The Proceedings of the 7th Annual International Conference on Digital Government Research

San Diego, California

U.S.A.

May 21-24, 2006
Developing a Youth-Services Information System for City and County Government: Experiments in User-Designer Collaboration

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ABSTRACT

Research on user participation in computer applications, including digital-government applications, emphasizes the need to engage users as collaborators or partners in software-design processes. The Connected Kids youth-services information system for city and county government is a product of ongoing experiments in user-designer-programmer collaboration in the development of system specifications and prototypes and a functional working model, still in process of modification in response to user needs and creative user-designer-programmer innovations.

Categories and Subject Descriptors
J.4. [Computer Applications]: Social and Behavioral Sciences – Communication

General Terms
Design, Theory, Experimentation

Keywords

1. INTRODUCTION

The development of a youth-services information system for city and county government illustrates the potential for creative collaborations by users, designers, and programmers through exchanges of information and perspectives about information-technology resources and potentials, on the one hand, and user needs and creative on-site innovations, on the other. Research on user-centered design and user-developer co-design emphasizes the need for user engagement in design processes extending from the development of system specifications, prototypes, and working models to the incorporation of user innovations during and after implementation of information systems and other information-technology applications.

This research originated in Scandinavia [2, 3, 6] and has been adopted in the United States as a set of principles and practices various described as contextual [1], cooperative [2, 3, 6], participatory [9], and user-centered design [8] and as co-design between users and developers [10]. More recently, research on the development of information-technology applications for digital government has acknowledged the important role of users, who enact information technologies as they interpret, implement, and use these technologies in the context of their own organizations [5]. These movements foregrounding the role of users in the design and implementation of information technologies are supported by technical developments that permit and encourage user modifications of system components and functions.

The Connected Kids Project (http://www.connectedkids.info/, November 25, 2005) is a youth-services information system for Troy and Rensselaer County, New York, currently active but still in the process of development [7, 11]. As a digital-government application for local governments and local youth-services organizations, Connected Kids has a unique opportunity to observe experiments in the various interactions and modes of cooperation between and among participants throughout the development and implementation of an information system. At the level of local government, organizational users, designers, and programmers interact regularly, with the consequence that new developments in software technology, such as APIs (Application Program Interfaces), mix and merge with end-user innovations in processes that are mutually reinforcing and enriching.

In this report, we review some of the research on user-centered design and user-developer co-design and present an overview of the Connected Kids Project, an account of its development, and a description of some recent experiments in what we call user-designer-programmer collaboration, to emphasize the balance of interests and expertise across the spectrum of development activities that engage organizational users, interface designers, and computer programmers.

2. FROM USER-CENTERED DESIGN TO USER-DESIGNER COLLABORATION

Research on the design and use of computer applications shows a shift from user-centered design to user-designer collaboration, extending throughout the development and implementation cycles and including innovations introduced in the context of use [1-3, 6, 8-10]. These shifting perspectives blur the distinction between users, designers, and programmers, as system users become designer-programmers and designer-programmers become system users.
2.1 User-Centered Design
Researchers have brought a variety of user-centered or user-oriented approaches and methods to the design of computer applications, encompassing the full range of design activities, from the development of concepts and specifications to the development of models and prototypes through testing, implementation, and use and application of end products [1-3, 6, 8-10]. Early work originating in Scandinavia promoted an ideal of “cooperative development”—full participation by both developers and users” on the basis of cost-benefit advantages, enhanced democracy in workplace practices, and, not least, improved product quality [2, pp. 157-58; 3, pp. 130-31; 6, pp. 79-80].

Extending and generalizing this early work, Beyer and Holtzblatt propose methods of contextual inquiry and design by which developers engage end users in collaborative partnerships for the purpose of exploring and modeling workplace practices, developing representations of customer populations, creating innovative designs, and refining designs through a process of iterative prototyping [1]. In contextual inquiry and design, users are “partners,” “collaborators,” and “co-designers” in the design process [1, pp. 37, 51-56, 371-77, 397-98]. Johnson presents a similarly “user-centered” view of the design of computer documentation [8, pp. 12-16]. As distinguished from traditional system-centered and user-friendly views, Johnson’s user-centered view of computer documentation takes into account the localized context of users’ activities, their choice of media and activities (doing, learning, or producing), and the social interactions and negotiations by which these contexts, media, and activities are incorporated into documentation products [8, pp. 122-36].

2.2 User-Developer Co-Design
More recent research extends and transforms the concept of user-centered design into a concept of user-developer co-design that recognizes the reciprocities between users and designer-programmers in design activities [10]. Spinuzzi maintains that traditional approaches to user-centered design are based upon a user-as-victim, designer-as-hero trope, according to which users are victims waiting to be rescued by skilled designers [10, p. 4].

As an alternative to these traditional approaches, Spinuzzi offers a concept of co-design that recognizes the contributions of both devious and wily users and skillful designers: “Trained designers can avoid common pitfalls of workers’ homegrown solutions, which tend to be of the chewing-gum-and-bailing-wire variety. Workers produce solutions that are devious, wily, and cunning, but often these solutions do not involve a deep understanding of the system . . . . Workers produce solutions that work—but often they do not produce solutions that work well by their own criteria, and often those solutions are not promulgated so that other workers can take advantage of them” [10, pp. 19-20]. Given the potentially creative and innovative contributions of users, Spinuzzi advocates a “decentralized” approach to design that permits and encourages user modifications: “Trained information designers can contribute much to the emergent innovations of workers, not by replacing those innovations with centralized solutions, but by helping to design systems that workers can modify” [10, pp. 4-5, 222-23].

Spinuzzi’s view of user-developer co-design is partially realized in new and emerging software technologies that encourage adaptations and modifications by both skilled developers and end users. One example of such a technology is the Google Web APIs service, which permits skilled software developers to “query billions of web pages directly from their own computer programs” in their favorite development environments, such as Java, Perl, or Visual Studio [http://www.google.com/apis/, November 25, 2005]. Another example is the EUSES (End Users Shaping Effective Software) Consortium (http://eusesconsortium.org/, November 25, 2005), a collective of universities organized to effect a fundamental paradigm shift in software technology by exploring the feasibility of bringing the benefits of rigorous software engineering methodologies to end users (About EUSES, November 25, 2005). These emerging software technologies parallel the more modest innovations of ordinary users but promise, in the long term, to support and encourage these innovations as the technologies become more flexible and adaptable and as increasing numbers of users become more technically skilled programmers. In relatively small-scale projects, in which users and developers regularly interact, these emerging software technologies and user innovations mutually enrich and support each other.

2.3 Digital-Government Applications and User-Designer-Programmer Collaboration
Research in digital-government applications reflects these trends and tendencies in user-centered design and user-developer co-design. Traditional digital-government research has emphasized the need to deploy information technology to deliver information more efficiently: “Stimulated in large part by widespread adoption of the Internet and the associated phenomenon of electronic commerce, a broad consensus has emerged in the past several years that government at all levels can exploit IT to deliver information and services more efficiently and to make improvements in other functional areas” [4, pp. 29-30]. These functional areas include satisfying customer-service expectations, increasing the efficiency and effectiveness of government operations, providing effective online access to information and transactions, and increasing participation in government, among others [4, p. 30].

Fountain, however, recognizes that information technology does not stand in a simple linear relationship to its users [5]. Rather, information technology is enacted by its users in the context of use: “Individuals and organizations enact information technology by their interpretation, design, implementation, and use of it in their organizations and networks.” [5, p. 89]. These “enacted information technologies” differ from and may represent only a limited subset of the capabilities offered by objective technologies—the Internet, hardware, software, etc. [5, p. 98]. Nonetheless, the outcomes of enacted technologies are “multiple, unpredictable, and indeterminate” [5, p. 98]. We imagine, therefore, that these enacted technologies have the potential to supplement, modify, or refine the objective characteristics of existing information systems. At the local level, this process of user enactment can be especially rich and complicated since local governments are more likely to have direct and frequent interactions with users than their counterparts at the federal and state levels. In the rest of this report, we illustrate this process of user enactment, taking the term user in the broad and complex sense that encompasses users, designers, and programmers in their shifting and varying contexts and functional roles and characterizing their relationship as a user-designer-programmer collaboration.
3. THE CONNECTED KIDS PROJECT
The Connected Kids Project is currently serving city and county governments, youth-services organizations, public and private schools, and families and children in Troy and Rensselaer County, New York. The Connected Kids information system includes a database of youth-services information with sophisticated search capabilities, a distributed data-input function, and separate interfaces for parents, teens, and kids—all accessible via the World Wide Web (Figure 1, Connected Kids Home Page); galleries of children’s artwork and photos (Figure 2, Connected Kids Galleries)—also accessible via the WWW; and a distribution system that extends the information system and galleries to low-income families at the Troy Housing Authority.

Figure 1. Connected Kids Home Page
The Connected Kids Home Page shows the points of entry for parents, teens, kids, and youth-services organizations and for the galleries and general-information pages. The parents, teens, and kids pages permit searching by key word or browsing by activity category, sponsoring organization, age, gender, time frame, or calendar date. The organization pages provide for registration, creation of an organization profile, data entry for organizational activities, image editing and storage, and the creation of a set of customized web pages. The organization pages offer an easy-to-use interface, with simple fill-in-the-blanks and copy-and-paste operations.

Figure 2. Connected Kids Galleries
The Connected Kids Galleries include galleries of children’s artwork and photos and a separate section with information about local art and history. The children’s artwork and photos are presented in a variety of formats, including user-operated slide shows with images from a number of youth-services organizations, with the requisite permissions, including signed Connected Kids permission forms for all photographs of children.

The Connected Kids distribution system includes computer and networking installations at six sites at the Troy Housing Authority, four with Linux setups and two with Windows setups. Four of the sites, including one for senior citizens, currently have Internet connections. In addition, the distribution system includes instructional support and periodic help and troubleshooting.

4. DEVELOPMENT OF THE CONNECTED KIDS INFORMATION SYSTEM
The early development of the Connected Kids information system engaged more or less standard approaches and methods described in the research on cooperative and participatory design: focus groups to develop system specifications, participatory-design and user-testing sessions to assess system prototypes, training sessions, and standard evaluation procedures [7, 11]. In our initial focus groups to develop system specifications, we presented mock-ups showing possible functionalities and uses of the system [7, 11, pp. 361-62]. In response, organizational users expressed concerns about what seemed to them to be an overemphasis upon listings of calendar events as opposed to descriptions of organizational programs and services, problems of duplicate data entry for both large and small organizations, the lack of a web presence for many small organizations, and the need to engage parents and children in the development of system specifications [7, 11, p. 362]. We developed a paper-based model of the system and a working system prototype on the basis of these responses and then conducted participatory-design and user-testing sessions to test and further refine the system specifications [7, 11, pp. 362-63]. During the participatory-design sessions, organizational users reconfirmed their original responses, described how the system would function in their organizations, and identified a variety of user needs, including the need to serve a growing Spanish-speaking population, to provide legal services, to support neighborhood activism, to ensure system security, and to engage parents and children in the design process [7, 11, pp. 362-63]. We have been able to address some but not all of these needs.

As an immediate priority, we conducted another series of focus groups with parents and children to further refine system specifications and to develop specifications for the WWW interface [11, pp. 364-66]. Because we suspected that relatively inexperienced computer users might have difficulty grasping the functions of a WWW-based information system, we presented working illustrations of search and browse operations for parents and dynamic WWW interfaces for children, selected by the children themselves. We did not ask parents and children to describe or explain possible system functions but instead asked parents to describe how they find activities for their children and for themselves and asked children to describe the kinds of web resources they use and enjoy [11, p. 359]. In response, both parents and children offered descriptive scenarios rather than explanations of how an information system might function [11, pp. 364-66]. Parents, for example, described challenges ranging from finding suitable activities for their children to keeping them productively occupied to sharing information about the quality of
available activities [11, pp. 364-66]. Children, not surprisingly, emphasized the need to develop a dynamic and visually attractive and engaging interface. On the basis of these responses, we developed the WWW interface and galleries shown in Figures 1 and 2. We are currently evaluating both the system and the interface, including the galleries, and developing further enhancements, including a new map interface, on the basis of these evaluations.

5. EXPERIMENTS IN USER-DESIGNER-PROGRAMMER COLLABORATION

These more recent developments reflect the underlying principle of co-design or what we call user-designer-programmer collaboration since they are based upon ongoing interactions between users—primarily organizational users—designers, and programmers. These developments include new data-entry and display functions, new search functions and the map interface, and new gallery and help functions.

5.1 Data-Entry and Display Functions

The development of the data-entry and display functions is based in part upon the innovations of organizational users and the efforts of designer-programmers to build these innovations into the system. These innovations are the “homegrown” or “chewing-gum-and-bailing-wire” solutions to organizational problems and needs that designers need to stabilize and thus make accessible to other users [10, p. 19].

Most of the Connected Kids organizational users are comfortable with computer technology, and some have limited programming or basic coding experience (e.g., html or xhtml). One of these organizational users—unexpectedly but almost immediately upon implementation of the system—bypassed the system’s image editing and storage function and wrote a small piece of code that pointed to a logo on the organization’s own server and thus inserted it into the descriptive field for one of the organization’s activities (Figure 3, Activities Display Page with Organizational Logo). Other users expressed interest in similarly inserting logos for their organizations, and one user inserted a very large graphical image, straining system capacity and display functions.

Figure 3. Activities Display Page with Organizational Logo

In response to these developments, we placed limits on image size and implemented a resize feature in the image-editing function. In addition, we recognized the utility of inserting html code into the activities descriptive fields and took advantage of this utility on other occasions. We recalled that organizational users had expressed concern about the potential problem of duplicate data entry, and we noted the difficulty of entering, or re-entering, large and complex documents, such as school or sports calendars, into the system. In one instance, therefore, we took advantage of the html utility to point to these documents, housed on a local server (Figure 4, Activities Data-Entry Field with HTML Code).

Figure 4. Activities Data-Entry Field with HTML Code

This “chewing-gum-and-bailing-wire” solution had very limited value, however, since it depended upon users’ ability to write html code (and only a few could write even simple code) and upon the availability of documents on local servers. We therefore built a document-upload function into our customized web pages, with the capability of converting standard MS Word documents into .pdf files (Figure 5, Customized Web Page). These pages, currently operational, include separate pages (under More About Us) for the organization profile, additional information (the uploaded documents), and staff and location listings.

Figure 5. Customized Web Page

The uploaded documents are accessible through each organization’s customized web pages and also its activity listings. For the Troy Housing Authority, the uploaded documents include housing application and survey forms, newsletters, and activity schedules, accessible electronically at the four sites with Internet connections and, eventually, at others, as the connections become available.

5.2 Search Functionality and Interface

The new search functions and map interface are designer-programmer innovations that draw upon recent developments in
software technology aimed at the creation of “decentralized” systems that user-designer-programmers can adapt to their own purposes and needs—such as the Google Web API technology and the EUSES Consortium projects described above [10, pp. 222-23]. We are using the Google Web API technology to develop our own application in the form of enhanced search capabilities via a map interface (Figure 6, Mockup of a Map Search Interface).

The Google Web API permits integration of the Google search capability with local applications, such as the Connected Kids information system. Recognizing the preferences of both parents and—especially—children for a dynamic and interactive search interface, we are working to enhance both the search capability and ease of use of the search interface. For our application, currently in beta, we are using the Google API as a search mechanism that permits users to search by triangulating kind of activity (what), location (where), and date and time (when) or by selecting an organization by name or by map location. To ensure ease of operation, we have created an interface to permit users to select one or more of the what, where, and when choices via simple point-and-click operations and display the specified results. We have also adapted the Google map interface to permit users to select an organization by name or map location and search for activities via the map. Using this map interface, the user can zoom in on a selected location, scroll the map in any direction to survey neighboring locations, or select About Us or Activities to go directly to the organization profile or activities pages to view the results.

To further extend and enhance the search capability, we are currently exploring the potential of the Google Web API to search the webs of organizations linked to the organization profile and activities pages and display the results along with the results for activities currently entered into the system. This functionality would extend the reach of the system, of course, but would also complement existing system capabilities since organizations could continue to enter documents through the customized web .pdf function but would not have to enter documents currently displayed via their own webs.

5.3 Gallery and Help Functions
In addition to the system search functions, other system enhancements are also possible via user-designer-programmer collaborations. For the Connected Kids Galleries, for example, we have engaged in a series of exchanges with organizational users to enhance the presentation of children’s artwork and photos. After a series of experiments, we settled upon a slideshow as the best method of displaying the images since it permitted the maximum of user control and manipulation of the images. To further enhance the image displays, we created a selection of colorful and attractive backgrounds for the slideshows. In the first iteration, we affixed the images to the background, with a consequent increase in load time and limited flexibility in the implementation of the displays. In the next and most recent iteration, we created separate layers for the image, background, and navigation components of the display, so that organizational users could create their own backgrounds for their images (Figure 6, Gallery Display with Layers).

For maximum control and flexibility for organizational users, we could, in principle, create an interactive interface that would permit users to enter their backgrounds and images for themselves. But such a development would require a considerable investment in technology, including the increased security required for the gallery displays.

For the Connected Kids distribution system, in addition to the computer reconstruction, networking, and maintenance, we have offered instructional and help and troubleshooting support. In one instance, as an experiment, we created a wiki as a collaborative mechanism to ensure maximum technical support on short notice (Figure 7, E-GroupWare Wiki Gmail Tutorial).

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In practice, the wiki permits us to respond to telephone or email requests for technical support and assistance by updating tutorials and other system helps remotely and posting updates within hours or even minutes upon receipt of a request. However, we have not yet taken the adventurous and perhaps risky step of permitting either senior citizens or children to contribute directly to the wiki, even though the technical capability is readily available.

6. CONCLUSION
Recent research on user-centered design and user-developer co-design, principles of user enactment of digital-government applications, and emerging software technologies such as APIs recognize and support user innovations and enactments of information-technology applications. The development of the Connected Kids information system illustrates the potential for user-designer-programmer collaborations in the context of local government, where the interactions between system users and developers are frequent and often creative. For our application, the results of these interactions impact virtually all aspects of the system, from the search functions to the search and gallery displays to even the most basic image display and help functions.

7. ACKNOWLEDGMENTS
This material is based upon work supported by the National Science Foundation under Grant No. 0091505. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation. Connected Kids is supported by the National Science Foundation, the 3Com Urban Challenge Program, the Rubin Community Fellows Program, Rensselaer’s School of Humanities and Social Sciences, and other organizations. We are grateful to Rensselaer graduate students Maureen Duffy, Sin-Hwa Kang, Stacy Newman, and Matthew Novak for assistance with the development of the Connected Kids interface and galleries and for discussions about the ideas in this report. We are grateful to the Lansingburgh Central School District, the Troy Boys & Girls Club, the Troy Housing Authority, and other organizational users for their creative innovations to the system.

8. REFERENCES