Participatory design in community informatics

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Participatory design – the direct involvement of end-users and other stakeholders in design – has become a standard design paradigm in informatics, that is, in developing information systems, applications, infrastructures, and associated work practices. Community informatics, which addresses the impacts and utilisation of information technology to facilitate community life, is a challenging, but important domain for further developing participatory design.

Keywords: community informatics, design methods, information design, user participation

Participatory design integrates two radical propositions about design. The first is the *moral* proposition that the people whose activity and experiences will ultimately be affected most directly by a design outcome ought to have a substantive say in what that outcome is. The moral proposition is that users have a right to be directly included in the process of design. The second is the *pragmatic* proposition that the people who will need to adopt, and perhaps to adapt to an artefact or other outcome of design, should be included in the design process, so that they can more offer expert perspectives and preferences regarding the activity that the design will support, and most likely transform. The pragmatic proposition is that directly including the users' input will increase the chances of a successful design outcome.

These propositions are radical because they fundamentally challenge conceptions of design as a profession and of what it means to be a designer. Thus, it might seem purely definitional that the people who shape designed artefacts and systems are the designers. But in participatory design, the designer's role is more nuanced and more complex. Ideally, all the relevant stakeholders participate in even the inner loop of design conception, and all continue to participate meaningfully as the design is specified, implemented, delivered, installed, and used.

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The stakeholders in design would most centrally include the direct users of the designed artefact or system, along with the users' managers, co-workers,

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customers, suppliers, and others whose practices would be affected by the design. The participatory design process becomes a social negotiation among partners, and the designer's responsibility in this process is to faithfully translate, collaborate, and respond to the concerns of the other stakeholders. Some designers might not want this job description!

In this paper, we review the emergence of participatory design as an accepted professional practice for developing information systems, applications, and infrastructures – including the socio-technical systems within which these technologies are *embedded* (Kensing and Blomberg, 1998). We focus especially on 'community informatics' – the design and management of information systems and infrastructures for civic and municipal-level entities: Nonprofit community groups, non-governmental social service providers, and the lowest, most local level of government (villages, towns, townships).

Participatory design clearly entails some reallocations of *power* in design collaborations. Thus, it becomes less acceptable for a designer to simply 'present' solutions tout court to other partners. However, our impression is that within participatory design collaborations, power is more of a legacy issue than a challenge. In our experience, the more significant lesson is that participatory design raises new opportunities and challenges with respect to human development for *all* stakeholders (Carroll et al., 2000).

1 *Participatory design in informatics*

Informatics is the design of information systems, applications, and infrastructures, including the socio-technical systems within which these technologies are embedded. Between 1970 and 2000, computer and information science and engineering (CISE) were profoundly reconstructed. In 1970, the 'software crisis' – an acute need for software applications that outstripped capacity to produce them – was still the driving challenge. It was conceived of technologically. Huge efforts were directed at systematising software design and engineering processes, and developing computational tools to automatically configure systems and applications from formal specifications (e.g., Sommerville, 1992).

Most of this proved to be ephemeral; higher-level programming languages, application-specific programming languages, and software libraries soon muted the software crisis per se. A relatively small cadre of computer scientists and engineers recognised that the more significant issue was that of presenting more and better information to people, and conceiving of new ways for people to manipulate vast quantities of information. Indeed, as we look back at the 'software crisis' from many years onward, it seems that the looming crisis of the 1970s was the *usability crisis* – broadly understood as the challenge of learning how to produce software that individuals and their organisations could readily adopt and apply, and through which they could become more

efficient with respect to their own objectives and activities. This crisis was not even recognised by the mainstream of CISE in North America until well into the 1980s (Carroll, 1997).

The 1980s in North America was the decade of human-centred computing. At the outset of the decade, it was a novel idea that human characteristics and the various experiences of using software were among the most important design requirements for software. By the end of that decade, this was taken as obvious. However, even in 1990s the concepts, skills, and practices to ensure that software meaningfully addressed human characteristics and produced a rich and satisfying user experience were rare in the computer industry. Unwieldy and ineffective behemoths regularly rolled out of Microsoft, IBM, and other software vendors.

North American human-centred computing in the 1980s basically meant studying the use of software, and adjusting and refining its design until it met usability specifications, understood analogously to functional specifications (Carroll and Rosson, 1985). This is still a sound software engineering practice, and in many variations still forms the core of what is now called *usability engineering* (Rosson and Carroll, 2002). However, the early versions of usability engineering in North America were very strongly rationalist. They focused centrally on observing and measuring users and use. They prized empirical laws of usability, such as Fitts' Law for cursor pointing tasks and the Hicks-Hyman Law for making selections in menus. Mechanical user models, based on information processing psychology, formed the core of theoretical work (Card et al., 1983). Although surveys and interviews were countenanced as methods, these were typically seen as supplemental. The human-centred computing effort — like the software crisis it supplanted — was directed at systematising software design and engineering processes through objective procedures.

Direct user participation was mostly absent from North American conceptions of human-centred design in the 1980s. This is surprising in that participatory design was being energetically and quite visibly pursued in Scandinavian CISE as early as the 1960s (see Bjerknes et al., 1987). During the 1970s and 1980s, as the information processing conception of human-centred computing emerged, and eventually became the dominant view in North America, participatory design became highly developed throughout northern Europe; it was constructed theoretically by Activity Theory. These two 'paradigms' — North American human-centred computing and European Activity Theory/Participatory Design — came into contact frequently during the latter 1980s as an international research community in Human—Computer Interaction formed first around the IFIP 13.2 Working Group, and eventually around the ACM Special Interest Group on Computer—Human Interaction (SIGCHI). A turning point was the publication of Bødker's (1991) monograph

'*Through the Interface*'; from that point forward, participatory design entered the North American discourse on human–computer interaction in a torrent.

During the 1990s, participatory design methods became standard practices throughout the world. There are still regional flavourings. For example, in Europe relatively greater weight is given to the moral premise, and accordingly, participatory design is well integrated into the broader concept of labour relations and negotiations. Thus, a frontier of participatory design in Europe is including managers in participatory design processes (Bødker, 1996). In North America, relatively greater weight is given to the pragmatic premise, and accordingly, there has been considerable work on lightweight design exercises to gather input from users quickly and without the verbal mediation of design rationales (Muller et al., 1995).

2 *Community informatics*

Community informatics refers to the design and management of information systems and infrastructures by civic and municipal-level entities: Nonprofit community groups, non-governmental social service providers, and the lowest, most local level of government (villages, towns, townships). Community informatics is a generalisation of disparate community networking initiatives (mostly in North America) in the 1970s and 1980s. These initiatives focused on jobs, housing, and veterans' issues in the Berkeley Community Memory (Farrington and Pine, 1996), community health in the Cleveland Free Net (Beamish, 1995), and problems of the homeless in the Santa Monica Public Electronic Network (PEN – Rogers et al., 1994). Education has also been a major focus. For example, Big Sky Telegraph supported teachers in rural Montana, linking 1- and 2-room schools with regional libraries, and providing computer support for the literary and artistic projects of Native Americans. The project was implemented on obsolete computer equipment refurbished by a local women's resource centre. It connected a remote and quite dispersed community to the world, for example, giving students access via electronic bulletin boards to professors at M.I.T. (Uncapher, 1999).

Community informatics strongly embraces democratic ideals (Schuler, 1996), but participatory design manifests much differently in community informatics than in traditional commercial informatics. In business informatics, there is a high degree of role differentiation among participating actors, for example, managers, workers, hardware developers, software developers, vendor organisations, service engineers, and so forth. 'Participation' has for the most part been articulated as mechanism for regulating power and access at the boundaries between these roles. Thus, Clement and Van den Besselaar (1993) enumerated several 'ingredients' for participation: (1) workers must have access to relevant information; (2) workers must have the opportunity to take independent positions on issues; (3) workers must be included in the processes of decision making; (4) appropriate participatory methods must be available; and (5)

the process must include sufficient organisational and technological flexibility. These elements are aimed at allocating power and access at the manager–worker boundary.

Over the past decade, computer networking has been transformed by the emergence of the World Wide Web. In the public sphere of computing this had major effects. The community networking movement has been influenced by competing visions of the Internet. The dominant contemporary understanding of the Internet is less that of a channel that can facilitate grassroots organising in a local community context, and more a matter of global access to collaborators and work activity, products and services, information and education, and so on. These are the themes Iacono and Kling (2001) emphasised in their characterisation of what they call the 'internetworking' computerisation movement. This movement also incorporates a variety of relatively anonymous interactions pertaining to shopping and entertainment.

Contemporary community informatics addresses the problem of how to use a fairly limited cache of civic resources to help community-based nonprofit groups meet their needs for information technology. Two challenges that shape this enterprise are the rapid rate of change in networking software and service paradigms and infrastructures, and the continuing growth in the need for services provided by community-based nonprofits. Even though these groups are often staffed by volunteers who themselves are not impoverished, the groups are quite stressed with respect to resources of every kind. Specifically, the groups do not have budget flexibility with respect to information technology, and they often lack volunteers who either can help with information technology needs, or who wish to spend their volunteer effort working on IT. This latter issue goes to the fundamental motivations people have for volunteering; people join Habitat for Humanity to help build housing for families, not to maintain databases.

The unique character of community informatics causes participatory design to manifest distinctively. Participatory design in informatics has often been a struggle of *inclusion*. Design meetings always are part of the process; users simply were not invited, or they were invited but not included as serious stakeholders. In contrast, the struggle for community informatics is more about *self-actualisation* (Maslow, 1943) of the community and its members; that is, a sustainable and continuing process of collective human development. The people who have been ignoring the information technology needs of community organisations are the *members themselves*. This happens because an overall lack of resources, and a specific lack of technology planning, makes it difficult to do anything else, and because the volunteers who comprise the majority of the groups' members are frequently not in the least interested in information technology. Nevertheless, the remedy, we argue, is the same: Community groups need to have more control of their own information

technology because the technology represents their group to the larger community, because it shapes what the group can accomplish within the larger community, and because they actually do know a lot about what they need and are able to participate effectively in designing it.

3 *Participatory design in community informatics*

Community informatics is a particularly appropriate domain for participatory design from both the moral and pragmatic perspective. If people have the right to participate in the design of technological artefacts and systems that affect their activities and experiences, then they clearly have that right with respect to community informatics, because they *are* the recipients of the technology. The community's technology infrastructure and associated activities have a direct effect on a citizen's everyday lived experience.

The Blacksburg Electronic Village (BEV) project illustrates how a community must take control of its community information technology structure (Carroll, 2005). The BEV project began in the early 1990s as a partnership among a university (Virginia Tech), a regional telecommunications company (Bell Atlantic), and the Blacksburg town government. However, as the community network evolved, community members and organisations became direct stakeholders in the project through inhabitation: they built web sites and experimented with innovative web-based interaction (Carroll and Rosson, 1996). The university-led partnership facilitated this with community outreach and training sessions; the town sponsored mini-grants to help local businesses and nonprofits take their first steps towards having a web presence. But eventually the university and telephone companied dropped out and the network was owned and controlled by the community. This organic process of colonising a community network is an example of what Dourish (2003) described as the *appropriation* of new information technology: People reshape technology-in-use to accommodate their practices and values, and in doing so, they increasingly come to feel ownership of the technology.

Beyond the moral requirement for direct participation, the complex requirements of community computing reinforce a pragmatic argument for participatory methods (Carroll and Rosson, 2001, 2003). The user population is diverse, ranging from young children playing educational games at a museum to elderly shut-in citizens sending email to loved ones. This makes it very difficult for outsiders to anticipate the needs of the target users. The technical infrastructure for community computing is also diverse and difficult to assess without direct involvement of households, community buildings and other loci for community interaction. When task-oriented activities are involved (e.g., organising for a blood drive), it is often difficult to predict just who will show up and for how long, what expertise will be present, and what tasks will even be possible at all. Often the same individual plays multiple roles across the community (e.g., a mother is also manager of a bank, a member

of a church, an officer in the historical society), and may even leverage interactions across these groups in subtle but important ways. Finally, because community groups rely on volunteer effort and intrinsic motivation, the supporting technology must be as cost-free as possible — so that individuals can get on with their real goals of helping one another.

From the pragmatic perspective, an important contrast between workplace and community informatics is the absence of 'us' and 'them'. No one is 'boss' in a community; most initiative flows bottom-up. Success and failure in community informatics initiatives typically depend on individual initiative-taking. Yet the consequences are more immediately tangible than business plans and stock trajectories. The community experiences technology initiative outcomes directly through the needs of its constituents. In this paradigm, a successful outcome is akin to self-actualisation — the community either inhabits, owns and controls its technology or it fails to. But if it fails, there is no manager to redress the failure; instead the community simply exists at a lower level of collective human development.

3.1 Civic Nexus: a community informatics initiative

Civic Nexus is a participatory design project focused on community informatics initiatives in Centre County, a rural county in central Pennsylvania that is also home to The Pennsylvania State University. In this project we engage with community groups in one-year partnerships aimed at developing the groups' capacity to analyse, plan for, and meet their own IT requirements (see also McPhail et al., 1998; Trigg, 2000). To this point we have partnered with a diverse set of 11 community organisations, including civic and social services, culture and education, and emergency planning (Table 1). A key aspect of the research project has been to explore techniques that can help nonprofit organisations develop a self-sustaining informal learning process that can address their continuing needs for IT. Thus while the individual partnerships have each had specific goals, each has also served as a testbed for activities that can prompt and sustain technology learning by the organisation and its members.

Civic Nexus projects begin with an analysis phase during which we observe and interview group members to create a shared understanding of their goals, vision, and current practices, especially with respect to the use of technology. Each year the partners also participate in a regional IT workshop (Central Pennsylvania Community Information Technology Workshop) that includes demonstrations and discussions of community technology projects (often these have been shared by one set of partners with one another as well as potential future partners; Carroll et al., 2007). The preliminary analyses, workshops, and other *ad hoc* discussions between the groups and the research teams support a process of brainstorming about technology project ideas; these ideas

Table 1 Civic Nexus partnerships and activities with community groups

Community Group	Focus of Collaborative Activities
Historical Society	Analysis and specification of current and possible future online tools for education and outreach
Learning Enrichment Center	High school students developed, delivered, and evaluated an online course
Spring Creek Watershed	Took control of web site development, redesigned site
Centre Connect	Organised and delivered web design training
Food Bank	Reconstruction of web site and database maintenance
Habitat for Humanity	Redesign of web site and associated maintenance
Leadership Centre County	Improvement of web site and of expertise database
Seven Mountains EMS	Online equipment forms and distributed EMS training
Mt. Nittany Symphony	Updating database software and data migration
Youth Services Bureau	Refined hardware/software acquisition and maintenance
Penns Valley Conservation Society	Web site development and training in web development

are discussed, refined, and used as a basis for our shared work over the rest of the year.

Each Civic Nexus project is documented with extensive field notes, and we present our research findings through case study analysis (Yin, 2003). For example, our case study of the Spring Creek Watershed web site project analysed the learning process as a form of cognitive apprenticeship (Farooq et al., 2006); our study of the Historical Society highlighted the challenge of finding the 'right' project that matches the perceived needs and vision of multiple stakeholders in an organisation (Merkel et al., 2004). More recently we have begun to develop more synthetic analyses, for example drawing inferences about design patterns for community informatics (Carroll and Farooq, 2005), and providing general methodological advice for engaging and promoting IT learning in community organisations (Merkel et al., 2007). In this paper, we focus on the general dynamics of the participatory design process.

Our discussion of participatory design is organised by the themes summarised in the central area Figure 1; these themes capture high-level requirements for an effective and sustainable community informatics initiative. The arrows to either side of the themes represent the inherent tension between the general scarcity of resources (people, time, funding) on the one hand, and the importance of direct participation in the community projects on the other. How can a community afford to analyse, build, and maintain IT projects when they do not possess the necessary resources and infrastructure? In Civic Nexus, by conceptualising and investigating participatory design as a vehicle for initiating informal IT learning processes, we were able to help community groups contribute directly to meeting their IT needs, while at the same time growing the infrastructure necessary for managing and addressing these needs in the future.

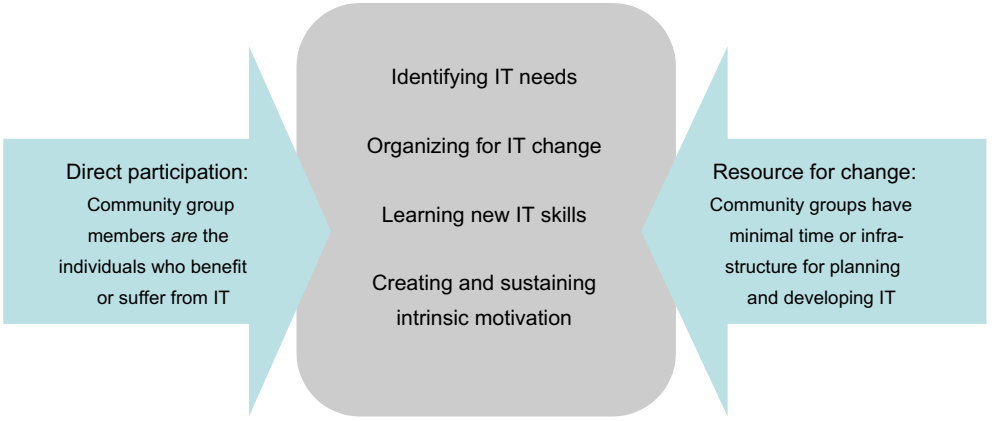

Figure 1 Participatory design activities that have helped community groups improve their IT resources and infrastructure for technology while meeting specific needs

In the balance of the paper, we illustrate in more detail the participatory design techniques we used to help our Civic Nexus partners *work with* the challenges that might have derailed their projects. In Section 4, we describe how community groups achieve a higher level of understanding about their organisation's IT needs by engaging in a reflective analysis of technology status and practices. In Section 5, we describe how such an understanding helps in motivating and organising a change process that takes analysis and planning of IT projects as an explicit organisational goal (i.e., along with their 'normal' missions of food delivery, cultural events, environmental advocacy, etc.). In Section 6, we describe how the opportunities for learning and practice of relevant IT skills become more apparent once an organisation includes IT strategy as an explicit part of its planning process. In Section 7, we describe how a community group can sustain this learning process by providing new sources of intrinsic motivation to its members.

4 *Identifying IT needs*

Community organisations vary along many dimensions: goals, size, structure, leadership, knowledge, financial and other physical resources, visibility within the community, and so on. Thus it is impossible to develop a generic solution for their IT needs; each case is different and requires its own analysis process. When an external agent makes this analysis, important pieces of the organisational context may be missed. For instance one of our partners worked through a difficult episode with a web designer who had created a modern and attractive web site for the group; in the process he had also taken responsibility for the organisation's web information content. Unfortunately the designer had misconstrued the group's mission, leading to considerable discontent within the group about their web identity. We helped the group to articulate the source of their frustration and to commit to taking over control of their web site's design and content.

Often organisational factors play an important role in IT needs analysis. For example, in one partnership we spent months meeting with stakeholders to discuss current uses and ideas for technology, in search of a shared project. Eventually we recognised an underlying tension between the group's director, who was focused on the group's community mission and saw our involvement as a resource for that, and the staff member working on IT issues, who saw her involvement as a chance to grow her own skills and level of technology contribution within the group. A similar case arose in a group hoping to update their information architecture; the group was stymied to some extent by a director who held decision power over IT initiatives but who saw her own responsibilities as relating primarily to publicity and fund-raising. In both of these cases, our discussions with the groups helped to articulate these socio-organisational aspects of their current situation, aspects that were just as (or more) important as technical requirements.

Starting with our second year projects, we carried out systematic participatory needs analyses. In addition to observing and interviewing stakeholders about their use of IT, we carried out (with them) a technology assessment. In this process we documented current technology resources, practices, and concerns as well as possibilities for future enhancements (Merkel et al., 2007). The report resulting from each assessment was posted on a wiki-style web page that enabled distributed review and commenting by our partners, as well as sharing during our face-to-face project meetings. The process of developing and reviewing the report often provided the impetus for further change. For instance in one case, the report identified a group's reliance on ad hoc volunteer efforts by a board member skilled in IT; after recognising this pattern, the board decided to procure the services of a technology consultant to analyse IT needs on a broader basis.

Another technique that has emerged from our projects is the sharing of reflections *across* community organisations. Early in the project we began a series of workshops that brought potential partners together to explore technologies and discuss requirements. As the projects evolved, these workshops also evolved to include more content from current or previous partners, including their comments and assessments of their own computing contexts. Over time the workshops began to take on their own identity as a community event and have become an ongoing project of a steering committee with rotating membership (the Central Pennsylvania Community Information Technology Workshops). One consequence of these workshops is that the community as a whole has begun to participate in a technology assessment process, working with us to survey community-wide information about technology practices and challenges for local nonprofit organisations, and sharing and discussing the results of the survey at a community information technology workshop (Carroll et al., 2007).

Elsewhere we have suggested the metaphor of a 'bard' to characterise the role we think is appropriate and effective in these participatory analysis activities (Carroll and Rosson, 2006). In medieval courts, the bards' role was to summarise and celebrate, and sometimes to critique, the community to itself through ballads about the community's shared exploits, folkways and mores, as well as to present visions and goals for the future. Bards were not principal actors in the community, like knights, chancellors, or bishops, not even blacksmiths, tailors or farmers. In an analogous fashion, our efforts towards participatory analysis helped groups to understand their own needs, at both a technical and socio-organisational level.

5 *Organising for IT change*

A recurring theme in our Civic Nexus projects has been the crucial role of social and organisational factors in achieving new objectives for IT support. We observed that community groups often rely on one-shot injections of 'IT solutions' that come from an outside source and thus are difficult to understand and evolve as requirements change. A good example comes from the Historical Society, a nonprofit organisation that often hosts technology interns from the university, who come in to develop a specific solution for a specific need (e.g., a history game on the web for children). But because such projects are not planned or coordinated in an overall fashion, they quickly become brittle and difficult to maintain or integrate with other technology projects.

Earlier we described an environmental group who decided to regain control of their web site development and maintenance process. The first step in doing this was to form a web site technology committee that was able take on the current problems with the web site as an action item. This committee formulated an appropriate set of communications with the web developer that allowed them to disentangle themselves and retrieve their web content. Once they had made this structural change, they were able to take on the more extended process of learning about web development and implementing a new web site design.

In another case our technology assessment activities had documented the importance of an external consultant who was hired on occasion for trouble-shooting of a database that was a key IT asset in their organisation. This element of the group's IT infrastructure had been in place for some time but was managed on an informal as-needed basis. One consequence of the technology assessment was that the group became more aware of the consultant's role in their IT-related activities; this led to the goal of better leveraging this infrequent but valuable resource. For example, in preparation for an upcoming meeting with the consultant, a staff member conducted a detailed preliminary analysis of the database (in contrast to just sketching a set of general notes and questions). Later on, the group's enhanced appreciation of the consultant's contributions became a rationale for attending more explicitly to

IT issues in the group's annual budget-planning process. Ultimately, the organisation decided to create a technology steering committee to oversee interactions with the consultant and other aspects of its ongoing IT infrastructure.

Discussion of organisational issues in community informatics has also begun to appear in community-wide forums. In the same survey that profiled local nonprofits' technology practices, we asked groups about their technology planning strategies (e.g., to what extent technology is part of their strategic plan, whether technology is a line item in their budget). Only about half of the 55 responding organisations reported having a technology plan in place. Thus, in a recent Community Information Technology Workshop, issues related to planning and managing technology initiatives became a theme, with several organisations sharing their own experiences as a model for others. As a side effect of the community workshop planning process, a steering committee was formed; these individuals are taking the lead in planning for resources and IT infrastructure that could be shared across community groups (e.g., a content management system that could both simplify and integrate across related efforts).

6 *Learning new IT skills*

A serious resource challenge for community groups is access to the expertise needed to address IT concerns. In our Civic Nexus projects we have observed many approaches to addressing this challenge, some more successful than others. For instance one group relies significantly on student intern projects that are focused on making a well-specified change; this solves an immediate problem but is difficult to sustain. Other groups have developed implicit organisation-based strategies, for instance recruiting a permanent board member who provides expertise or contacts as needed to other experts in the community. However, in many cases the group must find a volunteer or staff member to take on at least a supervisory role in IT maintenance and enhancement.

For nonprofit groups that are large enough to already have IT-specific resources, the problem in acquiring new skills is often a lack of the release time or training resources that would typically be available in a commercial setting. For instance we worked with an organisation whose mission was to provide services to at-risk youth in our community. They were large enough and had enough funding to have a few paid staff members, and one of these was responsible for supporting the IT infrastructure (an extensive network of workstations used to manage the large number of cases in their portfolio). This staff member had a high-level concern about the security and consistency of the software installed across these networked machines, but the task of investigating the status of each machine was overwhelming in the face of other day-to-day responsibilities. Our team was able to point him to free software that could be configured to carry out a semi-automated status check, enabling a more frequent and accurate picture of this specific aspect of the IT

infrastructure he maintained. This individual was willing to acquire a new skill but needed support to make what seemed to him a big step from the status quo. Because our help in this process included working with the staff member to evaluate, select, install, and configure the package, the organisational learning was not specific to the problem of status checking, but also included the broader problem of finding, evaluating, and installing open source software.

Many technology needs in community informatics fall in the general area of web development, an IT need that is increasingly open to shared construction in a group. With several Civic Nexus partners, we have explored the use of high-level authoring tools that would enable them to work together on their group's web site. In one project we introduced these tools (featuring a wiki-style editor for web pages), and the group members responded very positively, feeling empowered almost immediately by being able to contribute to shared content in a distributed fashion. Interestingly, in this same project, a parallel effort (by a student volunteer) developed sample web pages with an alternative set of tools. The subsequent group discussion and decision making about tool alternatives (which we facilitated but did not direct) provoked an even deeper level of technology learning: Rather than simply learning to 'use' one tool, the group developed strategies for determining how to 'choose' among tools. The evidence of learning was clear, in that the conversation among group members expanded to include not just discussion of what should be on their web site, but now also what made sense as an IT infrastructure for creating and sustaining it.

Like in participatory analysis and planning, it is important to recognise that technology learning is not always about learning to use *software*. An important technique that we introduced into some of the Civic Nexus projects was user interaction design *scenarios*, simple textual narratives that explore the experiences of one or more stakeholders as they pursue a goal with envisioned technology (Carroll, 2000; Rosson and Carroll, 2002). In one case, we encouraged a group leader to write a scenario addressing the experiences of different community stakeholders as they visited the group's (to be designed) web site. During this process, she identified a class of web site users that is important to the mission of the group but that had been implicit in their discussions up to that point (Farooq et al., 2007). By sharing this scenario with her team, this group leader persuaded them that the views of this stakeholder group needed to be analysed and considered in their design. In this instance, the IT learning consisted of user-centred design concepts and techniques that had direct implications for shared web site development.

As part of the Community Information Technology Workshops, we have encouraged members of community organisations to provide the 'training sessions' for other organisations (i.e., rather than members of our research team taking on the more typical role of the 'sage on the stage'). This helps to present the new concepts and skills in the meaningful context of sister

groups who are facing many of the same resource challenges, which makes them more believable and accessible to groups just beginning to consider a new IT project. It also establishes and reinforces the social networks within the community that will be a critical support factor in the longer-term sustainability of IT learning and enhancement. For example, one promising outcome of a recent community technology workshop is the emergence of a roundtable group that has begun to discuss how best to share resources, knowledge, and training across community groups.

7 *Creating and sustaining intrinsic motivation*

The model we have observed and facilitated in our Civic Nexus project involves enabling greater community participation in articulating requirements for information technology, in establishing planning and management processes and institutions, and in putting community members directly in control of the means to design, develop and deploy information technology solutions. These initiatives entail significant consequences for how individual community groups and civic sector more generally conceives of information technology. Specifically, our model alters how community members think about what it takes to be an effective community group with respect to information technology, how community groups identify and access local resource networks, and how these community groups articulate roles.

A pervasive concern in the Civic Nexus projects has been the sustainability of the learning that takes place (Merkel et al., 2005). To some extent, individuals may volunteer and continue to participate in IT activities simply because they enjoy working on IT problems. Indeed most nonprofit groups depend greatly on intrinsic motivation because most group members are never paid. For these people, simply providing the opportunity, and in some sense an organisational 'blessing' to focus on technology changes may be enough. One of the members of our local symphony organisation is an IT expert who maintained the group's donor database for many years, simply because he enjoyed the responsibility and control associated with management of this key information asset. However, the intrinsic motivation of one individual may not always be enough, if the organisation does not value their interest an efforts – in another group, we interacted early on with a very motivated staff member, but her initiative was not reinforced by the group's leadership and was not enough to drive IT change on its own.

Particularly challenging cases arise when there is no volunteer with intrinsic motivation to learn about and supervise IT planning and management. In these cases, the trade-off between the cost of working on IT projects and the benefits of having the project(s) completed become more central. Offering community organisations tools or techniques that significantly reduce the cost of 'doing' IT may reduce the perceived cost of IT projects (e.g., wiki-style tools for end user authoring). At the same time providing low-cost techniques

like scenarios for analysis and envisionment can help to experience (in advance) the potential benefits of achieving the potential IT enhancements.

More generally, when an organisation revises its strategic planning to include technology issues, it changes group members' cost–benefit analysis for enhancing or maintaining IT skills. Earlier we cited a case in which a group moved from relatively ad hoc and informal relationship with a consultant to a technology steering committee that had a line-item budget for IT planning. Although we did not directly measure the motivational consequences of these organisational changes, we speculate that the increased attention to IT resources and planning increased the felt reward for the staff member and volunteers participating in IT support.

Finally, as the critical mass of community organisations engaged in technology assessment, planning, and innovation increases, the social and community-building rewards of leading others in IT change will increase. The groups that have shared their technology project experiences at the Community Information Technology Workshops have enjoyed the recognition among other community groups and in general have enhanced their community 'reputations' as innovators. As the network of nonprofit organisations working together on these community informatics initiatives continues to expand, the distributed group-specific efforts can be seen as coming together as part of a learning community, where the dynamics of mentoring, personal development, and leadership become important sources of reward.

Early in our project, we observed that many community groups were managing their information technology needs by applying to government and quasi-government grant programmes. When they were able to win a grant, they upgraded, or more accurately, they partially caught up with the state of the art. We were struck by how this strategy sometimes led to halting progress that was resource-driven more than needs-driven. We wondered how groups could ever be inclined to work together when they were in effect cast as competitors for the very limited amount of such technology funding.

We see a very different picture now. Once members and groups understand the value of their own knowledge with respect to planning and articulating information technology requirements and designs, and even with respect developing and managing implementations of those designs, they become less intimidated by information technology, and more able to act. Through the Civic Nexus projects and the Central Pennsylvania Community Information Technology Workshop series, our partners came to understand information technology more broadly as an intrinsic part of operating an organisation, and as a routine category of contribution for members. They perceive fellow community members and peer organisations as part of a resource network that can provide expertise and material to help them plan and develop their

own information technology. Surprisingly, this seems to be much more fundamentally a motivational issue than a vocational issue; more a matter of how people see themselves, and understand their own capabilities and scope of action, than it is a matter of being able to write a programme or run wires. In other words, our partners have not, for the most part become better programmers or engineers, instead they have become more competent and confident information technology planners and designers.

Our view is that these developments are essential to the sustainability of our model. No community group could manage its own use of paper and pencil, of the telephone, or of management principles by opportunistically waiting for interns, grants, or other assistance. Information technology is just as critical to contemporary organisations as those earlier technologies, but it is far more complex, and continuously evolving.

8 *Summary and conclusions*

It has become a commonplace of contemporary culture to remark that information technology changes everything. Yet often this is said in the same way that one might observe that the weather changes everything. The difference is that people design information technology, and while designers may not have the level of control they aspire to, we are at least able to articulate and strive towards ambitious goals with respect to how technology affects human activity and experience. Participatory design has become a key tool in enabling such ambitious goals: The 'users' — that is, the people who stand to have their activity and experience transformed — ought to have a direct say and a meaningful role in how that comes to pass at the very least because they know a lot about what is precious and what is annoying in their current activity and experience, but equally because they are morally entitled to have a say in anything that might change everything.

Community informatics is an important context for participatory design in informatics because it facilitates or undermines the way all of us live together. Our work in this domain during the past 13 years has convinced us that collective actualisation with respect to information technology is possible and necessary. IT has always been more cumbersome and arcane than anyone would have wanted, and probably more so than it ever had to be. But people create IT and people can master it. The challenge of participatory design in contemporary community informatics is chiefly one of creating a self-directed and sustainable process of continuous learning. Our case studies suggest models for how the members and leaders of community-based nonprofits can exert greater control, for example, by explicitly planning and managing their (limited) IT resources and by making use of lightweight tools like scenario descriptions of actions and reactions with respect to information technology.

In the immediate future, we want to develop a second Civic Nexus project in a different community to verify and elaborate our observations and approaches.

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