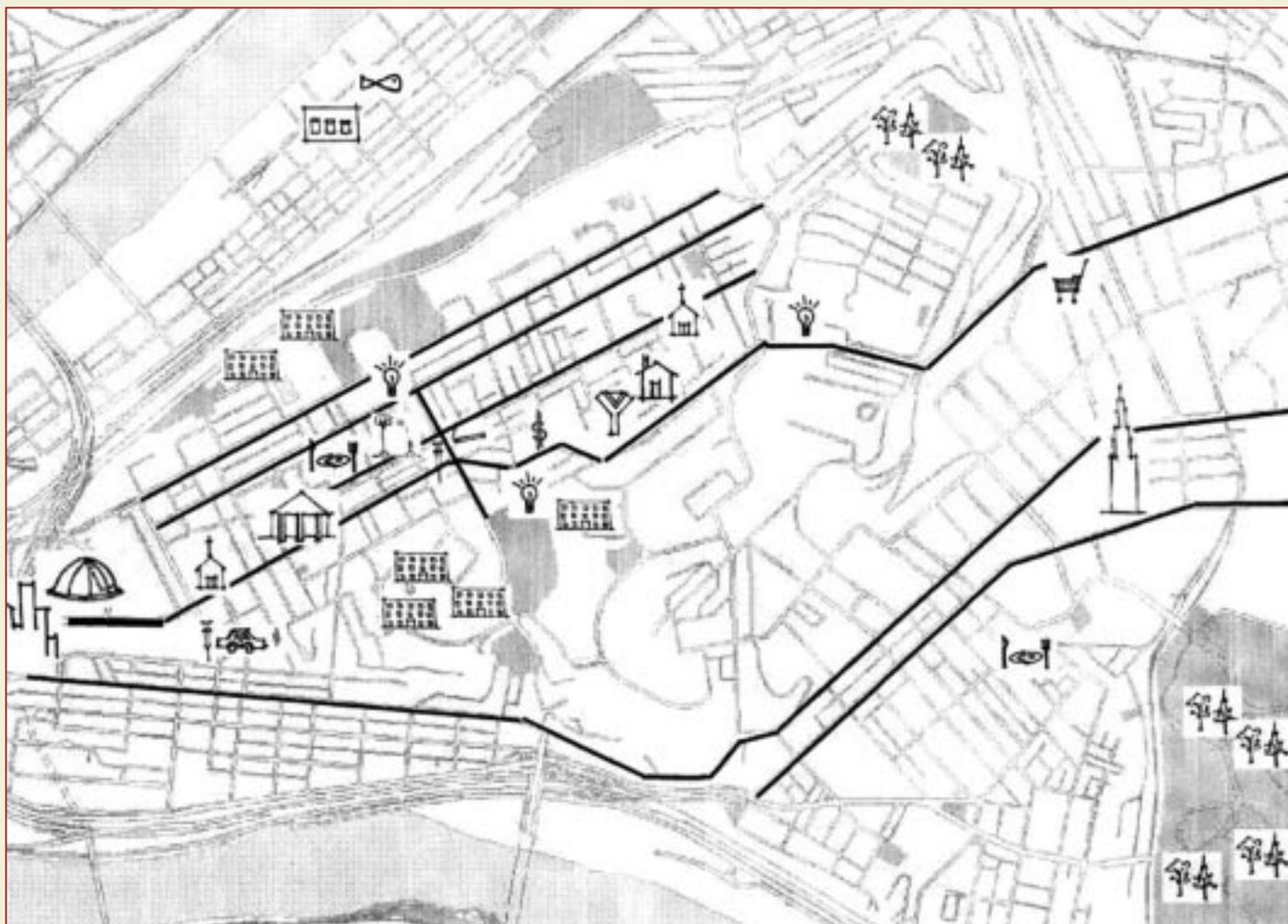
Figure 2.

Right: A digital version of a participatory map by a male resident of a low-income neighborhood with standardized symbols at their original scale.



Figure 3.

Below: A scaled GIS version of the participatory map, from Figure 2 above, with standard symbols at their actual locations.



required for effective participatory decision-making. During the process of drawing their maps, individuals provided street addresses and estimated distances to key points. These addresses were then matched with existing citywide GIS data points, and the locations of other elements were extrapolated and added to the GIS based on supporting data. Symbols were scanned into a GIS library as standardized, hand-drawn images (like those on the legend on page 18) and were assigned to the appropriate locations on each map.

Given the diversity of stakeholders in many development and environmental projects, different groups frequently require common information about a project but understand and use this information very differently from one another. For example, planners involved in siting major energy facilities require detailed technical information about possible sites including soil types, tree heights, and other relevant environmental data, while residents are often more generally interested in how a new project might impact their communities and landscape views. Both groups require common information about the same project, but displayed at very different scales and levels of detail.

To evaluate ways of combining and displaying information in GIS that address the varying information needs of different stakeholders, participants' original maps were used to create several types of maps in GIS. Two versions of these maps are illustrated on page 16. Figure 2 shows a digital version of a participatory map, and Figure 3 is an accurately scaled GIS version of this same map using standard symbols. The personal digital map is the most similar to the individual hand-drawn map and is simply a graphic recreation of the original with standardized symbols at a proportionate scale. As Figure 1 illustrates, respondents' maps were often clear, but rough; therefore, all symbols were redrawn, standardized, and then loaded into GIS. Using this framework, a graphic version of the original map with all of the original destinations and routes was created using the new standard symbols (Figure 2). Finally, spatially accurate GIS maps were developed by referencing points on the digital maps to correspond with the actual locations of places to generate new maps at different scales (see Figure 3 for an example).

Evaluating Survey Findings

The final phase of this project tested how various versions of participatory and GIS maps are understood by different groups to evaluate each map's effectiveness and accuracy for communicating both the actual neighborhood characteristics as well as the original map makers' perceptions. A written survey was conducted with volunteers from community

organizations in a town near Pittsburgh. This study area was specifically selected for its relative geographic isolation, in order to work with a survey population that was largely unfamiliar with both the specific neighborhoods mapped in the survey and the process of map-making. Surveys were administered to groups of 15 to 50 volunteers in three moderated sessions. One hundred eleven participants were randomly assigned to receive a written survey booklet with maps representing either of two urban neighborhoods in Pittsburgh, one low income, and the other high income.

GIS versions of the hand-drawn maps described above from four neighborhood residents and a single city-data based GIS map of the same area were collected into two separate survey booklets, one representing each neighborhood. The five maps in each booklet were cropped to describe a common 2×2-mile square area to allow for direct comparisons across maps. We asked a series of questions to test individual understanding of each map, the map makers, and the two neighborhoods. We specifically designed the survey booklets around sets of repeated questions to measure differences between the standard GIS and participatory GIS maps, between selected map makers, and across neighborhoods to evaluate which maps and map makers were most effective at communicating information about each neighborhood.

Major Results

A large majority of respondents correctly interpreted and answered basic symbol and scale-comprehension questions for both standard GIS and participatory digital maps. The ability of respondents to interpret symbols and scales was not significantly different for the standard GIS maps than for any of the participatory maps. Interestingly, those respondents who answered basic symbol and scale questions incorrectly were still able to provide relatively accurate assessments and ratings of the neighborhoods described by the participatory maps and different map makers' perceptions.

The most significant findings from the survey are the result of comparisons of survey respondents' ratings with those of the original map makers for a set of community attributes. Respondents were asked to assess the neighborhood represented in their booklet and to give their own ratings on a scale of 1–5 after viewing only the GIS map and then after viewing all five maps.

After viewing GIS maps, individuals gave overall ratings that were not significantly different for the two very different communities. After viewing all four digital participatory maps in their booklets, however, respondents' overall neighborhood ratings shifted significantly in the direction of the

original map makers' own community ratings. Participants who evaluated the low-income neighborhood on average adjusted their ratings downward and moved toward the actual ratings of community residents and the original map makers. Similarly, respondents who viewed maps of the high-income neighborhood shifted their ratings upward to reflect a more positive impression of the community that also aligned with the ratings of that community's residents and map makers.

This change in perceptions and neighborhood evaluations clearly illustrates that the digital participatory maps not only communicate additional information over the standard GIS maps, but they also convey accurate information about the original map makers' perceptions of their neighborhoods. Comparisons of these before-and-after neighborhood ratings provide strong support for mapping as a medium for accurately eliciting and communicating the perceptions of community map makers to wider audiences.

Conclusions

What our results show is that respondents clearly understood what different maps depicted and had a strong preference for how community map makers represented their commu-

nities, over standard GIS maps. By thoroughly testing and evaluating how idiosyncratic symbols drawn by individuals could be translated into stable, replicable data, we were able to address the question of just how well participatory maps could work as a policy tool.

While we focused on individuals in urban neighborhoods, participatory mapping is widely used for more general projects with communities and groups around the world. Examples include studies of how villagers in the Philippines define local forests and watersheds, how residents of informal communities in India can plan for resettlement, and spatial evaluations of the critical differences in how access and mobility patterns between men and women in rural southern Africa vary.

Like all participation strategies, mapping methods have to be tailored to local settings and issues. However, the results of this study and the process of integrating participatory maps and GIS maps used here are relevant in a wide variety of projects where the goal is to bring together information on local perceptions and planned developments for effective communication with wider audiences. Overall, participatory mapping in combination with GIS can help planners and policy makers "ground truth" new projects in both local realities and perceptions. ■

Figure 4.

A sample of the standardized symbols and icons identified by a participant and used as the legend in a symbol comprehension test of both participatory and GIS maps.

