



Coordinating Community Cooperation: *Integrating Timebanks and Nonprofit Volunteering by Design*

John M. Carroll ^{1,*}, Patrick C. Shih ², Kyungsik Han ³, and Jessica Kropczynski ¹

¹ Pennsylvania State University, University Park, Pennsylvania, USA

² Indiana University, Bloomington, Indiana, USA

³ Pacific Northwest National Laboratory, Richland, Washington, USA

Timebanking and volunteering in local nonprofits are major extant paradigms for citizen cooperation, civic contribution, and community building. Both paradigms are currently growing rapidly worldwide. In this paper, we review and analyze key challenges in timebanking and nonprofit volunteering. We argue that both paradigms could benefit from an integrated information infrastructure for volunteering interactions. We validated and developed this design concept through a scenario probe study, and through discussions with timebanks and other nonprofit organizations. We illustrate our design and its rationale through a walkthrough of screen shot mock-ups. Finally, we identify and discuss design issues and future research steps.

Keywords – Community, Scenario-Based Design, Participation, Timebanks, Volunteering, Socio-Technical Infrastructures.

Relevance to Design Practice – This paper describes current challenges in managing volunteering in nonprofit organizations, arguing that a key opportunity is to design an integrated community information infrastructure for volunteering. The paper analyzes this opportunity, and presents a design scenario, supported by screen shot mock-ups, that can guide further design development and implementation of this concept.

Citation: Carroll, J. M., Shih, P. C., Han, K., & Kropczynski, J. (2016). Coordinating community cooperation: Integrating timebanks and nonprofit volunteering by design. *International Journal of Design*, 11(1), Xy-Yy.

Introduction:

Community and Human Development

Community is a key human institution for support and development. The issue of support is well known through the considerable literature of “lost community,” running from Tönnies to Putnam. The issue of human development is less highlighted perhaps; sustainable communities must plan and govern, solve problems and learn, develop and maintain infrastructures, and so forth. The context for this study is emerging information infrastructures at the community level. These have both enabled and challenged local paradigms for citizen cooperation and community building. Here we focus on impacts and new possibilities for volunteering in local nonprofits and for timebanking. Specifically, we re-envision design changes to timebanking software that would allow it to coordinate volunteering. We argue that this could benefit both timebanking and volunteering, and contribute to community information infrastructures.

Bowling Alone

During the long pre-modern period, human success depended upon sustaining small communities, Paleolithic bands, and then Neolithic villages. The recognition and analysis of community per se, starting with Tönnies (1988), has always emphasized the theme that community is threatened, deteriorating, and/or disappearing. A contemporary meme for this is Putnam’s (2000) haunting image of solitary modern Americans, largely disengaged from others, and bowling alone. For example, Putnam reported that between the 1960s and the 1990s, Red Cross volunteering

declined by 60%. An alternative view of community is that it has constantly changed, and may be changing faster today than it ever has. On this latter view, the challenge for community informatics is to identify, analyze, and design computational support for emerging community perspectives, possibilities, and paradigms.

Community Innovation

A defining function of community has always been to organize and mediate mutual support for members. One developmental trajectory through the modern period is that the nature of community support has narrowed. Thus, education, healthcare, and much employment are no longer primarily the responsibility of local communities; as Warren (1978) put it, these functions have become vertically integrated, and are now mediated by societal institutions, instead of by local community institutions. Many issues, however, are inherently place-based (placement and management of local utilities, buildings and other physical infrastructure, provision and receipt of personal services, emergency and disaster relief). In our recent work, in State College,

Received July 7, 2015; Accepted November 6, 2016; Published April 30, 2016.

Copyright: © 2016 Carroll, Shih, Han, and Kropczynski. Copyright for this article is retained by the authors, with first publication rights granted to the *International Journal of Design*. All journal content, except where otherwise noted, is licensed under a *Creative Commons Attribution-NonCommercial-NoDerivs 2.5 License*. By virtue of their appearance in this open-access journal, articles are free to use, with proper attribution, in educational and other non-commercial settings.

*Corresponding Author: jmcarroll@psu.edu

Pennsylvania, we have observed and described a community-wide initiative to articulate opportunities and strategies for innovation in social support (Carroll, Kropczynski, & Han, 2014).

Research Objectives and Methods

Timebanking is a service-based community currency, built on the principle that everyone's time is valued equally. We have established partnership with hOurworld (hOurWorld.org), one of the largest timebank groups in the U.S. with over 40,000 members in 600 timebank communities. As part of our work with hOurWorld, we have carried out interviews, survey studies, and design research on timebanks and other peer-to-peer exchange infrastructures (Bellotti et al., 2014, 2015; Carroll, 2013; Shih, Bellotti, Han, & Carroll, 2015), and invented mobile timebanking as a mechanism to facilitate micro-tasks (Han, Shih, Bellotti, & Carroll, 2015). In this paper, we explore the possibility of enhancing community infrastructure and services by proposing a framework that integrates mechanisms found in traditional community volunteering and timebanking that are complementary to overcoming challenges in the respective community efforts. Since it requires a significant sociotechnical investment to

John M. Carroll is a Distinguished Professor of Information Sciences and Technology at the Pennsylvania State University. His research is in methods and theory in human-computer interaction, particularly as applied to Internet tools for collaborative learning and problem solving, and design of interactive information systems. Recent books include *The Neighborhood in the Internet: Design Research Projects in Community Informatics* (Routledge, 2012), *Creativity and Rationale: Enhancing Human Experience by Design* (Springer, 2012), and *Innovative Practices in teaching Information Sciences and Technology* (Springer, 2014). He is editor of the Synthesis Lectures on Human-Centered Informatics. Carroll received the Rigo Award and the CHI Lifetime Achievement Award from ACM, the Silver Core Award from IFIP, the Goldsmith Award from IEEE. He is a fellow of AAAS, ACM, IEEE, the Human Factors and Ergonomics Society, and the Association for Psychological Science. In 2012, he received an honorary doctorate in engineering from Universidad Carlos III de Madrid.

Patrick C. Shih is an Assistant Professor of Informatics in the School of Informatics and Computing at Indiana University Bloomington. His current research interests include community informatics, healthcare informatics, virtual communities, and educational technologies. He was a Research Associate and Lecturer in the College of Information Sciences and Technology at The Pennsylvania State University in 2012-2015. He received the Ph.D. degree in Information and Computer Science from the University of California, Irvine in 2011, the M.S. degree in Information Networking from Carnegie Mellon University in 2005, and the B.S. degree in Computer Science and Engineering from the University of California, Los Angeles in 2003. Dr. Shih is a member of ACM and IEEE.

Kyungsik Han is a research scientist at the Pacific Northwest National Laboratory. His research interests include mobile & ubiquitous computing, community informatics, social media analysis, and social computing. He received his B.S. in Computer Science from the Kyungpook National University, M.S. in Computer Science from the University of California Los Angeles, and Ph.D. in Information Sciences and Technology at Pennsylvania State University.

Jess Kropczynski is a faculty member in the College of Information Sciences and Technology at the Pennsylvania State University. Her research interests include methods and theory in human-data interaction and human-centered design, particularly as applied to smart and connected cities, collective action in community networks, and the design of civic technology. She has worked with local and state governments to assess communication and information needs of target audiences in order to promote informed decision-making. Her recent work has been with the GeoDeliberation Project, which is a partnership with the State College Borough Government to develop an online platform to help citizens interact more directly with planners and decision-makers. In addition to this platform she has worked on the design and assessment of mobile apps for community engagement.

implement the proposed framework at the community scale, our goal is to catalyze a change in paradigms for community cooperation and volunteering through this design concept and to invite practitioners and community partners to implement these mechanisms in future community service platforms.

In the remainder of this paper, we first describe current challenges in volunteering and timebanking and explore the design space and opportunities in which these community efforts can be enhanced. We conducted a survey with university students who are ideal prospective members of both the Red Cross and hOurWorld. The survey study will be described in detail in a later section. We developed a paper-based prototype to enable walkthroughs of the integration of community volunteering and timebanking, leveraging our own mobile timebanking system (Han et al., 2015), and addressing issues identified in our community fieldwork and in discussions with our partners in the Red Cross and hOurWorld.

Challenges and Opportunities in Volunteering

Volunteer participation in local nonprofits is a modern generalized exchange paradigm in which services instead of commodities are transferred. Volunteer community service organized by nonprofits is a well-established and growing global paradigm for service provision (Salamon, Sokolowski, & List, 2003). Nonprofits address a wide range of societal concerns including education and schools, disaster relief and recovery, environmental preservation, food provision, healthcare and hospitals, housing construction, library, museums and heritage, public media and information access, retirement communities and care of the elderly, sustainable development, and youth programs. Note that there are multiple ways to classify organizations as "nonprofits" and that the division between government services and nonprofit services varies across countries.

Community Volunteering

In aggregate, nonprofit volunteering is a very substantial component of overall economic activity. In 2012, the US Internal Revenue Service (IRS) registered 1.44 million nonprofits, contributing an estimated \$887.3 billion to the US economy, about 5.4 percent of gross domestic product (GDP). In 2013, 25.4 percent of US adults served as volunteers for nonprofits, more than 60 million people, contributing 8.1 billion hours, valued at \$163 billion (Urban Institute, 2014).

At the community level, US nonprofit organizations often operate quite austere, with 1-2 paid staff and a loosely coordinated network of volunteers, lack all sorts of infrastructure, such as telecommunications equipment and skills, as well as planning, management, and knowledge practices (Merkel, Farooq, Xiao, Ganoë, Rosson, & Carroll, 2007). It is significant that the value of nonprofits with respect to social capital derives *both* from the services they provide and from the fact that the services are provided for the most part by community volunteers who are fellow citizens of those receiving the services.

Contemporary and Global-Scale Issues

Volunteering has changed and is changing in several respects. People are no longer limited to volunteering where they live; they can travel to where they wish to volunteer (global volunteering) or work as volunteers through the Internet (virtual volunteering). Recently volunteer service has become better integrated with education through internship and service learning programs; some curricula now require volunteer service participation.

In our fieldwork, In State College, Pennsylvania, we observed that potential volunteers often cannot easily identify opportunities to volunteer. There is no acknowledged clearinghouse for volunteers; each nonprofit manages its own volunteers, and connections among them, and possibilities of referrals, depend for the most part on accidents of the community social network. We suspect that at least some potential volunteers stop looking for an opportunity before they find one.

The International Federation of the Red Cross and Red Crescent Societies, which manages more than 17 million volunteers in 189 countries, is conducting a global review of volunteering (IFRC, 2014). Their preliminary findings indicate that volunteering is becoming more dynamic: Overall rates of volunteering are stable, but volunteers move among Volunteer Involving Organizations (VIOs) more fluidly; lifetime volunteers are becoming rarer. The number of VIOs in some countries has increased by factors of 4-5 in recent decades.

Although traditional altruistic motivations remain important, volunteers now also prioritize more individualistic motivations: They want to develop skills and personal contacts. They expect good organizational experiences, as well as feedback and assurance that they are making a difference. Volunteer work is increasingly professionalized both with respect to skills required by contemporary projects, and incentivizing and managing volunteers. The Red Cross analysis calls for a new model of volunteering that engages volunteers more easily and rapidly, framing mutual benefits of volunteerism more broadly, and including better integration of information technology and social media.

Supporting Sociability, Collaborative Services, and Sustainability for Design

Preece (2000) introduced the idea of community-centered development as a guideline for participatory design processes involving community members. The two key components of this process are usable software design and supporting sociability. Designing for sociability allows a system to become more sustainable in a community by changing as the community changes by considering the people, policies, and the community's purpose (Preece & Maloney-Krichmar, 2003).

Meroni (2007) conceptualized sustainability as the ability to live well while consuming fewer resources and generating new patterns of social cohabitation, a notion of collective wellbeing. She framed sustainability as a systemic discontinuity with preexisting conceptions that associate wellbeing with material consumption. Collaborative economy platforms such as Uber and Airbnb recently emerged as a popular way for people to make

their excess resources available for others to consume. Jégou and Manzini (2008) proposed collaborative service platforms that involve grassroots efforts of citizens in creating sustainable and scalable social innovation platforms. More recently, peer production platforms similar to commercial collaborative economy platforms were developed in attempts to facilitate volunteerism and altruistic behaviors. For example, Lampinen, Lehtinen, Cheshire, and Suhonen (2013) conducted a study of Kassi, a peer-to-peer gifting platform that allows people to help each other in any way they see fit. They found that while Kassi gift providers often face difficulties with knowing what they are capable of in providing for others and when and how to offer the help, whereas gift receivers are often uncomfortable receiving the help because of the discomfort associated with indebtedness. Bellotti et al. (2015) found that such mismatch of motivations and expectations also negatively impacted transaction exchanges in generalized peer-to-peer commercial platforms.

Carroll and Bellotti (2015) delineated a design space for future peer production systems that took into account the exchange pre-conditions, exchange interaction dynamics, exchange consequences, disparity and support, reciprocity, and market variables. They suggest a possibility of future collaborative service systems that could restructure global financial architecture based on principles of equity, transparency, accountability, and democracy. Our effort in integrating mechanisms in community volunteering and timebanking in a design framework contributes to the existing design research in collaborative services and sustainable social innovation systems.

Challenges and Opportunities in Timebanking

Timebanking is generalized exchange of time for services among community members, mediated by a database that records services contributed and received: Members of a community timebank provide services to and receive services from one another, for which they receive and assign time credits. Time-based exchanges create economic value in a community, but also social capital; as for community volunteering, services are co-produced throughout a community, by community members themselves (Lietaer & Dunne, 2013).

Human Development

A central motivation for timebanks is to allow marginalized citizens to participate in economic exchange (Cahn, 2000): Everyone has time, and can contribute that time toward a service for someone else. Timebanking developed out of the economic crises of the early 1980s, and experienced a burst of growth during the economic crisis that started in 2007. For example, during the years 2010-2012 the number of timebanks in Spain doubled (Moffett & Brat, 2012). This role of timebanks seems analogous to the trend in community volunteering identified by the Red Cross: People wish to simultaneously serve and support their fellow community members as they develop themselves, as engaged community members, but also as skilled and experienced workers.

Timebanks face demographic human resource challenges, however. The average age of timebank members is around 45 years; only about 3% of members are younger than 25 (Collom, 2007, 2008). The future of timebanks depends on recruiting younger people.

Uncertainty about Service Availability and Quality

A key issue for timebanking is uncertainty about services that can be obtained within a timebank. This can be an issue of availability of members with particular skillsets required for various services; in a small timebank community the distribution of services offered may not match the distribution of services requested, for example, a surfeit of people who can give guitar lessons or massage, but a shortage of people who have a car or will cut firewood. It is also a known challenge in equitable exchange systems, like timebanking, that specialized skills, such as plumbing or medical care, may become scarce, or traded inequitably (Lietaer & Dunne, 2013).

Another source of uncertainty is dealing with unknown persons. It is a strength of timebanking that community members interact peer-to-peer to exchange, or even co-produce services and create social capital. But it can be awkward to arrange such interactions with fellow community members who are nonetheless strangers (Shih et al., 2015); for example, a service requester might not be confident that the service provider will actually show up at the time and place agreed, or provide a high-quality service. Standard designs of timebanks, such as the Time & Talents software of hOurWorld, provide some basic profile information such as the number of services provided and the rate of satisfaction but do not allow in-depth reviews or special recognition of progress achievements. In our prior work, we developed mobile clients for timebanking that support more flexible interactions with respect to managing time and place (Han et al., 2015), but there is an opportunity to more explicitly address the reputation issue through on-line information designs. There is a need to address member recruitment and retention to diversify the demographics and skill sets available in timebank communities. Below, we propose an integration of community volunteering and timebanking mechanisms to complement issues found in either system.

Integrating Community Volunteering and Timebanking

To this point, we have described nonprofit volunteering and timebanks as two paradigms for citizen cooperation and community building that currently face analogous challenges and opportunities of improving and simplifying coordination of participants, facilitating skill and professional development consequences of participation, and making community service activities more accessible and attractive.

This confluence led us to ask the question of whether timebanking software could be re-envisioned to support volunteering, in addition to hour-for-hour time exchange, and thereby to become more general as a community information

infrastructure. We propose two extensions to the standard design of timebanks (Han et al., 2015) that would allow timebanking to mediate volunteering and charity interactions as well as the generalized exchange of hours for services.

Our first idea is to elaborate the model of timebanking to include institutional members, as well as individual members. Current timebanks conceive of service exchange as a person-to-person relationship; a service is provided to a recipient, and the service provider receives hours. This model could be extended to include institutions as a special kind of member: services could be requested by and provided to institutions; people providing those services could either receive hours (classic timebanking exchange) or could donate the hours they work back to the institution (volunteering).

Our second idea addresses the point made in the Red Cross study that people use volunteering as a way of developing themselves with respect to skills and reputation/resume. The timebank is a database; it could produce portfolio reports of members' activity. Thus if someone volunteered over a course of time for Red Cross activities, the timebank could produce a report listing all those activities. Such a report would be quite detailed and validated by the timebank; it would be more like a university transcript than the brief and invalidated self-reports of traditional resumes. The portfolio report could also include timebank activity, timebank services provided to others, and requested of others (i.e., opportunities one provided to fellow community members to contribute).

These ideas address the challenge we identified in our State College fieldwork that no single community entity provides a comprehensive clearinghouse for volunteering opportunities. People just do not know where or how to connect with volunteering opportunities. The first idea above unifies timebanking and volunteering in one exchange framework.

Our portfolio idea addresses the issues of uncertainty in timebanking interactions. Timebanks should manage not only service exchanges, but also reputation development. Timebanks often do have mechanisms for recording stars, badges, or comments from service recipients, but a portfolio mechanism would address this issue more comprehensively as well as providing instant resume reports for members. The second idea above unifies reputation management and service resumes in one framework.

This design proposal would benefit both timebanking and nonprofit volunteering: It benefits timebanks by bringing a huge number of communitarian transactions into the timebank framework. Volunteering is a much larger and established space of communitarian activity than timebanking itself. As mentioned earlier, more than a quarter of US adults volunteered for a nonprofit in 2012; we estimate that this is three orders of magnitude greater than timebanking. Timebanking could benefit from access to more diverse populations and skill sets. Better integration of timebanking and volunteering would also benefit nonprofit volunteering: The community timebank could be a comprehensive clearinghouse for volunteering opportunities throughout a given community.

Perceptions of Prospective Members

To initially investigate and develop the design direction of an integrative framework of community volunteering and timebanking, we used scenario-based design probes (Carroll, 2000b). The goal of the integrative framework is to facilitate reputation building in existing community volunteering organizations and to recruit members with diverse skill sets into timebanks. Since timebanking is still a relatively unfamiliar concept to most people, we use the scenario-based design approach. Design envisionment scenarios make design activities more accessible to a great variety of stakeholders that can contribute to design while minimizing distractions of lower level usability issues that could distract attention from the needs and concerns of the people who will use the technology (Carroll, 2000a).

As a part of a scenario-based design approach to initially evaluate perceptions of prospective members, we generated 3 scenarios that map to each of the activities supported by the proposed integrative framework shown in Figure 1, and embodied in our design prototype. The 3 scenarios are presented below.

- Scenario 1 (timebanking):** Mark needs his lawn mowed, so he makes a request through the timebank. James is able to mow Mark’s lawn so he contacts Mark to offer his service. They arrange a time for James to mow Mark’s lawn. It takes James 2 hours to mow Mark’s yard. Upon completion, James receives 2-hour time credits that are marked as “2 hours earned” on James’ profile, which he can spend in requesting services that he needs from other timebank members.
- Scenario 2 (volunteering):** Caroline is a college student majoring in computer and information science. She is good at computer programming and likes to volunteer for a local charity, meet people, and teach what she is good at. Caroline created a basic programming language class and decides to offer the class for free in a timebank (no time credit needed). A few days later, 10 people (mostly high school students) showed interest and signed up for the 2-hour class. Upon completion, she chooses not to earn any time credits. Caroline’s service is marked as “2 hours volunteered” on her profile.
- Scenario 3 (donation):** Mary realizes that her computer does not work. She doesn’t know how to fix it. Rather than bringing the computer to a store, she decides to use timebanking and searches for someone who might help her. From a list of members who indicate fixing a computer as one of their skills on their profile, she contacts John. After receiving John’s reply, they arrange a time to meet. It takes John 2 hours to fix Mary’s computer. Upon completion, while Mary rewards John with 2 hours of time credit for his service, John, however, decides to donate his time to the American Red Cross so that the nonprofit organization can use the time credits to acquire services that could benefit other people in the community. This is marked as “2 hours donated” on John’s profile.

We created a survey that assessed participants’ reactions toward the scenarios, their motivations and willingness to participate, and their demographics information (see Appendix A & B). We distributed the survey on a college campus along with the 3 scenarios. A total of 57 students completed the survey. The survey took around approximately 20 minutes to complete. Below, we provide a description of the participants and the survey results.

Participants

Table 1 shows the participants’ demographics information. Almost half of the study participants were in their 20s, and more than a half of the participants did not have any volunteering experience. This suits our intended population because our intention is to gauge whether people who may not have prior experiences with volunteering would be willing to participate in the form of volunteerism proposed by the integrative framework. In our analysis, we provide an analysis of the two groups of population, people with and without prior volunteering experiences.

Table 1. Summary of participants’ demographics (N = 57).

Attribute	Type	N	%
Age	10-19	1	1.8
	20-29	26	45.6
	30-39	14	24.6
	40-49	5	8.8
	50-59	6	10.5
	Over 60	4	7.0
Sex	Male	34	59.6
	Female	23	40.4
Volunteering Experience	Almost never	34	59.6
	Weekly	2	3.5
	Monthly	7	12.3
	Once every 1-3 months	2	3.5
	Once every 6 months	7	12.3
	Once a year	5	8.8

Our participant sample was skewed younger than is typical of established timebanks. As mentioned earlier, it is a challenge for timebanking, but also for community volunteering, to extend and develop participation by younger members.

Survey Results

To understand the participants’ perceptions, we clustered the participants into two groups: 34 participants were assigned to a non-volunteer experience group and 23 participants were assigned to a volunteer group. We then measured the differences in their Likert responses on a 5-point scale using ANOVA. Table 2 shows participants’ reactions towards the 3 scenarios. Overall, participants were significantly more interested in the possibilities of donating earned credits to other individuals or institutions

(scenario 3; Mean = 3.48, SD = 1.11) than the ability to personally volunteer (scenario 2; Mean = 2.91, SD = 1.18). Participants with prior volunteering experiences showed significantly more interests across all 3 scenarios, whereas participants without prior volunteering experiences were especially more interested in the possibilities of donating earned credits to other individuals or institutions (scenario 3).

Table 2. Participants’ reactions toward scenarios (1: lowest; 5: highest).

	With Volunteer Experiences [Mean (SD)]	Without Volunteer Experiences [Mean (SD)]	F-statistics
Scenario 1 (timebanking)	3.78 (0.93)	2.88 (1.29)	$F(1, 55) = 8.33^*$
Scenario 2 (volunteering)	3.35 (0.90)	2.62 (1.27) ^b	$F(1, 55) = 5.69^*$
Scenario 3 (donation)	3.83 (0.97)	3.25 (1.14) ^a	$F(1, 55) = 3.92^*$

Note: * denotes $p < 0.05$; superscripts denote the following statistically significant relationships: a > b.

We grouped participants’ motivation to participate into 5 types—timebanking, volunteering, donation, idealistic, and social—based on the categories identified in prior research on motivational differences in peer production platforms (Bellotti et al., 2015; Shih et al., 2015). Table 3 shows participants’ motivations to participate with and without prior volunteer experiences. In general, participants were positive; all group means were greater than 3. Participants with prior volunteering experiences showed significantly more positive responses across all 5 motivation types; all of their group means were greater than 4 on the 5-point scale. For people without prior volunteering experiences, while they were generally less enthusiastic than people with prior volunteering experiences, they responded significantly more positively toward being able to help others (idealistic) than volunteering and socializing.

Table 3. Participants’ motivation to participate (1: lowest; 5: highest).

	With Volunteer Experiences [Mean (SD)]	Without Volunteer Experiences [Mean (SD)]	F-statistics
Timebanking	4.35 (0.49)	3.66 (0.90)	$F(1, 55) = 11.07^*$
Volunteering	4.28 (0.61)	3.27 (1.04) ^b	$F(1, 55) = 17.34^*$
Donation	4.13 (1.01)	3.32 (1.47)	$F(1, 55) = 5.22^*$
Idealistic	4.42 (0.76)	3.85 (0.70) ^a	$F(1, 55) = 8.45^*$
Social	4.17 (0.89)	3.26 (1.10) ^b	$F(1, 55) = 10.77^*$

Note: * denotes $p < 0.05$; superscripts denote the following statistically significant relationships: a > b.

Together, these results indicate that people who do not currently participate in direct volunteerism may be enticed into participating in a pay-it-forward fashion, in which their services can be donated to others in the form of time credits so that those in need will have the flexibility of choosing to receive the services that they actually need.

Detailed Design of Timebanking for Volunteering

We developed a detailed design model and paper-based prototype for integrating timebanking and volunteering. Our goal was to specify and visualize the key interactions in such a system, enough to substantively guide further envisionment, critique, and implementation, for example, to support design discussions with potential users and their community nonprofit organizations.

A timebanking transaction involves a service provider and a service receiver. A transaction can be initiated by either a requestor with a service need or an offeror who is willing to provide a service. In either case, a post is submitted to the timebanking platform, and details such as the specific terms of service, location, and time requirements are discussed and negotiated by the members using the timebank’s messaging feature. Figure 1A shows the standard conceptual model of a timebanking transaction. We present three new design features that enhance the existing timebanking model to accommodate for community volunteering. The proposed model that integrates timebanking and volunteering services implements a donation mechanism to nonprofit institutions and individual timebank members (Figure 1B), and visualizes timebanking and volunteering contributions on member and institutional profiles to build reputation (Figure 1C). We provide detailed descriptions of the volunteering, donation, and reputation building mechanisms in the sections below.

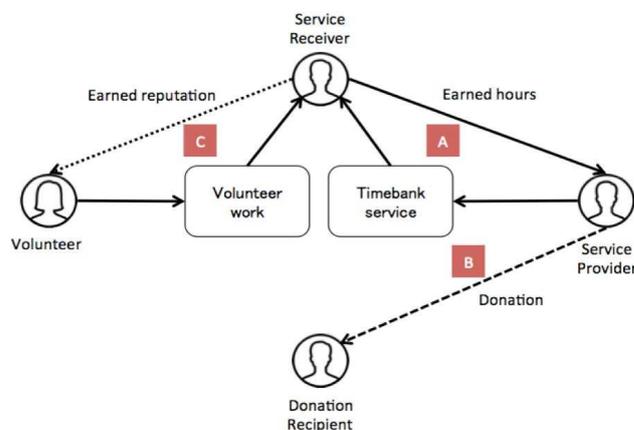


Figure 1. Timebanking with volunteering, donation, and reputation features. (1) Solid lines represent standard timebank transactions between members, (2) a dashed line represents donation from one member to another, and (3) a dotted line represents reputation made from volunteering.

Integrating Volunteering Tasks

In the existing timebank framework, hours can be reported by either the service provider or the service receiver after the completion of a service. In either case, the service provider earns hours that are deducted from the service receiver’s balance. In this framework, hours are exclusively handled by the members who are involved in service transactions, where hours spent by a service receiver will be recorded as “Hours spent” and as “Hours earned” for the service provider. To extend the current framework

to volunteering, a nonprofit institution or an individual member must indicate that the requested service is of volunteer nature when posting the request in the system. A special label (star) that denotes the volunteer task will be displayed in the list of requested services, so that members who are available to provide services could tell them apart from conventional timebanking tasks (Figure 2). When a member decides to perform the task as a volunteer, no hours will exchange hands between the service receiver and the service provider upon service completion. Instead, hours for that service will be recorded as “Volunteer work received” on the service receiver’s profile page, and as “Volunteer work performed” (Figure 4). The key innovation here is that volunteer work can be requested by both nonprofit institutions and individual timebank members using the same mechanism in a common platform. Those who are looking to perform volunteer work would have the option to dedicate their efforts to a wide variety of causes represented by nonprofit institutions or help the individuals who are in need.

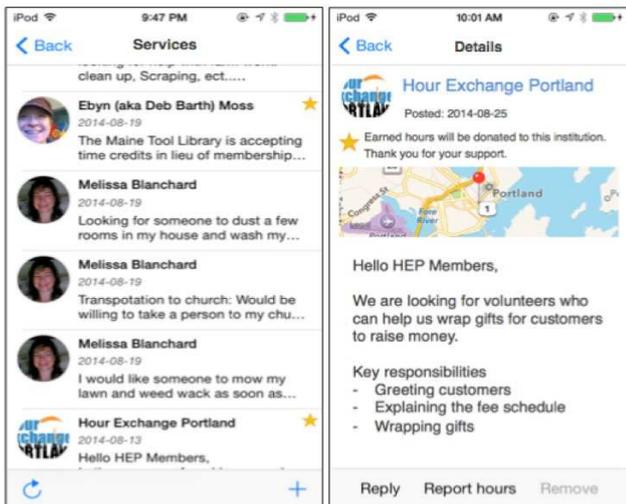


Figure 2. Screenshots of a service list and a service detail page. Services denoted with a star icon indicate volunteer work.

Allowing Donations

The aforementioned mechanism is an extension of the existing timebanking practice by providing an option to distinguish volunteer work from standard timebank services. Here, we added a donation interface that allows nonprofit institutions or individual members to gift hours to another member without partaking in a timebank or a volunteer service (Figure 3). By allowing donation, hours are deducted from the giver’s account and deposited into a recipient’s account like a conventional timebank transaction. In this case, a transaction for a gift receiver will be marked as “Gifts received,” but as “Gifts donated” for the gift provider (Figure 4). The donation mechanism supports an alternative way to help by simply donating the hours accumulated from completing previous timebank services instead of helping in the form of physical labor. This extends the conventional timebanking model to support different forms of participation that mimics giving to charity in the real world.

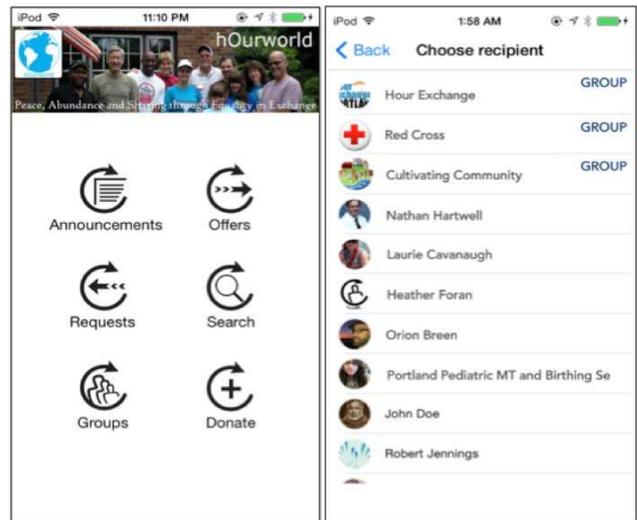


Figure 3. Screenshots of the donation interface.

Establishing Reputation

The timebank system currently contains a profile of all members, which includes a photo and a short bio of the member, the number of exchanges s/he has had, the number of other members s/he has engaged with, a percentage of those receiving that were satisfied, contact information, and the current services posted by the member. In addition, these activities are automatically populated with badges the member has earned on his/her profile page. To establish a reputation in the timebank system, we suggest that showing additional information on the member’s profile page will create a rich and full summary of one’s personal information, specialties, and timebanking activities. The information about the hours that one has provided to and received from others through regular timebank services, volunteer work, or donation will be detailed in the credit history page (Figure 4, left). The profile page also presents the top three service types that a member has engaged in based on his/her completed services. This information can be used for matching services or making recommendations when members are requesting or looking for services. After clicking the See services button, a list of completed timebanking services is also available on the profile page to show a more detailed story about one’s specialized activities. However the detailed information about the specific hours exchanged for each service is not presented to protect the privacy of the timebank members. The Read reviews button presents a list of reviews (e.g., satisfaction, quality, promptness, etc.) added by other members from prior timebank transactions.

For nonprofit institutions, a different profile view is presented. Figure 4 (right) shows the views of the number of hours volunteered and hours donated by other members. It also shows the top five active members along with their profile image and the number of hours volunteered or donated to celebrate people’s achievements.

We have shared this design with our partners in the Red Cross and hOurWorld for initial feedback and validation. At this preliminary stage, the design appears to embody and address the issues and analysis that motivated it.

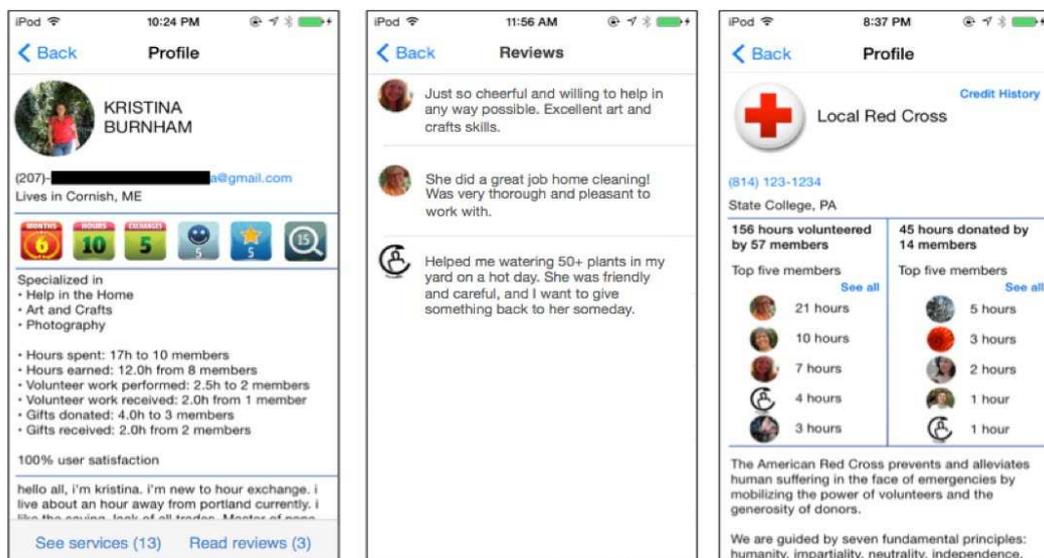


Figure 4. Screenshots of the profile page for a member (left; contact information anonymized), a review page (mid), and the profile page for an institution (right).

Discussion

In this paper we motivated, analyzed, and described a new community information infrastructure to unify timebanking and nonprofit volunteering. We used a scenario-based design approach to better understand people’s perceptions toward an integrative framework of community volunteering and timebanking. We found that people with prior volunteering experience were keenly interested in the variety of paradigms as well as various motivations to participate. Although people without prior volunteering experience reported neutral feelings about the scenarios, they reported positive motivations to participate in the proposed paradigms because of their pay-it-forward nature. An integrative framework for volunteering and timebanking has the potential to improve satisfaction for people who have prior volunteering experiences and to encourage participation of those without prior volunteering experiences. Below, we articulate broader impacts of the proposed design, addressing the unique challenges of nonprofit organizations as resource poor organizations, supporting the increasing fluidity of volunteer participation, expanding the reach of timebanks through donation infrastructure, and indicating the potential to expand the impacts of timebanks in a global marketplace. We begin by describing the direct impacts of the detailed design in the previous section and then describe additional broader impacts of our design.

Today, volunteer coordinators who work with larger populations have noticed that there is an increasing fluidity of their volunteer base given the rise in one time or episodic small group volunteer efforts (Hustinx, 2010). While a small core group may be quite conscientious of the larger mission and goals of the organization and return to many events, others prefer to attend one event at a time and may be inactive with the organization for several months at a time. Paired with the absence of a clearinghouse of volunteer opportunities in local communities, the timebank can act not only as a hub of local volunteer opportunities, but

of potential volunteers. The envisioned goal of such a unified platform is to create a service clearinghouse for people to be more aware of the community and individual needs, and to participate in co-producing and generating community value. This could enrich the visibility and diversity of volunteering opportunities in a community, and thereby evoke a stronger and more sustainable volunteering response from the community.

In the existing timebank system, a nonprofit will have to accumulate a negative balance in order to receive volunteer help. This is problematic because a negative balance has a negative connotation, and discourages members from seeking help from others (Bellotti et al., 2014). The proposed integration of volunteer tasks is a new contribution to the timebank service framework. The ability to post a volunteer task in the timebank allows nonprofit organizations that do not typically have the resources to acquire a stockpile of hours in the timebank to obtain help. In exchange, the nonprofit offers volunteers other gains by recognizing the volunteer work and building reputation of the service provider.

The current design of the timebank platform allows members to indicate if they were satisfied or unsatisfied with the exchange and to leave an open-ended review. To build a more robust reputation system based on past activities, the service receiver may also endorse particular skills that a service provider has. Given these additional features, a user’s profile will be a rich display of recent activities, personalized testimonials, and endorsed skills. This strengthens a key principle and purpose of timebanks, namely, enabling underemployed and marginalized people to participate in society and to develop skills and reputations. The reputations of service providers not only act as a benefit to those earning reputations, but can also be used to build the trust of requesters who would like to find the best person to fulfill a particular service. Additionally, if local nonprofit organizations are more aware of the range of local talents, they can utilize the talent in the local volunteer pool in a more efficient and creative manner.

In addition to incorporating volunteer work into the timebank model, the proposed framework allows hours to be donated to other users or organizations. While some may have the time available to participate in volunteer activities, other timebank users may not have the time available to provide services to a nonprofit. In the proposed framework, timebank users can elect to make a charitable donation of hours to the nonprofit. Nonprofit organization can then use these hours to obtain services that require specialized skills that are not typically available in the volunteer pool. In essence, the donation of hours provides nonprofits to purchase timebank services and expand their volunteer base to include those who would not normally participate in volunteer work. Alternately, consider a timebank user with technical skills who often feels obligated to spend their time doing less skilled tasks for an elderly family member. That user may be able to justify providing their technical services to earn hours in a timebank, and in turn donate those hours to the elderly family member to help him/her to meet the service needs. The gifting of hours can also be directed to non-family members. In this way, banked hours may be donated and recirculated in the local community in a new way. In a globally networked timebank system, a timebank user with a stockpile of hours in Portland, Maine, may hear of a crisis situation in Africa, and donate timebank hours to an aid organization in Africa to draw upon from a pool of local skills.

One broader impact of our design is explicit support for co-production, interactions in which the service provider and the service recipient benefit reciprocally. Co-production is a core principle of timebanking: In the original descriptions of timebanking just allowing a neighbor to provide a timebank service is itself regarded as acknowledging that the neighbor can make valuable contributions (Cahn, 2000). Classic cases of collectivized co-productions were described by Ostrom (1996), and anticipated by Jacobs (1961), such as public safety co-produced by neighbors who keep an eye on local street activity. Indeed, any service relationship involving assistance is clearly a co-production, succeeding only through coordinated joint effort of participants. As timebanks have become integrated with social service provision, this design flaw has become more salient. For example, in the United Kingdom, National Health Service doctors can prescribe mood disorder patients to work in a timebank doing errands for the elderly, both participants directly benefit from this kind of service exchange, though only the patients earn hours. Glynos and Speed (2013) argue that a “logic of recognition” is central to understanding such healthcare interactions. However, current timebank designs support the recognition of service co-production only through workarounds (Carroll, 2013). Our design allows co-production to be directly recognized as hour-neutral volunteer contributions, more tangibly rewarded through time donation, and richly described in reputation information. In recent design work, we are exploring boundaries of co-production systems that operate purely through the logic of recognition (Carroll, Chen, Yuan, & Hanrahan, 2016).

We are also addressing the issue of uncertainties in timebank exchanges, experimenting with matching service requests and offers based on similarity of interests, complementarity of

abilities and needs, and activity histories, and found that matching algorithms have the potential of improving member experiences in an evaluation (Jung et al., 2016).

A key thread of future work is to concretely embody and evaluate our design proposal, to implement and deploy an integrated information infrastructure scaled at least to a moderate sized community. This is an ambitious project, which we have initiated by organizing a consortium of community nonprofit organizations in a medium sized community in North America with the goal of using community-scale participatory design to develop a consensus design proposal, starting from the model presented in this paper. It has been interesting to observe that the local nonprofits readily recognize the challenge we are addressing as valid and important to them. A critical step will be to secure resources to implement and evaluate “at scale” the design that emerges from this participatory process.

Conclusion

In this paper we outline a detailed design to extend the timebank system in a way that can be adapted into a community innovation infrastructure. This infrastructure provides a clearinghouse of volunteer opportunities, a new form of charitable giving making those with banked hours a new kind of local philanthropist, new analytics to document local volunteer skills available in a community, and a system for volunteers to build reputation based on demonstrated skills and community contributions. These broader impacts are just a few examples of how this system may redirect previously untapped or unfocused energy and create innovative use scenarios for timebank users. Our findings also contribute to existing design research in collaborative services and sustainable social innovation systems and offer insights for future designs of sociotechnical platforms in this space. Although the proposed integrative framework may not solve all the challenges in the nonprofit space, such as existing operational, management, and coordination challenges, it affords the possibility of attracting new skill sets into timebanking and new members into community volunteering. Other domains such as university education may be able to utilize this infrastructure to support the emergence of community engagement as a form of educational activity, and the establishment of credits and requirements for community service, and other engagement experiences in university curricula.

Acknowledgements

We are grateful to Edward Happ and Geri Lau of the International Federation of Red Cross and Red Crescent Societies for discussions and advice about contemporary challenges in volunteering, and to Stephen Beckett, Terry Daniels, and Linda Hogan of hOurWorld for discussions and advice about challenges and directions in timebanking. This work is supported by the US National Science Foundation (1218544, 1406858).

References

1. Bellotti, V., Ambar, A., Turner, D., Gossman, C., Demkova, K., & Carroll, J. M. (2015). A muddle of models of motivation for using peer-to-peer economy systems. In *Proceedings of the 33rd Conference on Human Factors in Computing Systems* (pp. 1085-1094). New York, NY: ACM.
2. Bellotti, V., Cambridge, S., Hoy, K., Shih, P., Handalian, L., Han, K., & Carroll, J. M. (2014). Towards community-centered support for peer-to-peer service exchange: Rethinking the timebanking metaphor. In *Proceedings of Conference on Human Factors in Computing Systems* (pp. 2974-2984). New York, NY: ACM.
3. Cahn, E. S. (2000). *No more throwaway people: The co-production imperative*. Washington, DC: Essential Books.
4. Carroll, J. M. (2000a). Five reasons for scenario-based design. *Interacting With Computers*, 13(1), 43-60.
5. Carroll, J. M. (2000b). *Making use: Scenario-based design of human-computer interactions*. Cambridge, MA: MIT press.
6. Carroll, J. M. (2001). Community computing as human-computer interaction. *Behaviour and Information Technology*, 20(5), 307-314.
7. Carroll, J. M. (2013). Co-production scenarios for mobile time banking. In Y. Dittrich, M. Burnett, A. Mørch, & D. Redmiles (Eds.), *Proceedings of the 4th Conference of International Symposium on End-User Development* (pp. 137-152). Berlin, Germany: Springer.
8. Carroll, J. M., & Bellotti, V. (2015). Creating value together: The emerging design space of peer-to-peer currency and exchange. In *Proceedings of the 18th Conference on Computer Supported Cooperative Work & Social Computing* (pp. 1500-1510). New York, NY: ACM.
9. Carroll, J. M., Chen, J., Yuan, C. W., & Hanrahan, B. V. (2016). In search of coproduction: Smart services as reciprocal activities. *Computer*, 49(7), 26-32. doi: 10.1109/MC.2016.194.
10. Carroll, J. M., Kropczynski, J., & Han, K. (2014). Grounding activity in people-centered smart territories by enhancing community awareness. *Interaction Design and Architecture(s) Journal*, 20, 9-22.
11. Collom, E. (2007). The motivations, engagement, satisfaction, outcomes, and demographics of time bank participants: Survey findings from a U.S. system. *International Journal of Community Currency Research*, 11, 36-83.
12. Collom, E. (2008). Engagement of the elderly in time banking: The potential for social capital generation in an aging society. *Journal of Aging & Social Policy* 20(4), 414-436.
13. Cook, K. S., Cheshire, C., Rice, E. R.W., & Nakagawa, S. (2013). Social exchange theory. In J. DeLamater & A. Ward (Eds.), *Handbook of social psychology* (pp. 61-88). Dordrecht, the Netherlands: Springer.
14. Corrigan, M. W. (2001). *Social exchange theory, interpersonal communication motives, and volunteerism: Identifying motivation to volunteer and the rewards and costs associated* (Doctoral dissertation). West Virginia University, Morgantown, WV.
15. Glynos, J., & Speed, E. (2013). Varieties of co-production in public services: Time banks in a UK health policy context. *Critical Policy Studies*, 6(4), 402-433.
16. Grobman, G. M. (2012). *Pennsylvania nonprofit handbook: Everything you need to know to start and run your nonprofit organization*. Harrisburg, PA: White Hat Communications.
17. Han, K., Shih, P., Bellotti, V., & Carroll, J. M. (2015). It's time there was an app for that too: An usability study of mobile timebanking. *Journal of Mobile Human Computer Interaction*, 7(2), 1-22.
18. Hustinx, L. (2010). I quit, therefore I am? Volunteer turnover and the politics of self-actualization. *Nonprofit and Voluntary Sector Quarterly*, 39(2), 236-255.
19. IFRC. (2014). *Global review on volunteering*. Retrieved December 3, 2016, from <https://www.ifrc.org/what-we-do/volunteers/global-review-on-volunteering/>
20. Jacobs, J. (1961). *The death and life of great American cities*. New York: Random House.
21. Jégou, F., & Manzini, E. (Ed.). (2008). *Collaborative services: Social innovation and design for sustainability*. Milano, Italy: Edizioni Polidesign.
22. Jung, H., Bellotti, V., Doryab, A., Leitersdorf, D., Chen, J., Hanrahan, B. V., ... Carroll, J. M. (2016). 'MASTERful' matchmaking in service transactions: Inferred abilities, needs and interests versus activity histories. In *Proceedings of the Conference on Human Factors in Computing Systems* (pp. 1644-1655). New York, NY: ACM.
23. Lampinen, A., Lehtinen, V., Cheshire, C., & Suhonen, E. (2013). Indebtedness and reciprocity in local online exchange. In *Proceedings of the Conference on Computer Supported Cooperative Work* (pp. 661-672). New York, NY: ACM.
24. Lietaer, B., & Dunne, J. (2013). *Rethinking money: How new currencies turn scarcity into prosperity*. San Francisco, CA: Berrett-Koehler Publishers.
25. Merkel, C., Farooq, U., Xiao, L., Gano, C., Rosson, M. B., & Carroll, J. M. (2007). Managing technology use and learning in nonprofit community organizations: Methodological challenges and opportunities. In *Proceedings of the Symposium on Computer Human Interaction for the Management of Information Technology* (no. 8). New York, NY: ACM.
26. Meroni, A. (Ed.). (2007). *Creative communities: People inventing sustainable ways of living*. Milano, Italy: Edizioni Polidesign.
27. Moffett, M., & Brat, I. (August 27, 2012). For Spain's jobless, time equals money. *The Wall Street Journal*. Retrieved December 3, 2016, from <http://www.wsj.com/articles/SB1000872396390443404004577577352038273664>

28. Ostrom, E. (1996). Crossing the great divide: Co-production, synergy, and development. *World Development*, 24(6), 1073-1087.
29. Preece, J. (2000). *Online communities: Designing usability and supporting sociability*. New York, NY: John Wiley & Sons.
30. Preece, J., & Maloney-Krichmar, D. (2003). Online communities: Focusing on sociability and usability. In J. Jacko & A. Sears (Eds.), *Handbook of human-computer interaction* (pp. 596-620). Mahwah, NJ: Lawrence Erlbaum.
31. Putnam, R. D. (2000). *Bowling alone: The collapse and revival of American community*. New York, NY: Simon and Schuster.
32. Salamon, L. M., Sokolowski, S. W., & List, R. (2003). *Global civil society at-a-glance: Major findings of the John Hopkins comparative nonprofit sector project*. Baltimore, MD: John Hopkins Press.
33. Shih, P. C., Bellotti, V., Han, K., & Carroll, J. M. (2015). Unequal time for unequal value: Implications of differing motivations for participation in timebanking. In *Proceedings of the Conference on Human Factors in Computing Systems* (pp. 1075-1084). New York, NY: ACM.
34. Tönnies, F. (1988). *Gemeinschaft und gesellschaft* [Community and society]. Piscataway, NJ: Transaction.
35. Urban Institute. (October 27, 2014). *The nonprofit sector in brief: Public charities, giving and volunteering*. Retrieved December 21, 2016 from <http://www.urban.org/research/publication/nonprofit-sector-brief-public-charities-giving-and-volunteering-2014>
36. Warren, R. (1978). *The community in America*. Chicago, IL: Rand McNally.

Appendix A. Survey Instrument

Introduction

Timebanking is the concept that uses time as a form of currency and keeps track of time balances between members in the same local, geographical community. The goal of this study is to understand factors that would influence your willingness to participate in a timebank.

Three timebank scenarios will be given, and you will be asked to answer some questions.

Thank you for your participation.

Scenario 1

Mark needs his lawn mowed, so he makes a request through the timebank. James is able to mow Mark's lawn so he contacts Mark to offer his service. They arrange a time for James to mow Mark's lawn. It takes James 2 hours to mow Mark's yard. Upon completion, James receives 2-hour time credits that are marked as "2 hours earned" on James' profile, which he can spend in requesting services that he needs from other timebank members.

Do you find this scenario interesting?

- Not at all interesting
- A little bit interesting
- Neutral
- Somewhat interesting
- Very interesting

Does this scenario make you excited about timebanking?

- Not at all excited
- A little bit excited
- Neutral
- Somewhat excited
- Very excited

Scenario 2

Caroline is a college student majoring in computer and information science. She is good at computer programming and likes to volunteer for local charity, meet people, and teach what she is good at. Caroline created a basic programming language class and decides to offer the class for free in a timebank (no time credit needed). A few days later, 10 people (mostly high school students) showed interests and signed up for the 2-hour class. Upon completion, she chooses not to earn any time credits. Caroline's service is marked as "2 hours volunteered" on her profile.

Do you find this scenario interesting?

- Not at all interesting
- A little bit interesting
- Neutral
- Somewhat interesting
- Very interesting

Does this scenario make you excited about timebanking?

- Not at all excited
- A little bit excited
- Neutral
- Somewhat excited
- Very excited

Scenario 3

Mary realizes that her computer does not work. She doesn't know how to fix it. Rather than bringing the computer to a store, she decides to use timebanking and searches for someone who might help her. From a list of members who indicate fixing a computer as one of their skills on their profile, she contacts John. After receiving John's reply, they arrange a time to meet. It takes John 2 hours to fix Mary's computer. Upon completion, while Mary rewards John with 2 hours of time credit for his service, John, however, decides to donate his time to the American Red Cross so that the nonprofit organization can use the time credits to acquire services that could benefit other people in the community. This is marked as "2 hours donated" on John's profile.

Do you find this scenario interesting?

- Not at all interesting
- A little bit interesting
- Neutral
- Somewhat interesting
- Very interesting

Does this scenario make you excited about timebanking?

- Not at all excited
- A little bit excited
- Neutral
- Somewhat excited
- Very excited

Questions

To what extent do you like about the timebanking activities described in the scenarios?

(Likert scale: 1 = Dislike a great deal; 5 = Like a great deal)

- Have opportunities to partake in an alternative economy that values people's time equally
- Have opportunities to build community
- Have opportunities to earn hours to pay for the services that I need
- Have opportunities to establish reputations of my skills and activities
- Have opportunities to help other members
- Have opportunities to socialize with other members

To what extent would you be willing to participate in the following activities if the following opportunities exist?

(Likert scale: 1 = Extremely unlikely; 5 = Extremely likely)

- Participate in timebanking so that I can earn hours to pay for other services that I need
- Have my timebanking services officially recognized and endorsed by volunteering organizations such as Red Cross, United Ways, and others
- Have my timebanking activities listed on my resume to boost my credentials for job purposes
- Perform timebanking services and donate the earned hours to other members or organizations in need

How often do you volunteer?

- Almost never
- Weekly
- Monthly
- Once every 1-3 months
- Once every 6 months
- Once a year

If you volunteer regularly, what organizations do you volunteer for?

What is your age?

- 10-19
- 20-29
- 30-39
- 40-49
- 50-59
- Over 60

What is your sex?

- Male
- Female
- Other
- Prefer not to answer

Appendix B. Motivation Items

Timebanking

- Have opportunities to earn hours to pay for the services that I need
- Participate in timebanking so that I can earn hours to pay for other services that I need

Volunteering

- Have opportunities to establish reputations of my skills and activities
- Have my timebanking activities listed on my resume to boost my credentials for job purposes
- Have my timebanking services officially recognized and endorsed by volunteering organizations such as Red Cross, United Ways, and others

Donation

- Perform timebanking services and donate the earned hours to other members or organizations in need

Idealistic

- Have opportunities to partake in an alternative economy that values people's time equally
- Have opportunities to build community
- Have opportunities to help other members

Social

- Have opportunities to socialize with other members