Participatory Design in Community Computing Contexts: Tales from the Field

Cecelia B. Merkel, Lu Xiao, Umer Farooq, Craig H. Ganoe,
Roderick Lee, John M. Carroll, and Mary Beth Rosson
Computer Supported Collaboration and Learning Laboratory
Center for Human Computer Interaction
School of Information Sciences and Technology
The Pennsylvania State University
University Park, PA USA 16802
{cmerkel, lxiao, ufarooq, cganoe, rlee, jcarroll, mrosson}@ist.psu.edu

ABSTRACT
As technology becomes more embedded in our daily lives, there is a great deal of hope about the use of information technology to achieve positive community outcomes like increasing access to local information, promoting civic engagement, and creating avenues for collaboration and communication. While these technologies provide opportunities for community groups to achieve their own goals, most community computing studies describe community members in fairly passive ways as users of existing systems rather than as meaningful contributors to the design process. The Civic Nexus project is a three year participatory design project that involves working with community groups to increase their capacity to solve local community problems through the use of leading edge computing tools. Our view of participatory design is one in which community members take control of the design process in terms of both directing what should be done and maintaining the technology infrastructure. In this paper, we describe our process of participatory design with three community groups and present associated challenges for designers engaging in participatory design in community computing contexts.

Categories and Subject Descriptors
H.4.3 [**Information Systems**]: Information Systems Applications: Communications Applications.

K.4.2 [**Computing Milieux**]: Social Issues.

Keywords
Community computing, community information systems, participatory design, social impact

1. INTRODUCTION
The trend towards studying community computing is tied to the larger realization that the use of technology is embedded in our daily lives [31]. This has led to a growing interest in building computer applications that can be used to help community groups achieve positive societal and organizational outcomes. Community networking studies tend to foreground the way that technology can be used to promote a more democratic society by facilitating social goals such as increasing access to community information, promoting civic engagement, and influencing public policy decisions [27]. Community informatics studies tend to foreground the ways that information systems can be built to facilitate organizational goals like recruiting new members, gathering data, developing content, and finding better ways to work with people inside and outside the organization [17].

Given the dynamic ways that community groups are said to be able to harness the power of technology to achieve their goals and the democratic impetus behind such efforts, it is surprising that there are few studies that explicitly position community members as active contributors or even drivers of the design process. Community computing studies typically provide a system level description of an application that was built to meet a perceived community need, utilizing data such as anecdotal reports, demographic profiling, web log analysis, and satisfaction surveys [11, 12, 23, 24]. These studies tend to assign a rather passive role to users, viewing them as receivers of technical systems or as informants in the design process. As a result, we know very little about the challenges that community groups encounter when making technology decisions for their organization or the barriers they encounter in using such systems. We also do not know how to work with these groups to achieve their goals, or even what counts as a "good" outcome when working with community groups.

This suggests the value of taking a participatory design approach to engage users directly in the design process [15, 22, 28, 29]. The few studies that incorporate participatory design techniques in working with nonprofit groups [1, 2, 3, 20, 30] and smaller organizations that are operationally similar to nonprofits [21, 25] hint at some of the challenges involved when taking on technology projects in community contexts. In community groups, technology decisions are

often driven by the availability of scarce resources including staffing, limited (or nonexistent) technology budgets, grants that include a technology component, and skilled volunteers. Staff members are overburdened with existing job responsibilities so new technology projects are taken up during their "spare" time. Community groups often make use of off-the-shelf solutions and have to live with a system even if it is not optimal because trying something new involves taking a financial risk.

One of the key issues that these studies raise is how to design for sustainability. For example, how do you sustain technology learning in an organization that relies on volunteers who come and go, or in organizations where much of the organizational knowledge resides in a few full-time staff members? In terms of taking a participatory design approach, the challenge in working with community groups is how to avoid becoming yet another temporary resource taking on the role of the consultant who builds something, leaving behind a system that is difficult to use, fix, and modify. Sustainability in this context involves finding ways of supporting groups as they learn about technology, as they identify ways that technology can be used to address organizational and community level problems, and as they develop plans to take on projects involving technology.

Sustainability is central to our project as we work with community groups to make technology use and learning an important part of their daily practice. Our approach builds on previous work that has taken a long-term participatory design approach in developing information systems to address local needs. Long-term participatory design is an emergent process that blends ethnographic methods with participatory design. We begin with ethnographic fieldwork to understand the user's work practices and identify opportunities for collaboration. At a basic level, we are trying to engage participants in the design process from the very beginning. Our long-term goal is for the participants to take control of the process in terms of both directing what should be done and maintaining the resulting technology infrastructure [9]. The goal is to gradually fade away with the participants maintaining and developing the achievement that is produced.

We developed this long-term participatory design approach in our work with middle school physical science and high school physics teachers in Montgomery County, Virginia USA [9, 13]. In this project, we worked with teachers over a five-year period to create a network-based system that supports collaborative learning in the classroom and knowledge sharing among teachers. This involved an iterative process in which we worked with teachers to understand their work practices and the benefits and barriers to knowledge sharing and collaboration in classroom settings. We then worked with teachers to design and refine scenarios through prototyping and tradeoffs analysis. Teachers were directly involved in the design process from the start, moving from being informants in the beginning to active participants in system design. By the end of this process, the teachers were serving as mentors to other teachers, encouraging their use of the system.

We are now adapting this model of participatory design to the study of community organizations. Through this new way of working with community groups, we should gain insights about how designers can best work with groups to use technology to achieve their goals. We also hope to develop models for sustainable technology use and learning in community computing contexts.

2. CIVIC NEXUS

Civic Nexus is a three year community-oriented participatory design project. We are working with community groups to increase their ability to solve local community problems by leveraging their capacity to use leading-edge technologies. Our goal is to help groups define the problems that they would like to address using technology and to help them to facilitate this process. Ownership for the project resides in the group, and they involve us as co-designers in the process. By ensuring that ownership stays with the groups, we hope to empower community groups to have greater control over their use and learning about technology. In the long term, our project hopes to: (a) understand how nonprofit groups use and learn about technology, (b) develop models to support sustainable technology use and learning in nonprofit organizations, (c) understand how to best work with community groups to design information systems, and (d) develop methods to evaluate informal learning using information technology.

We are in the early stages of this participatory design process. Our initial efforts centered on recruiting interested community partners. We chose groups that had a web presence and who expressed an interest in doing more in their organization with technology. Our first contact with these groups was through an email to tell them about our project. We also conducted interviews with possible partners and held a workshop to provide more details about the project and to learn more about the groups. Through this process we identified five partners all located in Centre County, Pennsylvania. The groups are diverse representing a range of people and issues, including: an environmental group, a high school learning enrichment program, a historical society, a senior center, and a group that works to provide technology support to local not-for-profits.

For the past eight months, we have conducted fieldwork to understand the overall mission of our community partners, their activities in the community, and the role of technology in their organization. We have also worked to identify stakeholders in the groups and to identify possible areas for collaboration. Part of the fieldwork process involves identifying strategies to work with each group in a way that makes sense to their organizational structure. In some cases, we observed regularly scheduled meetings that are part of the organization's routine. In other cases, we scheduled meetings with the group to talk about potential areas of collaboration.

In the next three sections, we report on our participatory design efforts with three community groups: the Spring Creek Watershed Community, the State College Area School District Learning Enrichment/Gifted Support Program, and the Centre County Historical Society. We have chosen to present our work with these groups because of their diverse interests and the insights they have provided to us about participatory design. We provide background on the mission of each group, our involvement with the group, and describe how technical change happens in each organization by describing a technology project we observed in our fieldwork. We will reflect on our experiences to discuss the challenges and

opportunities involved when incorporating concerns about sustainability into the design process.

3. SPRING CREEK

The Spring Creek Watershed Community (SCWC) is an informal stakeholder organization that is organized around a commitment to show how regional environmental and economic planning by watershed is more effective than planning by municipality. The mission of the organization is to explain the basic terminology and information about watersheds and to demonstrate the impacts of the watersheds on people's quality of life and the local economy. SCWC is an organization that works to shape public policy rather than an implementer of policies.

3.1 Infrastructure

SCWS is largely a volunteer organization with limited staffing and financial resources. The leader of SCWC works for the Clearwater Conservancy, a stakeholder group of SCWC. She spends 15% of her time on SCWC business. SCWC uses its one unpaid intern and some volunteers to work on the website. Four of the volunteers are regular participants in influencing the overall goal of SCWC, two of whom have technical skills such as web site design, databases, etc.

As with most nonprofit community groups, SCWC has limited funds relying on small grants to hire human resources and/or to purchase technological equipment. What makes this group unique is the fervent philanthropic effort by volunteers to advance the goals of SCWC, including the two technical volunteers who have a high personal stake in driving the organization to achieve its goals. One example that illustrates the lack of funds is that SCWC used to distribute a bi-monthly newsletter to its stakeholders (approximately 2500 people). As finances became tight (the variability in acquiring grants from funding sources), SCWC temporarily halted publishing the newsletter. Recently, they have decided to find a way to distribute the newsletter online to its stakeholders.

3.2 Our Involvement

Our fieldwork so far with SCWC has involved interviews and observations. We began attending regularly scheduled meetings in which the group discussed its future goals and plans. Over the last eight months, we met with SCWC eight times. These meetings were not specifically oriented for or by us. In the early meetings, our role was that of a "lurker" or "observer". We would simply attend their meetings, observe group conversations, and analyze the status and concerns of this group. We would reiterate at each meeting that our role was to facilitate SCWC's learning about technology so that they could be more sustainable and independent in the design process. At the end of 2003, SCWC was faced with the challenge of revamping their web site. At this point, our role gradually shifted towards a more "consultant" role. We gave advice to the group as they made decisions about the content of the web site and as they moved on to the semantics of its layout and presentation. At no point did we actually design their website for them.

3.3 Technology Project

One major technology issue confronted by this group was dealing with an earlier failed attempt to redesign their website and their attempt to restart this process. Before our involvement with the group, SCWC received a grant that enabled them to hire a third party commercial vendor to make changes to their web page. The contract with the vendor did not include any "customer service." It was a one-shot deal where the initial requirements laid out by SCWC were taken as "final requirements" by the vendor, and in turn, he/she did not show any flexibility later on. The web page that the vendor created contained general information about the group and a database that stored information about the local watershed and water quality. The group was extremely dissatisfied with the web site that was produced. From their perspective the website did not reflect the goals of SCWC and did not reflect the idea that they were working on watershed issues in Centre County, PA. Whereas the goal of SCWC was local economic planning, influencing decision makers, and encouraging quality of life through watersheds, they felt that the vendor-authored site depicted SCWC as a generic "tree hugger" group.

SCWC decided to disconnect their links with this vendor. This resulted in further complications because due to the working on their contract, there was a danger that the vendor would charge them for returning *their* data to them. After several provocative emails, SCWC was able to get access to their web site content. SCWC is currently in the process of revamping their web site. Through their experience, they now realize that it is simply not enough to rely on vendors to create their web site. Instead, they should at least be minimally aware of the technology needed to manage their resources and be more involved in the decision-making process. At the moment, SCWC holds meetings every two weeks with the goal of first deciding about what content should be posted, and then finalizing the layout of their web site.

We have worked with the group to help them realize that they need to be active in making decisions about web content and layout throughout the web design process. The leaders and volunteers of SCWC need to have technical knowledge, not only to avoid unfortunate incidents such as the one mentioned above, but also to make better-informed information technology decisions.

3.4 Lessons Learned

Technology used in the wrong way does not achieve goals

SCWC wanted to establish a web presence to further their goals by reaching out to their digital community. However, their lack of knowledge about the web design process contributed to a website that misrepresented their group. It is tempting to claim that by having a web presence the goals of the community will be met. This claim falls short when the stakeholders are unaware of what this decision entails and the process does not encourage user engagement throughout the design process.

Design failures can cause changes in practice

From our perspective, one of the reasons why SCWC had a negative experience in the redesign of their web site is that they were relatively uninvolved in the web design process. SCWC did provide some content for the site and some initial suggestions about the information that should be included on the site. They were not involved in the design process in an ongoing way and they relied on the vendor to make decisions about the underlying technical structure and information

architecture of the site. In the end, the website that was produced did not met their needs. This negative experience led them to change the way that they make technology decisions in their organization and to institute more long-term technology planning. They now have a technology committee that is directly responsible for the redesign of the website.

Making learning about technology part of practice

In addition to remaining flexible with respect to human and technical resources, organizations need to acquire knowledge about the ever-changing technology. Knowledge about the organization's underlying technology directly influences their goals. In this case, a web site influenced the goals of SCWC (by misrepresenting their web presence, they did not achieve their mission). Knowing about technology could mean a whole range of things: (a) knowing which technologies are being used, (b) knowing the benefits/tradeoffs while making decisions about which technologies to use, (c) knowing how to use technology (minimally) for empowerment, and (d) knowing how to adapt to different technologies. Acquiring knowledge about technology, at the very least, allows the organizations (and its leaders) to make informed decisions that influence the achievement of their goals.

As we analyze SCWC longitudinally, we can trace the trajectory of IT adoption, starting from their original web site (supported by a third party vendor) to their current status. The website mismatch incident for SCWC actually molded their organizational processes and practices. Before the incident, there was hardly any practice within the group to capture their intangible and tacit knowledge. After the incident, the group realized the importance of building lateral ties by incorporating skilled volunteers and other community stakeholders into the design process. SCWC significantly changed its practice by focusing on knowledge management and attributing value to self-management of technology. One way to precipitate similar lessons in other groups would be to share knowledge among community groups so incidents such as the one with SCWC are vicariously experienced, thereby reinforcing the need for dynamic processes, changing practices, and information technology literacy.

4. LEARNING ENRICHMENT CENTER

Another community group we have worked with is the Learning Enrichment Center/Gifted Support Program (LEC), part of the State College Area School District. One of the major goals of the program is to provide learning opportunities to students who are interested in exploring areas beyond the standard curriculum. This program supports the development of a range of interests such as art, writing, and mathematics through activities such as field trips, guest speakers, and training sessions. It also encourages students to develop their problem solving and research skills through participation in real world projects.

4.1 Infrastructure

The LEC is located at a local high school. While this center facilitates a number of student projects, we are working with a group of LEC students who are interested in learning web technology and who are involved in a project where they are putting courses on-line. There are 12 students participating in this project. The students overall have a fairly high level of technical skills. A few students have more advanced technical skills including knowledge about LINUX, MySQL, and PHP. There is one staff member who is our major contact at the LEC and who is responsible for coordinating the students' activities on this project. The teacher is comfortable with basic web technologies like email or web surfing but does not have experience using some of the more advanced technologies used to develop the course.

4.2 Our Involvement

Our fieldwork with LEC has involved interviews, observations, and an open-ended questionnaire. So far, we have completed four interviews, one with the LEC director and 3 with the staff member responsible for technology activities. The interviews covered a range of topics including background on the LEC, the project goals, and discussions about the process of design. Our observations involved sitting in on weekly meetings in which students discussed and worked on the design of the on-line course. We asked students to fill out an open-ended questionnaire at the end of the project to probe their learning progression and to get their feedback on the process. Our role in working with this group changed throughout the design process. In the early stages, we were more active in providing advice about the format of the web sites, suggesting course management software, and hosting a lab session at our university. Over time, our role faded to the point where we are in the role of "observer", occasional "hint giver", or "active listener" encouraging reflection on the design process. We plan to interview a few students involved in the LEC and to continue to observe this ongoing technology project. We also plan to interview the teachers and students who may use the prototype course.

4.3 Technology Project

Students at the State College high school are required to take a health course. Currently, two options exist. Students either take a health course in a traditional classroom setting or as a correspondence course. The school noticed an increased demand for online courses so they decided to explore offering some courses online beginning with the health course that is the subject of this study

The students in this project were responsible for the design of the health class web site. They used open source software to design the website for the course, to manage course content, and to set up a grading infrastructure for the course. The students were also in charge of maintaining the server for the course, managing the course database, putting existing course material on-line, and developing new content in the form of quizzes to test student learning.

After setting up the health course, the students gave a demo to teachers and administrative staff. Overall, the presentation went well and the teachers and staff were impressed with the students' accomplishments. The health teachers raised some concerns about the online format of the course and its ability to meet course requirements and learning objectives. In the online version of the course, it would be impossible, for example, to teach physical skills like CPR. There was also an underlying tension about losing students from the existing health course to the online format. As a result of this resistance and because of the interest of other teachers in the school, the efforts of the students have been redirected to putting an English course online that will be piloted this summer.

4.4 Lessons Learned

Technology projects can provide "proof of concept"

While the original health course that the students designed has not been fielded, this project had a significant impact on other teachers at the school and on the school curriculum. At the demonstration that the students conducted with teachers and administrators, they talked about how the teachers might use this system. The students discussed the choices that the teachers had in using the online system to present course materials and to evaluate student learning in the course. The teachers in the English department decided that they wanted to put one of their courses online and the students took up the challenge of working on this new course. The students' work on the demo and the work that they did to help the teachers envision what such a course might look like was important in making the decision to put the English course online. In this case, the work that the students did served as a "proof of concept" that a course at the high school could successfully be offered in an online format.

Evaluation efforts need to account for long-term and indirect changes

Traditionally, evaluation of technical projects is mainly focused on more immediate and direct outcomes of the designed products. If we evaluate the LEC project in the short-term, we might say that the redesign did not "succeed" because the health course was not approved for use in the school. But if we take a broader approach, we can call the project a "success" because the it led other teachers to see how they might incorporate online teaching into the curriculum. This raises questions for researchers about when to end the telling of the story about IT adoption, use, and learning in a community. Our argument is not that we should ignore failures to meet short-term goals but rather that we should recognize the dynamic process involved in introducing new technology into an organization. Sometimes the impacts are not immediate and they involve people who are not directly part of the project.

Importance of ownership over design and learning

A unique feature of this project is that students were, in large part, in control of the design process and their own learning. This represents a shift away from more traditional learning models where the teacher structures student learning. In this case, the teacher had less technical knowledge than her students and she acted as a facilitator in the students' learning process. This matches our goal of fading from the process so that users take control of the design and their own learning processes. It also matches the goals of the LEC to provide learning opportunities that do not fit within traditional classroom settings. Perhaps one reason students were able to take control of this process is that our vision of participatory design matched the goals of the LEC.

5. HISTORICAL SOCIETY

Founded in 1904, the Centre County Historical Society (CCHS) is one of Centre County's oldest and largest historical organizations. CCHS works to collect and preserve historical materials related to local history (particularly iron history) and makes the materials available to the public. These materials include artifacts, books, manuscripts, maps and photographs. They are dedicated to educating local citizens about the history of Centre County through activities such as on-line and off-line exhibits; tours of their historic building and related sites; and publications about local history that they publish and promote. For example, they make lesson plans available to teachers and facilitate student tours of their building. The organization has a website that reflects their organization's mission and a newsletter to keep the public updated on the organization's activities.

5.1 Infrastructure

CCHS is a nonprofit organization that has two paid full-time employees who manage all the organization's activities and volunteers. Volunteers perform activities such as giving tours to the public, updating the website, and working at the store. The organization has a committee structure with different committees responsible for guiding decision-making in the organization.

While the organization is heavily motivated towards achieving their goals, there are also external pushes that drive change such as grants and external requests for collaboration. Because of their strong educational mission, they often partner with local teachers and university professors on projects related to local history. These projects are sometimes initiated by people who wish to tie an outside interest such as geography or technology to local history. Grants and external requests for collaboration are also important drivers of technical change in this organization. For example, certain exhibits featured on their website were developed because they received a grant that had a technology component. Other portions of their website were developed based on the initiative of volunteers with technical expertise.

5.2 Our Involvement

Our fieldwork so far with the CCHS has involved interviewing staff members and attending design meetings. We met with CCHS staff members a total of twelve times. In the interviews, we tried to understand their interest in using technology to achieve their goals and to identify possible points of collaboration. At this point, we are still working with the group to better understand how we might work with them. We plan to attend some regularly scheduled organizational meetings that occur in the group to get a more precise sense of the infrastructure of the organization.

5.3 Technology Project

One project that highlights the way that information technology is implemented in this organization is the collaboration between CCHS and the Pennsylvania Governor's School, an enrichment program for high school students. This program works to match students in the program with groups in the community that have an information technology project. A consultant who worked at CCHS made the connection between the historical society and the Governor's School.

The students participating in the Pennsylvania Governor's School program collaborated with CCHS to create an interactive quiz for their website geared towards teaching children about history of iron work. This project was tied to the educational mission of the CCHS in the sense that they were developing a resource that could be used to support learning on their web site and they were supporting a learning project among high school students. In designing the quiz, the

students visited the Historical Society. These students selected artifacts to be used in the quiz, interviewed employees at the Historical Society to understand how the artifacts were used, developed questions, and created the web pages that made up the online quiz.

In the design process, employees at the CCHS acted mainly as content experts rather than being actively involved in the design process. This may have been an appropriate decision given the nature of this project. The CCHS involvement in the project reflects an overall approach to minimizing input on the technical side of design and to receive a push from an external group to change their website. The quiz has not been updated since the students from the Governor's School delivered the final product.

5.4 Lessons Learned

Community history influences design roles

The experiences of CCHS point to the importance of paying attention to the group's prior history when implementing technology projects. In this organization, as with many nonprofit organizations, technology adoption is piecemeal and the process is ad hoc. Much of the process is driven by grants, the projects are often initiated by outsiders, and the work is done by volunteers. Based on their prior experience with IT projects and the way that the group traditionally works, they expected us to have a more direct role in initiating a technology project. In our participatory design process, we wanted community members to participate in the whole design process from the very beginning. It took several interviews to communicate this idea to the group. Working with this group has involved a negotiation process where we learned what they want, and they learned about the things that we could and were willing to do.

Inquiry as part of design

The experience of this group also points to the need to make inquiry about the roles taken by both designer and community an explicit part of the design process. One important difference between the CCHS and the other groups is that we initiated all the meetings. We were not observing a technology project already in place but rather were trying to find ways that we could work together. Over time our meetings have been characterized by shifts in potential areas of collaboration. It has been difficult to find "the project" to work on with this group. This has led to challenges in terms of making sure that we did not push this group to select a project based on *our* interests rather than *their* interests. The lack of a clear project raises the issue of control: how to shift control to community groups and how to best communicate this view of the design process to our partners. It also suggests that it is important for designers to interrogate their role in the design process and to talk about this in an explicit way with community partners.

6. DESIGNING FOR SUSTAINABILITY

Community groups have a unique set of characteristics that present challenges for designers who take a participatory design approach. Technological solutions are bounded by limited financial and human resources. Community groups need to leverage local resources such as volunteer efforts, small grants, and community-oriented initiatives to get technology projects done. We saw this in the cases of the SCWC and CCHS who used grant funding to develop their web sites. The danger in this approach is that these resources are often short-lived so once the volunteer or the consultant is gone the group may be left with a system that is not usable or easily modifiable. The other danger is that without direct involvement in the design process the group may wind up with a system that does not meet their needs and is not flexible enough to adapt to changes in the group's needs. The case of the LEC highlights the importance of technical skills and having an infrastructure in place to support technical work and decision-making. This infrastructure and skill set is often not present in other community organizations. There is evidence that our findings are not unique and that these issues are systemic to nonprofit organizations [20, 30].

These cases highlight the need to develop the capacity in community organizations to learn about technology and to direct the design process. This means that designers may need to take on new roles, avoiding the role of simply providing technology solutions [8]. The motivation for involving community groups in design is not simply to gather design requirements. Designers must focus on issues of long-term sustainability for these community groups finding ways to encourage technology learning and planning in the organization. Learning about information technology (or information technology literacy) is the driving force and key element in working with community groups.

The overall goal of Civic Nexus is to establish a sustainable model for incorporating information technology learning into the everyday practice of community groups. Designers must encourage community groups to take charge of their technology, so that better informed decisions are made that reflect their goals. The focus of participatory design in community computing contexts is not on the product but the process. Our goal, as designers, is to facilitate the process of learning about information technology. Sustainability is critical to our objective and for community groups. Our challenge is to find ways of working with groups to help them understand the need for sustainability while at the same time respecting their short-term need to balance scarce resources. Below we present some reflections on the process of participatory design with community groups.

6.1 Dynamism of Participatory Design

Participatory design with community groups is challenging because the management and coordination of activities is different, and the organizational structure depends heavily on dynamic changes in human resources. This further conditions the uncertainty in design requirements. Volunteers come and go. Full-time participants of these community groups, such as their leaders, typically do not have resources to learn technical skills, do not have the time to do so, or do not see it as central to the work that they do. Therefore, the process of participatory design encompasses more than just the art of design.

In community groups, participatory design has to deal with multiple roles conditioned by the different group requirements. Designers cannot just take a techno-centric view, by assuming that technology is the panacea for solving community-level problems. Intra-organization uncertainty presents the challenge of first establishing common ground with these community groups. Even though it may seem that the goals across all these community groups converge, there

are nuances that lend itself to different solutions for different groups.

While there are certain problems that may be systemic to nonprofit groups there are also ways in which the groups differ which impacts the design process. There can be difference in the management structures of nonprofits and on the value that they place on the work of volunteers which impacts design choices [1, 2]. Similarly, while from a technical perspective the use of a particular technology will "obviously" solve some problems, we must also understand the ways that some technical solutions do not fit the organizational structure of the group. A naïve and unproductive view would be to assume that all community groups should have, for example, collaborative web tools for achieving their tasks.

Designers should also be wary that as their roles co-evolve with time and shifts in organizational goals, the roles of community groups change as well. Our goal is not to be content by situating community groups as mere end users. Community groups also need to move beyond providing design insights and technological requirements by learning about information technology itself and leveraging that knowledge to sustain their organizational goals. Roles may be completely switched between designers and community groups—it may happen that community groups evolve as end users into designers themselves, and designers gradually fade away from the process. By not assuming ownership from the very beginning, we as designers can facilitate this evolution of roles and encourage technological sustainability.

Therefore, participatory design in community computing contexts encompasses more than "design". The initial process of social grounding takes time and roles are negotiated. Designers in this context should realize this dynamism and be ready to assume these expanded roles. The groups that we are working with are not static. They are and they should be learning and growing (so should we of course). The relationships that we are in are dynamic.

6.2 Seeding Ownership

An important goal in doing participatory design is to find ways to seed ownership for technology projects in the community groups themselves. In terms of promoting sustainability, we must see community groups as owners of the projects, not designers. Community groups share their projects with designers. Designers go into their world and play evolving roles without assuming ownership of their services. The goal of community computing reminds us that designers need not just provide technological solutions, but empower community groups in their day-to-day decision making, processes, and practices by inducing knowledge about information technology. This perspective is inline with participatory design approaches in which organizational change is driven by and projects are undertaken by workers rather than management [5, 29] and approaches that encourage active engagement of users in the design process [5, 15, 18, 28].

The case of CCHS speaks to the difficulty of trying to seed ownership and to promote learning in an organization. CCHS had a model where outsiders came into the organization and did technology projects for them with the staff serving as content experts. The staff did not get involved in the design process. This was a reasonable practice in the sense that the staff did not have a lot of technical expertise and they did not have a lot of time to devote to technology projects. This organizational practice provided a challenge to our project's goal of promoting long-term technology learning and planning and active engagement in a technology project. This case reminds us of the need to reflect on the expectations that we bring into the field when we work with groups and the assumptions that we make about the process such as what it means to work on a technology project together, who gets to define the nature of the work, and what counts as a technology project. More recently, we have had better success working within the organizational structure of the group by working with a technical volunteer on an existing project rather than trying to initiate a brand new project. Reflection about our role and the role of the community groups must be part of the process of participatory design.

The cases examined in this study also encourage us to see the process of individual and social change in broad terms. We see some of the larger shifts in practice that can occur as in the case of the SCWC who added technology planning as a more formal part of their practice. These shifts can be smaller such as the shift that Trigg [30] noted where members of the nonprofit that he worked with decided that at least one staff member should be responsible for learning about any changes that a designer made to the database that was being developed. Methodologically, small shifts in practice are as important to notice as more obvious changes in organizational learning and decision-making.

6.3 Shifting Roles, Crossing Boundaries

The goal of seeding ownership requires designers to find new ways of working with community groups that go beyond eliciting project requirements. Working with community groups expands the role of designers into lurkers, facilitators, consultants, and bards and foregrounds the need to find ways of communicating this role to community groups [8]. In our project, when we initially met with the community groups, our role, even as designers doing participatory design, was passive in nature. Instead of gauging design requirements, we were establishing our less directive role. This process of social grounding facilitated a mutual feeling of "having a stake in the project."

As our role of authentic stakeholders settled in, community groups questioned the nature of our contribution to their goals. Interactions and dialogues related to this were a segue to our role as facilitators and/or consultants. In the LEC group, we facilitated students who were the active designers in putting learning material online. In the SCWC group, we would frequently advise the group on revamping their web site. At the same time, our role for CCHS was less clear and it was difficult to move beyond the expectation that we would act as the traditional designer working with end users to develop interactive technical solutions.

The goal of seeding ownership in community groups requires a new set of skills and competencies that go beyond technical design skills. Bødker and her colleague make a similar point in their call for new definitions of usability competence [4, 6]. They argue that the focus should not just be on design skills but on the designer's ability to create conditions that

encourage a collaborative design process and active reflection. This requires usability professionals to find ways of pushing on traditional boundaries between overlapping knowledge sets, professional identities, and practices [7, 29].

The goal of seeding ownership in community groups also requires a new set of procedures for working with groups that are resource poor and that push on traditional boundaries between users and designers. Kyng [19], for example, provides some techniques that can be used with resource poor groups such as: (a) the sharing of stories and work place visits that serve to demonstrate different ways that technology might be incorporated into their organization, (b) finding models for local work, (c) using futures workshops, and (d) and creating mock-ups that make design decisions more concrete. Trigg [30] created a database that served as an in-house "sandbox" to try out design ideas. Robertson [25] served in an advisory capacity helping the organization think through some of the "shopping" decisions that they needed in choose a technical system to meet their needs. Mogensen and Shapiro [21] worked with groups to expand their technology thinking by presenting alternatives to solve problems that organizational members encountered in their everyday work. McPhail et al. [20] used a futures workshop and demos to elicit user participation. Others stress the importance of using techniques like using artifacts that serve as boundary objects to push on terms like "designer" and "user'" and encourage boundary crossings, articulation work, and translations [7, 29].

Our own work points to the different strategies required when working with groups and the way these strategies evolve. With the CCHS we found that it may be more productive to find ways of working within the group's existing practices to encourage change. In SCWC, we were involved in an ongoing project and a shift in practice where the group became directly involved in the redesign of their website. In the LEC, we acted as consultants as they created an on-line content management system for an online class at their high school. A future role for the LEC and other groups that possess in-house technical skills might be to take more of a "design collaboratorium" approach where designers introduce ways that the community members can utilize participatory design techniques themselves. Because we are looking at a number of community organizations in this project, as we get further along we will gain a clearer understanding of some of the key similarities and differences between groups. This knowledge will help us understand the choices that a designer needs to make in working with groups to promote sustainability in participatory design.

6.4 Future Directions

Sustainability is central to our project as we work with community groups to make technology use and learning an important part of their daily practice. Our work as designers in the Civic Nexus project involves partnering with community groups as they pursue their goals and, in some cases, suggesting ways that a group might redirect their efforts to achieve more favorable outcomes. Our partnership with the community groups also feeds into the work that we do as researchers as we use these experiences in identifying models for supporting sustainability in community organizations. Such models include: (a) strategies that community groups can use to sustain learning/problem solving, (b) strategies that people can use when working with community groups, (c) technology tools that community groups can use in their work, and (d) ways of doing research with community groups that explores IT use/participatory design.

Our goal in working with the community groups is to fade away taking a less active role in the technology projects that they are coordinating. We will continue to monitor the progress of our current groups and identify new groups that will challenge our current thinking and help us tease out some of the important factors that encourage and challenge IT adoption, use, and design in community computing contexts. We are interested in working with social service agencies because they seem to be a standard type of nonprofit that is represented in most communities and they face some of the resource limitations that we identified in this research. We also hope to look at grass roots approaches to community safety such as emergency response and civil defense organizations because it seems their needs may be very different than the other groups we have worked with so far.

Thematically we hope to explore the issue of developmental learning trajectories. The community groups and individuals within the groups change over time in terms of the ways they think about and do their work. These changes may involve learning new technology skills but they also include non-technical issues such as learning how to provide the social infrastructure needed to effectively use a technical guru. The changes may involve more obvious shifts in practice like SCWC's creation of an in-house technology committee to redesign their website or more incremental shifts in thinking about a problem. Methodologically, areas of conflicts and technology breakdowns provide areas for the researcher to understand some of the assumptions that the group makes about technology use, planning, and learning in their organization.

We also would like to identify patterns in community computing contexts [10, 26]. The SCWC case provides an example of what this might look like. One technique that we have used with SCWC is to introduce the idea of scenario-based design as a way to resolve design conflicts experienced in working out the design of their website. This proved to be an evocative technique because it provided scaffolding to help the group to think more about the audience for their site and it provided less technical members of the group with a way to talk about factors important in the design process. Through this technique, the group identified an audience for their website that they had not previously considered. The lead coordinator of the group, who was less technically proficient, used a scenario that she created to demonstrate her stake in the design process and to articulate her vision about how the group should be represented on the front page. Arming people with a simple scenario envisionment technique provides a language for turning their disappointments and frustrations about their own IT into a guiding vision of what it is they want to achieve

6.5 Conclusion

Typically, design is evaluated using traditional software engineering methods like verification and validation, where the developed technological solution is tested. In community computing, evaluation is a continuous process from day one. Evaluation is not just about the quality of the technological solution. Community goals and informal learning have to be part of the evaluation process. Participatory design is tied to

evaluation because designers want to maximize community outcomes from the perspective of the user. This may involve learning about technology as an evaluation criterion. For example, if SCWC learns to develop their web site, it is very well a success story that fits into the process of evaluation. Hence, evaluation in participatory design in community computing contexts must encompass pedagogical and socio-technical goals, going beyond just the assessment of technological solutions.

Evaluation in community computing contexts is not restricted to just design. Designers must take into consideration the holistic effect of design and the process of learning about information technology on the community. In the case of SCWC, the usability of their web site is an important aspect, but even more critical is the effect of the web site on the activities of the SCWC community. Design evaluation in community computing should consider the influence of information technology on the sociology of the community.

The community groups involved in the Civic Nexus project were initially recruited because of their inherent motivation to "do" something with information technology. As designers, we are naturally interested in facilitating these groups to use information technology in an effective, efficient, and sustainable way to further their goals. However, designers must pursue this goal with caution because information technology may undermine the goals of community groups. As we are currently assessing how to best balance our skills with the goals of these groups, it may turn out that information technology is not at all required. Take the example of CCHS. This group is currently satisfied with how they manage tutorials and historical exhibits. As they learn more about what information technology can do for them through us, it may turn out that technology is not central to their goals. This is not to say that designers should in any way undermine the role of information technology; rather, information technology may not be the solution. However, one can only arrive at this judgment by learning about information technology, which in itself is a goal for designers to encourage in the community groups. It would also be premature to claim that information technology will never facilitate the goals of community groups. Technology may not be central to a community group's goals currently, but at some later point in time, its role may become more important. Designers must acknowledge that the role of technology in community computing contexts is not central—it is just means to further the goals of community groups in a sustainable way.

Ultimately, we also must start asking questions about the design process itself, how we view potential users of our systems, and what counts as a successful use of a community information system. When we start asking these types of questions at a very basic level we begin to understand how to build community information systems that meet user needs. The ultimate goal is not to just give users access to a new system but "effective use" as defined by the end user and his or her community [16]. As designers working in community computing contexts, perhaps one of most important roles that we can play in working with community groups is to find the "right good" or "effective use" in a given situation. As Dewey put it:

"The practical meaning of the situation – that is to say the action needed to satisfy it – is not self-evident. It has to be searched for. There are conflicting desires and alternate apparent goods. What is needed is to find the right course of action, the right good. Hence, inquiry is exacted: observation of the detailed makeup of the situation; analysis into its diverse factors; clarification of what is obscure; discounting of the more insistent and vivid traits; tracing the consequences of various modes of action that suggest themselves; regarding the decisions reached as hypothetical and tentative until the anticipated or supposed consequences which led to its adoption have been squared with actual consequences." [14]

7. ACKNOWLEDGMENTS

We would like to thank all members of the community groups for providing us insights for this paper. This research is partially supported by the US National Science Foundation under award IIS 03-42547.

8. REFERENCES

[1] Balka, E. Participatory design in women's organizations: The social world of organizational structure and gendered nature of expertise. *Gender, Work and Organizations 4, 2* (April 1997), 99-115.

[2] Balka, E. Political frameworks for system design: Participatory design in nonprofit women's organizations in Canada and the United States." In J. Gaertner & I. Wagner, (Eds.) *Workshop Proceedings: Political Frameworks of System Design From a Cross-Cultural Perspective. Held in conjunction with the Third Decennial Conference: Computers in Context: Joining Forces in Design* (Aarhus, Denmark, August 14-18, 1995). Available WWW: http://www.sfu.ca/~ebalka/aarhus.htm

[3] Benston, M. (with E. Balka). Participatory design by nonprofit groups. In *Proceedings* of the *Conference on Participatory Design (PDC '90)* (Seattle Washington, March 31 - April 1, 1990). CPSR, Palo Alto, CA, 1990, 107-113.

[4] Bødker, S. and Burr, J. The design collaboratorium: A place for usability design. *ACM Transactions on Computer-Human Interaction 9, 2* (2002), 152-169.

[5] Bødker, S., Ehn, P., Knudsen, J., Kyng, M. and Madsen, K. Computer support for cooperative design. In *Proceedings of the Conference on Computer-Supported Cooperative Work* (CSCW '88) (Portland, OR, September 26-28, 1988). ACM Press, New York, NY, 1988, 377-394.

[6] Bødker, S. and Iverson. O. S. Staging a professional participatory design practice: Moving PD beyond the initial fascination of user involvement. In *Proceedings of the Second Nordic Conference on Human-Computer Interaction* (Aarhus, Denmark, October 19-23, 2002). ACM Press, New York, NY, 2002, 11-18.

[7] Bødker, S., Nielsen, C., and Petersen, M. G. Creativity, cooperation and interactive design. In *Proceedings of the Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques* (New York, NY, August 17-19, 2000). ACM Press, New York, NY, 2000, 252-261.

[8] Carroll, J. M. Participatory design of community information systems: The designer as bard. In F. Darses, R.

Dieng, C. Simone, & M. Zacklad (Eds.), *Cooperative Systems Design* (COOP '04). IOS Press, Washington, DC, 2004, 1-6.

[9] Carroll, J. M., Chin, G., Rosson, M. B., and Neale, D. C. The development of cooperation: Five years of participatory design in the virtual school. In D. Boyarski and W. Kellogg (Eds.), *Designing Interactive Systems* (SIS '00) (Brooklyn, New York, August 17-19, 2000). Association for Computing Machinery, New York, NY, 2000, 239-251.

[10] Carroll, J. M., Dunlap, D. R., Isenhour, P. L., Kavanaugh, A., Rosson, M. B. and Schafer, W. Community-based information technology workforce development. In R. Carveth, S. Kretchmer & D. Schuler (Eds.), *Shaping the Networked Society*. 2003 in press.

[11] Carroll, J. M., Rosson, M. B. Better home shopping or new democracy? Evaluating community network outcomes. In *Proceedings of CHI 2001: Conference on Human Factors of Computing Systems*. (Seattle, WA, March 31 - April 5, 2001). ACM Press, New York, NY, 2001, 372-379. Also published as CHI Letters, 3, 1.

[12] Carroll, J. M., Rosson, M. B., Cohill, A. M., and Schorger, J. R. Building a history of the blacksburg electronic village. In *Proceedings on Designing Interactive Systems: Processes, practices, methods, & techniques* (Ann Arbor, MI, August 23-25, 1995). ACM Press, New York, NY, 1995, 1-6.

[13] Carroll, J. M., Rosson, M. B., Dunlap, D. R, and Isenhour, P. L. Frameworks for sharing knowledge: Toward a professional language for teaching practices. *Proceedings of the 36th Annual Hawaii International Conference on System Sciences*. (HICSS '03) (Kona, HI, January 6-9, 2003). IEEE Computer Society, Washington, DC.

[14] Dewey, J. *Reconstruction in Philosophy*. Beacon Press, Boston, MA, 1948. (Original work published in 1920)

[15] Greenbaum, J., and Kyng, M., Eds. *Design at Work: Cooperative Design of Computer Systems*. Lawrence Erlbaum Associates, Hillsdale, NJ, 1991.

[16] Gurstein, M. Effective use: A community informatics strategy beyond the digital divide. *First Monday 8, 12* (December 2003). Available WWW: http://www.firstmonday.dk/issues/issue8_12/gurstein/index.html

[17] Gurstein, M. Community informatics: Current status and future prospects. *Community Technology Review* (Winter-Spring, 2002). Available WWW: http://www.comtechreview.org/article.php?article_id=56

[18] Harris, S. R. PD in ponty: Design-by-doing. In *Proceedings* of the *Conference on Participatory Design* (PDC '02*)* (Malmö, Sweden, June 23-25, 2002). CPSR, Palo Alto, CA, 2002, 278-283.

[19] Kyng, M. Designing for a dollar a day, In *Proceedings of the Conference on Computer-Supported Cooperative Work* (CSCW '88)(Portland, OR, September 26-28, 1988). ACM Press, New York, NY, 1988, 178-188.

[20] McPhail, B., Costantino, T., Bruckmann, D., Barclay, R. and Clement, A. CAVEAT exemplar: Participatory design in a nonprofit volunteer Organization. *Computer Supported Cooperative Work 7, 3/4* (1998), 223-241.

[21] Mogensen, P. B. and Shapiro, D. When survival is an issue: PD in support of landscape architecture, *Computer Supported Cooperative Work 7, 3/4* (1998), 187–203.

[22] Muller, M. J. Participatory design: The third space in HCI. In J. A. Jacko and A. Sears (Eds.), *The Human Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications,* Lawrence Erlbaum, Mahwah, NJ, 2002, 1051–1068.

[23] Pettigrew, K. E., and Durrance, J. C. Public use of digital community information systems: Findings from a recent study with implications for system design. In *Proceedings of the First ACM/IEEE-CS Joint Conference on Digital Libraries* (Roanoke, VI, June 24-28, 2001). ACM Press, New York, NY, 2001, 136-143.

[24] Pettigrew, K. E., Durrance, J. C., and Vakkari, P. Approaches to studying public library Internet initiatives: A review of the literature and an overview of a current study. *Library and Information Science Research*, *21, 3* (1999), 327-360.

[25] Robertson, T. Shoppers and tailors: Participative practices in small australian design companies. *Computer Supported Cooperative Work 7, 3/4* (1998), 205-221.

[26] Schuler, D. A Pattern language for living communication. In *Proceedings* of the *Conference on Participatory Design* (PDC '02*)* (Malmö, Sweden, June 23-25, 2002). CPSR, Palo Alto, CA, 2000, 434-436.

[27] Schuler, D. Community Networks: Building a New Participatory Medium, *Communications of the ACM 37, 1* (January, 1994), 38-51.

[28] Schuler. D. and Namioka, A., Eds. *Participatory Design: Principles and Practice*. Erlbaum, Hillsdale, N.J., 1993.

[29] Suchman, L. Located accountabilities in technology production. Centre for Science Studies, Lancaster University, Lancaster LA1 4YN, UK, 2000. Available WWW: http://www.comp.lancs.ac.uk/sociology/papers/suchman-located-accountabilities.pdf

[30] Trigg, R. H.. From sandbox to "fundbox": Weaving participatory design into the fabric of a busy nonprofit. *Proceedings of the Participatory Design Conference* (PDC '00) (Palo Alto, CA, November 28 - December 1, 2000). CPSR, Palo Alto, CA, 2000, 174-183.

[31] Wellman, B. and Haythorthwaite, C. *The Internet in Everyday Life*. Blackwell Publishing, Malden, MA, 2002.