Toward a Public Rhetoric Through Participatory Design: Critical Engagements and Creative Expression in the Neighborhood Networks Project

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Introduction

In her paper, "P for Political," Beck poses the question: "What constitutes political action through computing?"[1] Certainly, the history and range of contemporary projects in Participatory Design provide a rich and varied set of answers to that question. To those answers, we would like to propose two others: prompting critical engagements with technology and enabling people to use technology to produce creative expressions about issues of concern.

By *critical engagements* we mean experiences that bring about the reflective analysis and interpretation of issues, building from traditions in education and in the arts and design.[2] In particular, we are interested in facilitating encounters that reveal and/or call into question common assumptions and beliefs about both technology and the urban environment, and the possible relations between these subjects. The goal of these critical engagements is to provide people with experiential knowledge so that they can make informed and insightful suppositions and judgments concerning the capabilities, limitations, and applications of technology.

By *creative expressions of issues* we mean imaginative and resourceful representations of problems, or possible interventions into the conditions of a problem, which have convincing and aesthetic qualities. Regarding the use of technology, our interest is in how people apply and manipulate the capabilities of a given technology while infusing the artifacts or systems they produce with their own voice and style. Our goal is not to teach people to be technologists per se, but to help bring people to a point of technological fluency where they are comfortable with and capable of using technology beyond familiar uses.

Taken together, critical engagements with technology and the creative expression of issues through technology begin to form a public rhetoric: They constitute the activity of discovering,

1   Eevi Beck, "P for Political: Participation Not Enough," *Scandinavian Journal of Information Systems* 14, no. 1 (2002): 77-92.

2   In the arts and design, see Anthony. Dunne and Fiona. Raby, *Design Noir: The Secret Life of Electronic Objects* (Basel: Birkhäuser, 2001); Grant Kester, ed., *Art, Activism, and Oppositionality* (Durham, NC: Duke University Press, 1998); Leah Lievrouw, "Oppositional and Activist New Media: Remediation, Reconfiguration, Participation," in *Proceedings of the 2006 ACM Conference on Participatory Design: Expanding Boundaries in Design* (New York: ACM Press, 2006): 115-24; Nato Thompson and Gregory Sholette, eds., *The Interventionists* (Cambridge: MIT Press, 2006); and Material Beliefs, http://www.materialbeliefs.com (accessed August 1, 2009).

inventing, and delivering arguments about how we could or should live in the world.[3] The artifacts or systems conceived or created become rhetorical by their persuasive intentions and capabilities, and by the way they inform and/or provoke a response from or dialogue with others.

This notion of a public rhetoric has salience to design, which itself can be portrayed as a form of argument.[4] Positioning design as rhetoric does not claim some essential or deterministic quality of technological artifacts or systems. Nor does it suggest that design is fundamentally duplicitous, as contemporary pejorative notions of rhetoric might imply. Rather, positioning design as rhetoric calls attention to the ways in which the built environment reflects and tries to influence values and behavior and explicitly recognizes the capacity of people to design artifacts or systems that promote or thwart certain perspectives and agendas. In this light, design—inclusive of both the process of making artifacts and the artifacts made—can be considered a discursive activity, and Participatory Design can be cast as using design to enable people to take part in public discourse in new or more effective ways. This participation becomes a kind of political action through computing as people use technology to gather data, communicate, and solicit support for their perspectives, with the hope of initiating change.

We developed the Neighborhood Networks project to facilitate and investigate this particular kind of political action through computing. The project includes the production and evaluation of multiple public participatory design workshops that provide opportunities for neighborhood residents to engage in the open exploration and application of emerging technologies in the context of neighborhood activism. In the Neighborhood Networks project, we are particularly interested in the use of robotics technology in urban community contexts. In this paper, we describe the structure and activities of one of the Neighborhood Networks programs and discuss the experiences and outcomes of the workshops as evidenced through conversations among participants and the artifacts designed. In the discussion, we call attention to the ways in which the Participatory Design process fostered critical engagements with technology and enabled residents to creatively express local concerns and suggest possible technological interventions to the conditions of those concerns.

Project Description
Neighborhood Networks was a community-based Participatory Design research project that ran from 2007 through 2010. The project consisted of multiple community workshops in selected neighborhoods in Pittsburgh, PA. In this paper, we report on the first community workshop, which took place in the Lawrenceville neighborhood of Pittsburgh. In the Lawrenceville workshop, seven meetings were held over an eight-week period. Meetings occurred

3   See Richard Buchanan, "Design and the New Rhetoric: Productive Arts in the Philosophy of Culture," *Philosophy and Rhetoric* 34, no. 3 (2001): 83-206.

4   Ian Bogost, *Persuasive Games* (Cambridge: MIT Press, 2007) and Richard Buchanan, "Design and the New Rhetoric: Productive Arts in the Philosophy of Culture," *Philosophy and Rhetoric* 34, no. 3 (2001): 83-206.

in the evenings, once a week, for two hours. The meetings were held at a multi-use community center, which was chosen because of its standing in the community as a place for people to gather and host neighborhood activities. Neighborhood residents were informed of the workshops through flyers posted around the neighborhood and in the center, notices in a neighborhood print bulletin, the email lists of community organizations, and word-of-mouth. The summer program began two weeks after these postings, with approximately 20 residents participating in the first evening's activities. Of the initial 20 participants, 14 continued through to the final workshop. Participants varied in age and gender, including four middle-school-aged children (3 boys, 1 girl), eight adults aged 35 to 55 (5 women, 3 men), and two adults over 55 (1 woman, 1 man). The participants were all residents of the neighborhood. None of them claimed to have technical expertise, and four characterized themselves as artists or artistic. The workshop was separated into four distinct phases.[5] The activities of each phase were developed to build toward our project goals, leading the participants through reflective inquiry into the limitations, capabilities, and potential uses of sensing and robotic technologies in their neighborhood, with the intention of enabling them to discover and invent novel and compelling applications of these technologies for locally relevant issues.

Throughout the workshops, we took an active part as design researchers in enabling the use of the technologies and structuring the concept development and prototyping activities. Specifically, our own design activities were focused on constructing the means by which the participants could discover and express connections between the capabilities of a given set of technologies and issues that were salient to them. Our primary role, then, was not as designers of goods or services in the familiar sense, but as facilitators and educators. In the end, the concepts and prototypes were developed and produced by the participants with our assistance and feedback, but they were ultimately outcomes of the participants' own desires, imaginations, and skills.

Phase 1: Initial Engagements
The first phase of the workshop was designed to familiarize participants with the basic capabilities and limitations of sensing and robotics technology and to ground the use of these technologies within their neighborhood. Because of the novel character of the technologies and the desire to provide a solid foundation for their future design work, we chose to move through Phase 1 in the first two meetings.

Scavenger Hunt with Commercial Sensors
Our initial objective was to provide participants with a broad introduction to the concept and activity of technologically mediated

5   Because of space limitations, the description of the program has been significantly abridged. A more in-depth description of the program's activities is available in Carl DiSalvo, David Holstius, Illah Nourbakhsh, Ayça Akin, and Marti Louw, "The Neighborhood Networks Project: A Case Study of Critical Engagements and Creative Expression Through Participatory Design," in *Proceedings of the 2008 ACM Conference on Participatory Design Conference* (New York: ACM Press, 2008): 41-50, and in Carl DiSalvo, Marti Louw, Julina Coupland, and Mary Annq Steiner, "Local Issues, Local Uses: Tools for Robotics and Sensing in Community Contexts," in *Proceedings of the 2009 ACM Conference on Creativity and Cognition* (New York: ACM Press, 2009): 245-54.

Figure 1
Participant engaging in sensor
scavenger hunt.

6   See Eva Brandt and Jorn Messeter,
    "Facilitating Collaboration Through
    Design Games," in *Proceedings of the
    2004 ACM Conference on Participatory
    Design* (New York: ACM Press, 2004):
    121-31, and Eva Brandt,"Designing
    Exploratory Design Games: A Framework
    for Participation in Participatory
    Design?" in *Proceedings of the 2004
    ACM Conference on Participatory
    Design*, 57-66.

environmental sensing, using professional sound-level and air-quality sensor platforms. We began the first session with a sensor scavenger hunt—an activity designed to excite participants and to encourage exploration of both the technology and the neighborhood (see Figure 1). As an activity, the sensor scavenger hunt builds on prior work in participatory design that investigates the use of playful approaches and games to motivate participation, stimulate creative and critical thinking, and overcome hesitancy to using unfamiliar technology.[6]

The sensor scavenger hunt participants, divided into small groups ranging from three to seven people, were given a packet of materials, including an environmental sensor (measuring either $CO/CO2$ or sound levels), a map of the area, a Polaroid camera, a pack of film, a pen, and a printed slip of paper outlining the tasks of the scavenger hunt. The scavenger-hunt tasks were developed around the idea of "taking a reading." For example, three of the tasks were: "Find a place with the highest value for a given sensor," "Go someplace you have never gone before and take a sensor reading," and "Find the least agreeable place and take a sensor reading." After taking a sensor reading, participants would take a Polaroid photograph of the place and then write the sensor readings and a brief description on the photo. Participants also marked the location of the sensor reading on the map provided.

After about one and a half hours, participants returned to the community center to share their experiences and documentation. This activity took place around two large maps of the area (30 by 40 inches, or about 1 square meter). As participants taped each Polaroid onto the maps, they described the place, the readings taken, their reasons for choosing that particular place, and their understanding of the readings.

Exploring the Neighborhood with the Canary

In the second session, participants were introduced to the Canary—a relatively inexpensive, handheld sensing and robotics platform that we designed and built for use in the Neighborhood Networks workshops. The objective of this session was to familiarize participants with the specific features of the Canary and to probe the possible application of sensing and robotic technologies in the neighborhood. Compared to desktop computers or mobile devices, only a few robotics prototyping tools are simple and robust enough to support Participatory Design in a community setting. The Canary is an attempt to expand the range of technologies available to Participatory Design endeavors, specifically to include robotics by combining adequate sensing capabilities with basic kinetic actuation in an accessible form factor. The Canary design allows participants to easily open and examine the internal components, touch actual sensors, and experiment with them

directly. The six mounted sensors visible on the main circuit board are air quality, light, sound, humidity, pressure, and temperature. Readings from these sensors are continually displayed on an external, built-in, LCD screen, which also tracks sensor highs and lows. The Canary comes with four servomotor ports for connecting motors to the Canary, thereby enabling prototype devices to be animated immediately, based on sensor readings.

For the next session, participants were given a 10-minute hands-on overview of the Canary and then asked to use it to explore conditions both inside the community center and in its immediate surroundings for 30 minutes. After the participants returned, we discussed their experiences, encouraging them to reflect on the differences and similarities between the Canary and the professional sensors used the week before.

From Exploration to Expression
The uniqueness of the Canary stems from the way it combines servomotor outputs with environmental sensors and signal processing in a single package. The Canary, as well as the artifacts constructed using the Canary, can be considered robotic because it enables the production of physically embodied entities that respond to the environment. Moreover, the manner in which the Canary "expresses" environmental stimuli is user-configurable. Users can select one of several different sets of "expressions," resulting in a different mapping of sensor inputs to motor outputs. These motors automatically move in response to environmental stimuli, facilitating the prototyping of reactive devices without any programming or engineering knowledge.

To demonstrate these capabilities, we developed a simple, single-axis, single–motor-driven mechanism that simulated a large pair of butterfly wings. By connecting the wing mechanism to different servo ports, we could animate a variety of stimuli (e.g., clapping near the microphone, or breathing on the humidity sensor). After demonstrating the actuation capabilities of the Canary, we encouraged participants to spend the final 30 minutes of the session experimenting with craft materials (e.g., feathers, pipe cleaners, and cardboard) to produce objects or sculptures of their own design that used the Canary to produce movement in response to sensed data.

Phase 2: Concept Development and Design
The second phase of the workshop concentrated on the discovery and invention of possible uses of robotic technology (via the Canary) in the context of the Lawrenceville neighborhood and its issues. The objectives of this next session were twofold: to enable participants to imagine what might be possible using the Canary

and to facilitate the documentation and specification of their designs, with at least enough definition to enable them to begin prototyping the following week. To achieve these objectives, we developed a robot storyboarding activity.

Robot Storyboarding
Through the process of storyboarding, participants tried to make their ideas more concrete and explicit by producing sketches and written descriptions of their robot, in terms of its construction, purpose, and actions/reactions over time. A key quality of storyboards is that they do the work of both eliciting and documenting. We provided a customized robot storyboarding sheet, with plenty of space for both drawing and writing, and included prompting questions organized around four themes:
- Actions: What actions will people, things, or the environment do that affect the robot?
- Sensing: What does your robot sense from those actions? Using what sensors?
- Output: How does your robot react to those actions and express what it senses?
- Communication: What do you want to communicate through your robot? How should people feel or respond to your robot?

Getting participants to make use of the storyboards required more explanation and encouragement than we had anticipated. More than half expressed strong resistance to drawing complete designs. However, nearly all participants (with one exception) at least roughly sketched some set of basic mechanisms or sensors they intended to use. As a method of design and documentation, writing was more actively pursued than drawing. All participants wrote at least a few (two or more) sentences in response to each of the questions.

Phase 3: Iterative Design and Production
Phase 3 spanned three meetings and focused on the iterative design and production of the final prototype for presentation. During this time, the workshop sessions took on an "open-studio" format, in which participants would arrive at the community center and work on developing their prototype. This work took a diversity of forms, with some participants forming small groups of two or three and others working individually. In addition to building the prototype robots, all participants were given posterboards and instructed to document their robot design process, and to provide an overview of the purpose and functioning of their robot for the final presentation.

During this time, we—as researchers—took an active role in scaffolding the work of the participants. We casually walked around the room, stopping at tables and asking participants to describe what they were doing, or asking if they wanted any feedback or direct assistance. Participants were at first hesitant to ask for either. However, as time passed, and as participants ran into mechanical or conceptual difficulties, they began to call on us for technical assistance and to seek feedback to help them achieve their goals for their project.

Phase 4: Final Presentation
The final session was organized as a public event, modeled loosely after a science fair, at which participants presented their designs to the community and invited stakeholders to come and offer feedback. On the evening of the event, participants arrived early to set up their project displays, which included both the robot prototypes and their documentation posters. Each participant, or group of collaborating participants, was given a table to use, and the tables were arranged around the perimeter of the room.

The use of the poster boards proved to be important, because three of the teams were unable to finish their prototypes to a level of completeness with which they were satisfied. The posterboards were used by these groups as an effective means to extend and complete the communication of their ideas via another format. For the visitors, the posterboards served to distinguish people and projects by establishing spatial distinctions and also created a visual order to the room layout.

The public event was well attended. As attendees arrived, they milled about, walking among the displays and chatting with the participants, who presented their projects and discussed their process and motivations. In addition to the 12 participants, another 25 people or so from the community attended, including family members, neighbors, two representatives from two different community organizations, and a city planner from the City of Pittsburgh Department of City Planning. Participants said they enjoyed the opportunity to share with their neighbors, but they were most excited by the presence of, and the opportunity to interact with, the city planner and the representatives from community organizations.

Evidence of Critical Engagements and Compelling Expressions
As stated, the goal of the Neighborhood Networks project is to prompt critical engagement with technology and to enable people to use technology to produce creative expressions of issues of concern. Evidence of such engagements and expressions were found

in the conversations that emerged throughout the workshops and in the artifacts participants created. In the following paragraphs, we describe and analyze these conversations and artifacts, with an eye toward articulating how they came to form a kind of public rhetoric. Because the amount and range of discussions within the workshop were extensive and broad, we have focused our description and analysis on two activities and a single prototype.

Scavenger Hunt Activity: Shared Experiences of Productive Questioning

The scavenger hunt activity in particular prompted a rich set of critical engagements between the technology, the neighborhood, and the participants who found the experiences both exciting and challenging. They were excited by the way they had to collaborate to understand and make use of an unfamiliar technology that they perceived as usually being for "experts," and were challenged because the sensors were at times ambiguous in their readings or even contradicted the participants' expectations. Through these experiences, the participants engaged in reflective analysis and interpretation of the sensing technology and its relation to their local environment.

For example, many groups used the air quality sensor to explore obvious sites of pollution, combustion, or natural rot, such as sewers, portable toilets, commercial waste bins, tail pipes, and exhaust vents. However, most of these sites did not emit stimuli detectable by the given sensors, resulting in readings that did not differ from casual readings noted on the street. In particular, the readings for volatile organic compounds (VOCs) or CO taken in a garden did not differ much from those taken next to an industrial waste bin. In other cases, the differences in sensor readings were counter to what participants expected. For example, through their sensing, participants discovered that the readings of VOCs can be higher in a playground next to a tire swing than near a sewer (as the rubber tire swing off-gasses chemicals, but no gasses were at that moment coming through the sewer). In undertaking these sensing activities, participants immediately perceived and noted such differences between presumed and measured air quality and would "talk through" both the way the sensors were functioning and the environmental factors.

The ways in which participants collaborated in the use of the sensors were also significant in shaping their processes of analyzing and interpreting the sensor technology. As they took sensor readings, and particularly if the readings were confusing or surprising, participants would ask each other questions, such as

whether they needed to adjust the sensor and, if so, how to do so. During outings, participants would stand shoulder-to-shoulder, often with multiple people holding the sensor platform, and vie to examine the readings. The photo documentation was also under-taken collaboratively. Across multiple groups we witnessed a process in which one or two people would hold the sensor platform, while another person posed next to the location being sensed, often pointing at it, while the remaining participants would stand back and together frame and take the picture. In this way, the act of taking a sensor measurement was transformed from a solitary action into a collaborative group activity. In addition to operating the sensor platforms in a collaborative way, we observed partici-pants frequently discussing, debating, and negotiating where to go and what to measure once there. Identifying the most agreeable or disagreeable place was not an opinion-neutral task, and the assign-ment resulted in group conversations about what was agreeable or disagreeable and also what was sense-able and not sense-able.

By the end of Phase 2, participants felt capable of using the technology and were enticed by its potential applications. They also were able to begin to question—in an experientially informed manner—the accuracy and appropriateness of sensing in the urban environment. While participants appeared to enjoy the social activity of sensing, they were also initially suspect of the sensing technology because of the ambiguity in sensor readings and the mismatch between perceptions of a place and its measur-able qualities. The things observed, encountered, and experienced through the scavenger hunt would later spark conversations con-cerning neighborhood issues and the potential applications of technology to address those issues.

The Robot Camera Prototype: Engaging the City Through Dialogue and Concepts

Traffic emerged as a paramount issue in the summer workshops. Nearly three-quarters of participants' concepts in some way tried to address problems related to speeding and loud traffic on neigh-borhood streets. As a salient example of how participants pro-duced imaginative and resourceful interventions for the problem of traffic, one participant named Mary conceived of and designed a device simply called *The Robot Camera*, which would monitor the sound levels of passing cars, and when a certain sound level was exceeded, a robotic finger mechanism would take a photograph using a digital camera. The photograph would then be "sent to the city" to report on the car. In addition to visually recording the noise incident with a photograph, it was also suggested that an audio recording could be made that would document the actual sound and level.

The Robot Camera generated significant discussion among participants. Through the storyboards, discussion, and prototyping, participants materially and dialogically surfaced and traced multiple themes regarding technology and the city, including legal issues, questions concerning technical feasibility, and questions of efficacy. The following discussion is striking because it so clearly illustrates the ways that Participatory Design activities can generate sophisticated reflections on the relations between technology and the urban environment.

Upon first presentation of the *Robot Camera* idea, numerous participants stated there might be "issues" with such a device, particularly surrounding the legality of capturing pictures of people purportedly breaking the law. But in the course of the conversation, several participants noted an existing surveillance system in the city that captures people running red lights, and they offered this system as a point of comparison, rallying to the existing technology/system as a defense of the proposed system. This discussion prompted further discussion of "the city" as a specific entity, evidently distinct from the individual or groups in the neighborhood in terms of what it legally and technically is capable of doing, exemplified in the following exchange between two participants:

A: *Well the city does it*. [referring to municipal traffic monitoring cameras]
B: *But that's the city and they can do things like that. It's different than just us doing it, and I bet even for them it's tough*.
A: *Well they* [the drivers] *are breaking the law. And if people are speeding, gunning their engines and all that, or breaking windows or writing all over* [referring to spray painting], *they are breaking the law, too*.
B: *Yeah, but I still don't know if we can take their picture and then send it around like that to the police or whoever or projecting it on the street*.

Participants also discussed the technical feasibility of the *Robot Camera*. These discussions illustrate the developing understanding of the capabilities and limitation of the technology and the capacity for invention and resourcefulness in its application. The first set of feasibility questions concerned the Canary itself and ways to add additional functionality to the limited capabilities of the Canary. Mary was concerned that the microphone might not be capable of distinguishing moderate, but nonetheless annoying, sounds. As another issue, participants wondered if the Canary could record the time of the incident. After learning that the Canary did not and could not record time, a participant proposed an alternative: You could have two synchronized cameras—one that took a picture of the event, and the other a picture of a clock.

The issue of how to communicate this information to the city was also raised. Mary realized it might be difficult to automatically email this picture to the appropriate person at the city. She and others assumed such a thing might be possible, but they were unsure of how to do it. As Mary noted, "The Canary connects to the computer, and if the camera is also connected to the computer and the computer is on the Internet, you should be able to do it." As the discussion continued, a suggestion was made that perhaps the photograph could be sent in separately, either as a digital photograph or even as a Polaroid sent through the mail system. When asked if she would be able and willing to mail the photograph, she said, "Yes, I could do something like that; I could totally do something like that. It could do the sensing and the recording, and I could send it on to the city."

The design of the *Robot Camera* thus sketches the ways in which participants began to bring critical engagements to bear on the production of creative expressions. The design process prompted participants to examine together their concerns with the capabilities of the given technology and, in the case of the *Robot Camera*, to conceive of an intervention that united these concerns and capabilities. Through this endeavor, questions surfaced that caused them to reexamine their understanding of the technology and to imagine how the technology might operate within the realm of their neighborhood. In a sense, through the design process, they were able to experiment with the invention and discovery of arguments for the local and specific uses of a given technology, having each other as an initial audience for these arguments.

Final Presentation: The Public Communication of Local Issues and Desires

Through the final presentation event, participants were able to communicate their perspectives to others in a manner intended to convince, inform, and/or provoke responses. The event provided a forum whereby the process and artifacts of critical engagement and creative expression came together to constitute a kind of public rhetoric. During the prior weeks, the participants had been the audience for each other; but at the final event, the audience for their arguments about issues in the neighborhood expanded to include other residents, as well as members of neighborhood organizations and a city planner. During the evening's busiest time, more than 30 people were in attendance—not just simply viewing the work of the participants but engaging them in significant conversations. These conversations focused on the technology; the
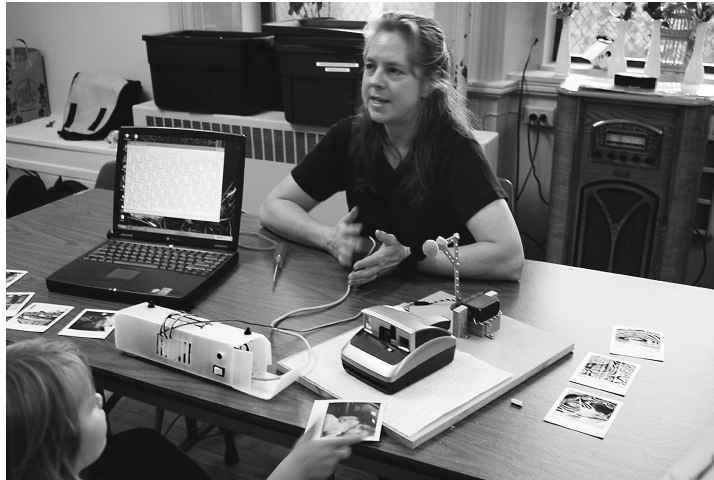
sensed data and its interpretation; the process of making the prototypes; and most of all, they were conversations around the ideas and motivations behind the prototypes—about the lived experience of the Lawrenceville neighbors, concerns in the neighborhood, desires for change, and possibilities for intervention. In the process of demonstrating their prototypes, participants communicated why they created what they had. From our observations of the conversations, these explanations, more than the details of the prototypes themselves, garnered the most follow-up questions from the city planner and community leaders (e.g., "Why would you want to do that?" or "Why would you only want to run this at night?"). These questions and the responses from the participants formed a casual dialogue in which the issues and desires of the participants were elucidated.

The ideas of the participants were not expressed through the prototypes alone; the robotic objects in isolation did not constitute the argument, but rather worked as part of an argument embodied and expressed through multiple materials. Many of the prototypes were only partially functional. This incompletion was actually a benefit because it challenged participants to develop multiple ways of expressing their intentions. In doing so, most of the participants had constructed stories to communicate their ideas and used the posterboards or forms of documentation as support for these stories (see Figure 2). In many ways, these stories functioned similarly to scenarios common to a user-centered design process and were grounded in the authentic experience of participants, calling attention to and leveraging the lived social and material particularities of the neighborhood. Thus, the robot prototypes, support documentation, data, storytelling, and conversation operated *together* as a rhetorical structure and format.

Conclusion

Historically, one of the objectives of Participatory Design has been to enable people to take part in the design and development of technological artifacts and systems. However, as Beck and others have stated, participation as we have commonly thought of it is "not enough:" We must consider how we can extend the participatory design project to new political forms and objectives. The explicit goal of the Neighborhood Networks project was to facilitate and examine the use of Participatory Design as a means to produce such critical engagements with technology and to give people the opportunity to use technology to produce creative expressions of issues of concern—as a kind of political action through computing. Throughout the workshops, as evidenced in conversations, activities, and artifacts, participants developed informed analyses and interpretations of sensing technologies and created imaginative and resourceful interventions to address local concerns.

In addition, the Neighborhood Networks project begins to describe a kind of Participatory Design practice that builds on the rhetorical character of design to constitute a public rhetoric. In the context of a public rhetoric, the aim of Participatory Design, then, is to enable participants to increase their visibility and the volume of their voices and to capture the imagination and attention of others in support of their agendas. In the case of the projects discussed in this paper, the arguments created were made up of prototype robots, documentation, and the narratives that participants constructed to convey the idea of their robot: how it would "work" and "fit" within the neighborhood.

Framing Participatory Design as an endeavor concerned with enabling the discovery, invention, and delivery of arguments has consequences for considering how we, as university researchers, might enable and promote these endeavors. It requires ongoing investigation into how technology functions in the construction and delivery of arguments, as a tool for discovery, and as a rhetorical device that supports certain kinds of argumentation and possesses certain persuasive qualities.[7] These qualities not only are a characteristic of the materiality of the technology (i.e., its affordances), but also are reflective of the standing of science and technology in contemporary culture. The authority of scientific data and access to the technological tools required to collect and produce that data typically reside with scientists and trained or licensed professionals. The interpretation of this data remains in these same hands and is released to the public through scientific publication, policy reports, press releases, and the media. Putting sensor technology and the data gathered into the hands of citizens to form and bolster public arguments that draw on the gathered

7   See, e.g., Ian Bogost, *Persuasive Games* (Cambridge: MIT Press, 2007).

"evidence" is a novel direction for political computing—especially when those arguments take on situated, embodied representational forms of data to creatively comment on, protest, and suggest possible interventions for local conditions of concern.

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