Co-production Scenarios for Mobile Time Banking

John M. Carroll

Center for Human-Computer Interaction/College of Information Sciences and Technology
The Pennsylvania State University
University Park, Pennsylvania 16803 USA
jmcarroll@psu.edu

Abstract. *Time banking* facilitates generalized reciprocity among neighbors by rewarding contributions in proportion to the time entailed in contributing. Contributions can be person-to-person services, such as driving another person to an appointment. They can also be *co-productions*, in which the provider and recipient jointly enact a service, such as giving/receiving a guitar lesson. Co-production is an important category of time banking interaction; it has been identified as a key to strengthening the core economy of home, family, neighborhood and community, and is becoming integrated into government social service schemes. As part of a requirements analysis for mobile timing banking infrastructures, we identified and analyzed co-production scenarios. Our objective is to contribute to the social movements of co-production of social services and of time banking through designing and developing a socio-technical infrastructure that mutually leverages both to build up the core economy and to enable societal-scale time banking.

Keywords: time banks, co-production (social services), scenario based design, community informatics, ubiquitous computing, socio-technical infrastructures.

1 Introduction

In this paper, we consider *co-production* of social services as a *time banking* interaction, drawing upon our on-going work developing new models for mobile time banking, and new software infrastructures and tools for time banks. Time banking is valuing contributions by the time it takes to produce them, and mediating exchanges of effort and other contribution among community members by adjusting time credit balances (Cahn, 2000; Cahn & Rowe, 1992; Seyfang, 2004a,b; Seyfang & Smith, 2002). For example, one person might have a car, and can drive neighbors to appointments and grocery shopping, while another knows how to garden. Each can contribute their effort to the time bank, and also draw against their time balances to make requests, for example, having someone mow their lawn. Time banking is an alternative economic paradigm to exchanges of money. Because it emphasizes person-to-person interactions, and because everyone's contributions are valued on the same scale (time), time banking strengthens local social ties and social capital, enhances personal dignity in ways that the money-based economy does not (Coleman, 1988; Collom, 2005, 2008b; Putnam, 2000; Ozanne, 2010; Molnar, 2011; Seyfang, 2002, 2003, 2009).

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In the context of modern market economies and government bureaucracies, time banking is radical. It is a generalized exchange economy not based on money, and values everyone's contribution on the same scale (time expended). Although accounts, debits and credits are explicitly managed in time banks, there is a high level of consensual self-management on the part of time bank members, based on moral obligation. Thus, although time credits can be used to obtain goods and services, they also serve to recognize engagement in and contribution to the community (Glynos & Speed, 2013). Time banking has spread rapidly in recent years; for example, the nonprofit organization, TimeBanks USA facilitates 276 time banks in North America through 27,000 members, as well as in other countries, including Australia, Canada, Costa Rica, Italy, the Netherlands, New Zealand, Portugal, Russia, Saint Martin, Ukraine, the United Arab Emirates, Uruguay, and Vietnam (TimeBanks USA, 2013). The number of time banks in Spain has doubled during the past three years, to about 300 (Moffett & Brat, 2012); the number of time banks in the United Kingdom is also about 300 (TimeBanking UK, 2013).

Co-production of social services is producing social service outcomes through collaborations of recipients, social service professionals, and other stakeholders, in which all the stakeholders have power and responsibility to identify and achieve successful outcomes, and in which recipients or clients of services work directly with service providers to produce services. The concept of co-production originated in the observation that effective delivery of social services sometimes depends upon the active involvement of the service recipients. The signature example is Ostrom's (1993, 1996) analysis of the increase in Chicago street crime that coincided with police switching from walking a neighborhood beat to patrolling in cars. Ostrom argued that patrolling in cars reduced contact with residents, and thereby diminished the extent to which neighborhood safety could be effectively pursued as a joint project of police (service providers) and residents (service recipients/clients). The police officer in the street is in a better position to co-produce public safety with active involvement of the public: Police and residents can get to know one another better, trust one another more, share and display awareness of events, and directly and indirectly collaborate to provide neighborhood safety.

Co-production is not passive cooperation, such as a patient answering a doctor's diagnostic questions in a medical interview. And it is more than participation in planning what will be done. It is direct sharing in the work itself; it makes a service provision into reciprocal support in which the client works with the service provider to achieve an outcome better for both. An institutional example is Habitat for Humanity, an international non-governmental organization that builds low-income housing with volunteer labor, including the labor of the people who will later live in the house being built and of people who previously received housing assistance from group.

Edgar Cahn (2010) extended the concept of co-production arguing that effective co-production involves partnerships among communities and agencies, as well as among individual community members and service professionals. In this view, co-production relies on individual initiatives and relationships but in the context of a broader transformation of roles and responsibilities, including roles and responsibilities of municipal and other government entities. In Cahn's notion, social service

professionals are facilitators more than providers, and services themselves are negotiated and produced by all stakeholders working toward collective goals. Time bank credit and peer recognition is a key social regulatory mechanism in this conception (Glynos & Speed, 2013).

In fall of 2011, we proposed to TimeBanks USA the project of creating smart phone software to support mobile time banking. TimeBanks USA agreed to work with us; they were in the midst of defining and developing a new version of the web-based Community Weaver platform, used by hundreds of time banks throughout the world (Community Weaver, 2013). Initially, our effort was focused on designing and developing a mobile client or clients that could access the database server of the Community Weaver platform. We began to envision and analyze mobile time banking scenarios. Design scenarios are intended to represent and to problematize designs, that is, to both initially codify and also raises issues about design approaches. As part of a requirements analysis for mobile timing banking infrastructures, we identified and analyzed co-production scenarios (Carroll, 2000).

In this paper, we describe scenario development for mobile time banking. We began inspired by the idea that community members could leverage one another to carry out small tasks, reducing the overall busyness of the ensemble of people throughout the community. In the course of developing and analyzing this idea and our initial scenarios for envisioning it, we discovered time banking as a pre-existing concept for what we had in mind, and reconceived our idea as mobile time banking. Coming at mobile time banking from the angle of reducing busyness probably biased us toward a somewhat task oriented notion of the services that community members might exchange in a time bank.

Our partners in TimeBanks USA were pleased with our initial prototyping work, and indeed asked us to consider that the mobile platform might be the new default platform for time banking. But they also urged us to emphasize co-production scenarios, scenarios in which time banking services and social effects are more collective. Initially it seemed to us that co-production scenarios were just a broadening of parameters for community-based exchanges. However, the logic and the motivational dynamics underlying co-production are entirely different. We operationalized this transition as one from scenarios that emphasize "doing for" to scenarios that also emphasize "doing with". We present our experience both as a concrete instance of shifting from an individual to a collective perspective in service design, and as a general reflection on the potentially cascading effects of what at first seem small refinements in a design concept.

2 Scenarios for Mobile Time Banking

Our initial scenarios for mobile time banking sought to identify ways people can do things for other people (1) with relatively minimal effort, (2) leveraging the affordances of mobile devices, such as GPS (Global Positioning System) information and being pre-situated in a flow of embodied activity. We saw this as a source of new value for time banking, which we understood to be highly transactional and managed

through a web-based content management system, Community Weaver (2013). Our reasoning was that small favors at just the right time and place might generate outsized benefit for the recipient to the actual time and trouble they cost the producer. We saw this as a novel and opportune approach to generating and strengthening social ties and social capital in a local community (Carroll, Bellotti & Han, 2013).

Our initial touchstone scenario for mobile time banking is the Get Aspirin scenario in Table 1.

Table 1. Get Aspirin scenario (from Carroll et al. 2013)

Mary was in the market to buy some groceries. While she was shopping, she quickly checked Mobile Time Bank (MTB) requests. One of her neighbors, John, had posted a request for a bottle of aspirin an hour ago. John was at home with his daughter, who had a cold. Mary would be driving right past his home anyway. Since she already knew John, she called him up and told him the aspirin was on the way. She also accepted the request in her MTB app. She had a brief chat with John while dropping off the aspirin. As she left, she felt good about helping someone, but also was struck by how easy it was to do, earning time bank credit as well.

This scenario was effective in evoking ubiquitous interaction possibilities, but also in raising requirements issues. On the upside, it conveys a new possibility for John to both get his aspirin quickly, and without having to drag his daughter to the store, and also to experience social support from his neighbor, Mary. On the downside, the scenario emphasizes how stringent the timing relationships are: If Mary has more shopping to do, and arrives three hours later, John may be frustrated. He may have made other arrangements for the aspirin and no longer need it. It also emphasizes the social risks implicit in such interactions. Perhaps John will be anxious about posting such a request to a community time bank, depending on a stranger for something vital like aspirin, and inviting a stranger to his home. On Mary's side, she may be reluctant to accept John's request, if she does not already know him.

We generated and analyzed a set of scenarios that emphasize needs and opportunities that involve relatively small efforts whose value is magnified by being timely and co-located. For example, someone's car breaks down on a highway as they are driving across town, or they miss the last bus, and they post a time bank request to get picked up.

We identified a type of scenario that involves transactions in which one person's efforts can be almost entirely leveraged by another person. For example, one person might want to get tickets to a Bruce Springsteen concert, or purchase a textbook for the Psychology 101 course. She/he could post a request to the time bank asking for someone else, who is already planning to carry out that transaction, to do it for both of them, that is, to get an extra ticket or textbook. In this type of scenario, the extra work is only the work required to manage the time banking transaction itself (e.g., exchange money for ticket or book), the person was going to wait on line and go through the purchase protocol anyway. We imagined real time versions of these

scenarios that could depend more critically on mobile interactions, such as arranging for someone to buy your ticket while you are in the queue, and so that you can leave the queue and still get the ticket. These scenarios have downsides in that money is involved: Someone buys something for someone else and either must front them the money, or must collect it advance, and then be trusted to deliver the purchase.

These first scenarios for mobile time banking, modeled on time banking scenarios but emphasizing finer grained coupling of participants with respect to time and place, all involve voluntary service provision, in which a doer provides a service to a recipient). We communicated regularly with our partners in TimeBanks USA as we developed our first set of scenarios, and implemented an Android prototype for a user study. Our prototype closely models the dialogs of Community Weaver (2013): Members can post requests and offers for other time bank members to accept. Accepting a request/offer initializes a handshake in which the original requestor/offeror confirms the arrangement. The confirmation step could include message exchanges, setting times and places, and checking one another's profile information (profiles include a summary of previous requests, offers, and accepts, though with names of other members involved). After the service exchange, the recipient notifies the time bank to award time credit to the service provider's account, and to debit the recipient's account (see Bellotti, Carroll & Han, 2013; Carroll et al., 2013, for details).

3 Co-production Scenarios

Our partners were pleased with our initial work, but also suggested that we consider including co-production scenarios. In fact, we had included co-production scenarios, but not emphasized co-production. Indeed, any interaction that involves tutoring or coaching is ipso facto a co-production scenario. This is because in any kind of teaching, the learner is an agent and collaborator in the activity. Once co-production had been specifically called out to us, we noticed that most time banks included these interactions in their basic descriptions of how time banking works. For example, in its overview description on the Web, Community Exchange (a large time bank located in Allentown, Pennsylvania, USA) describes several "typical" time banking interactions, as quoted in Table 2 (next page). Tony installs an air conditioner for Carol and drives Ellen to the doctor; these are both service contributions that are good examples of concrete helping, but are not co-productions. However, Tony helps Linda move furniture; this is a co-production, because Linda is involved too. Tony uses his time dollars to have Frank help him install tile; this is also co-production. Carol teaches drawing, though her students are not named in the scenario sketch, those students are co-producers of the drawing lessons. Linda assists time bank members with word processing; again, this is co-production.

Once we "got" the general co-production schema, it was, of course, everywhere. It suggested variations on the person-to-person mobile time banking interactions we had already identified. For example, in the Get Aspirin scenario, if Mary is a neighbor who is going shopping anyway, and takes John along so that he can get aspirin, that is co-production in that the two actors jointly achieve the outcome. Similarly, if

someone's car has broken down and they request help to get it started (e.g., to borrow jumper cables for a battery charge up), that could be co-production. And for the scenario of waiting online for tickets and books, if instead of asking someone to wait *for* you, you ask someone to wait *with* you, that is co-production. We summarized the general distinction to ourselves as "doing for" (service provision) versus "doing with" (co-production).

Table 2. Co-production scenarios illustrating the lessons pattern and the helping pattern (from the overview of Community Exchange, 2013)

"Tony needed help tiling his bathroom before his new baby arrived. He earned "time dollars" by installing an air conditioner for Carol, driving Ellen to the doctor and helping Linda move furniture. He earned enough "time dollars" to have Frank help him with the tiling. In exchange for Tony's help, Carol teaches drawing and transports Community Exchange members to the grocery store. Linda uses her computer skills to assist members with word processing, and Ellen serves on Community Exchange's advisory board and offers telephone assistance and companionship. Over and over and over, members exchange their time and skills, building healthy community connections, while learning that receiving is as valuable as giving."

Co-production initially appeared to us as an elaboration of the service contribution scenarios we had been developing. The examples we found on websites of TimeBanks USA members overwhelmingly were instances of what we might call the "lessons" pattern (using the term *pattern*, loosely, in the sense of a schematic design solution; Alexander et al., 1977), as in Table 2 where Carol and Linda actually provide instruction to time bank members, and the "helping" pattern, where Tony helps Linda move furniture, and Frank helps Tony install tile: In both patterns, the doer provides a service to the recipient, but the service entails close collaboration, and thus the recipient also must be a doer. The lessons and helping patterns illustrate "doing with" in contrast to "doing for".

We found examples in which helping co-productions were integrated into government social service provision (Ryan-Collins, Stephens & Coote, 2008). For example, in the Rushley Green time bank in London, members receive credit for accompanying elderly members who are shopping, visiting elderly people in their homes, etc. to enable the elderly to live on their own. In this case, local doctors, working for the British National Health Service, refer their patients to the time bank for co-produced social support, in effect, having their patients do their own social services with the help of fellow citizens. Current policy debate in the United Kingdom is considering broader incorporation of co-production into social service programs (Glynos & Speed, 2013; Seyfang, 2006).

Table 3. Pay-forward co-production pattern (from Stephens, Ryan-Collins & Boyle, 2008)

If you are discharged from the Lehigh hospital outside Philadelphia, you will be told that someone will visit you at home, make sure you're OK, if you have heating and food in the house. You are also told that the person who will visit you is a former patient, not a professional, and that – when you are well – you will be asked if you could do the same for someone else.

As we focused on co-production, we were able to identify further patterns. For example, we call the time banking interaction described in Table 3, the *pay-forward pattern*: A doer renders a service contribution to a recipient (while mobile), but subsequently that recipient becomes a doer with respect to an analogous service provided to another recipient. In this example the service co-production is mediated by a community institution, the hospital; it is not an interaction between two community members, as in the helping and lessons examples of Table 2.

Also, the service that is produced and exchanged is quite specific, not generalized; the recipient is expected to do something more specific than just contribute the same amount of time to the time bank, though it is important to emphasize that in this interaction, as in all time banking interactions, the reciprocity is based only on moral obligation. Habitat for Humanity is another example of the pay-forward pattern; the organization helps you build your home with the expectation that in the future you will help others to build their homes. As is also the case with participation in Habitat for Humanity, recipients in this pay-forward service exchange often become longer-term doers, providing visits not just for *one* other patient, but adopting the role of patient visitor and visiting many other patients (Stephens, Ryan-Collins & Boyle, 2008). Note also that the lessons pattern and the helper pattern become versions of the pay-forward pattern if the recipient goes on to share what they learned through the lessons or helping interactions (e.g., Frank helps Tony with tiling, then Tony helps someone else; Carol teaches someone drawing, and then that person teaches someone else).

Another interesting fact about this example is that it was based upon practices in the Community Exchange time bank, from whose website Table 2 was excerpted. Thus, the more radical form of co-production that is very much a part of the time bank's practice (Table 3) is nevertheless invisible in the short examples they present on the overview page (Table 2). Community Exchange is affiliated with TimeBanks USA and this type of mobile time banking scenario was one of their specific motivations for establishing the partnership with our group.

We identified another example of co-production in which members initiate a service for other members, in this case sharing telephone conversations with housebound people who may be lonely (Ryan-Collins, Stephens & Coote, 2008). As described in Table 4, the service is intended to be reciprocated (and thereby is a co-production), but we might go further and consider that the interaction could be a social model for the housebound members to reach out to community members beyond the specific people who initiated the contact. Because many people have mobile telephone service, these interactions can be mobile time banking scenarios; indeed, this is the type

Table 4. Cascading communication co-production pattern (from Ryan-Collins, Stephens & Coote, 2008)

Volunteers telephone an older person regularly for a chat. Many of the volunteers receive as well as make phone calls providing opportunities for reciprocity and enabling house bound people to make a contribution.

of telephone interaction many people now carry out in interstitial time (Dimmick, Feaster & Hoplamazian, 2011). We call this the *cascading communication pattern.*

This pattern is like the pay-forward pattern in that the service exchange is specific to telephone chats. Indeed, to the extent that the recipients (the housebound people) return calls only to those who first called them, it is entirely dyadic, generalized neither with respect to what service is rendered nor to whom it is rendered. However, we suggest that housebound people might come to see that telephone chatting is a role they can play, and a general way they can contribute. In that case, seeding the initiation of the calls could create a cascade of (co-produced) support network activity throughout the community.

Another category of co-production scenarios involves *community programs* that aggregate and focus collective effort on various community interests and concerns. Timebanking Wales created the "Time for Young People" program through which young people helped to run a summer festival, participated in environmental projects, and produced concerts for the community, earning time credits, and contributing directly to the community (Ryan-Collins, Stephens & Coote, 2008). As in the Rushley Green and Community Exchange examples above, this is an example where time banks are becoming integrated with public services. The young people in Wales are in effect co-producing their own social service program, which in turn is producing services to the broader (festivals, concerts, environmental projects). This is a good example of Cahn's (2010) elaborated view that effective co-production involves partnerships between communities and agencies, as well as between particularly community members and service professionals, co-production can also be taken as a policy and design principle, urging that recipients, providers and society all benefit more when recipients play an active role in the services they receive.

The community program pattern does not require direct involvement of government. In our Nostalgia project (Carroll et al., 1999), we helped a group of community elders carry out a community program in which they posted stories about community life when they were young adults, and other community members commented on these posts, creating an online discussion about community history by the community itself, and enhancing awareness, knowledge and engagement in community history. The elders co-produced this service with all those who posted comments, or even read posts and comments. The community program pattern has a mobile time banking variant through services like Lost State College (Carroll & Ganoe, 2008), which allows participants to tour community heritage sites, to access site-specific heritage information via GPS coordinates, and to participate in social media interactions referring to the heritage sites.

We also reconsidered two examples of co-production that are widely cited as touchstone examples: Ostrom's example of the help residents provide to police when the police walk a beat (cited above), and Jacobs' (1961) example of the contribution longtime residents make in awareness of street activity for ensuring neighborhood safety. In Ostrom's example, policemen and community members casually interacted, neither classified most of that interaction as instrumental, but it nonetheless has the consequence of building trust between the police and the community and of keeping police apprised of what was going on. This is an example of community work, of community members playing an active role in maintaining their own safety, but in the example no one is really being called upon to do anything beyond being sociable. In Jacobs' (1961) example older residents in a neighborhood keep an eye on what is going on more so than residents who have recently arrived. The older neighbors would be able to do this because they know more about what is normal for a given day of week or time of day (Table 5). This is not the same as a neighborhood watch, where a community member is designated and actually patrols; it is more a matter of vigilance or active awareness.

Table 5. Street life vigilance (based on Jacobs, 1961)

Harry and Maude are a retired couple who have lived in neighborhood for many years. They walk their dog several times a day, and like to sit on their porch in good weather. They recognize many of their neighbors, and like to say Hello. They have a sense of what is normal and keep an eye on things.

These examples seem to be instances of a *community awareness pattern:* Community members, especially long-term residents, have rich local knowledge; they recognize neighbors, and they know what is normal activity. These resources allow them to co-produce safety and security with service professionals, like the police, and collectively with their fellow community members. In Ostrom's example, the residents are human sensors to inform the police, but the interaction works best when the police walk a beat, and regularly chat with the residents, in effect pulling information. In Jacobs' example, the long-time residents are acting as push sensors; they incidentally see and hear what is going on in the street in front of their homes, and in the community around them. If something is amiss, they can detect it early and report it.

Mobile time banking variants of the community awareness pattern are easy to identify. Community members who are out and about in the community space and carrying mobile devices are all potentially human sensors. They can report suspicious activity to police or other authorities, and they can in principle be directly queried. As in Jacobs' example (Table 5), more established and connected neighbors would be expected to make especially good mobile human sensors.

4 Institutionalizing Co-production

Our analysis of co-production scenarios for time banking raises questions about valuing contributions in time banking. The principle that contributions are valued by

the time required to perform the contribution makes clear sense for lessons and helping: Recipients are collaborating to produce the services but it is also clear that they are receiving services and from whom they are receiving services. Time-based valuing seems somewhat less relevant to pay-forward and cascading communication cases since these are specifically targeted, and also include a sort of "chain letter" logic to achieve a fan out of reciprocated service contributions. Looking specifically at the economic exchange, pay forward and cascading communication are really barters of specific acts of social support. Thus, the issue of time credits, of generalized exchange, seems secondary. The time bank in such cases seems to be functioning more as an instrument of recognition than of value exchange.

In the community program pattern it seems like all the active participants – teenagers, counselors/advisors, people who participate in or attend program, elder storytellers, younger story commenters, story and comment readers – are providing services for one another. Indeed, although these seem to be good examples of co-produced community services, it is difficult to pin down all the recipients of the service in these cases, raising the question of who or what would be debited for time credits for the service exchange. This problem of identifying the service recipient also seems critical for Ostrom's and Jacobs' community awareness co-productions; these are co-productions because the human sensors are both recipients and providers of the service. However, many other residents are also recipients of enhanced neighborhood safety, but would never even realize that they had received this benefit. Indeed, many of the co-producers of the services – people who chat with police on the beat, neighbors who keep an eye on cars pulling into driveways – might not even realize that they are in fact participating in producing a community service.

One way to think about this is that the exact magnitude of the valuation of a time bank contribution matters less than *the fact that it is valued at all*. Thus, in many of the more difficult examples, those beyond the lessons and helping patterns, people generally receive nothing at all for doing this, and yet they do it. The key to Ostrom's example was not that the police paid for this service, but merely that they made themselves available to it by being in the streets walking a neighborhood beat, instead of insulated from residents by riding in a patrol car. In this analysis, time credit for co-production is an issue of community visibility and validation, that is, of making community contributions more visible to the community, including those that participate in producing the contributions, and conveying to community members that such active participation is indeed valued by the community.

This reconception, however, has design implications for time banking infrastructures. The logic of recognition is different than the logic of generalized exchange. The latter emphasizes that the time required to make a contribution is a general way of valuing contributions, and regulating exchanges of contributions through the time bank. The former emphasizes making contributions visible and legitimate to the community. One way to achieve recognition is to award significant time credit, though as discussed above, complications arise in co-production scenarios as to who was a recipient of the contribution. But achieving recognition goals through award of time credits also undermines the generalized exchange of time credits. Thus, if Harry and Maude (Table 5) get 6 time credits for merely being home and occasionally

looking out their front window, will it seem equitable to you to wash my car for one time credit? Conflicts between the logic of recognition, which seems critical to implement co-production scenarios for time banking, and the logic of generalized exchange, which is the basis for person-to-person scenarios like Get Aspirin (Table 1).

We have confronted the tension around recognition and exchange with respect to co-production scenarios both by trying to envision designs that could mitigate the tension, and by investigating how this issue manifests and is managed in current time banking practices. One approach to this challenge is to award *nominal time credit* for relatively continuous co-production for which it is difficult to identify a specific recipient. Thus, Harry and Maude might receive just one time credit. In many cases, indeed in Ostom's and Jacobs' original observations, community members are already making these contributions with neither recognition nor reward; a nominal reward publicly and tangibly acknowledges the contribution, makes what might have been invisible more visible, and does not disturb the overall economy of generalized exchange "too much".

Another design approach would be a separate mechanism for time banks to manage recognition. In this approach, Harry and Maude would not get time credits for co-producing neighborhood safety through their street life vigilance. They would instead receive recognition for contributing to community awareness. This might be implemented as a notification subsystem in the time bank to apprise members of recognitions. This approach has the advantage of avoiding the "deficit spending" of awarding time credits when there is recipient account to debit, but it has the great downside of disaggregating contributions into categories, which is economically chaotic and socially fragmenting.

In addition to envisioning design interventions, we consulted research literature and best practices in time banking. There is a well-documented tendency for time bank members to provide more services than they request (Ozonne, 2010; Seyfang, 2006). In some respects, this is a flaw with respect to the logic of exchange, and signals some sort of problem with respect to reciprocity. However, just with respect to tallying time credits, it suggests that time banks may often run a surfeit, and therefore could fund the "deficit spending" approach of awarding nominal, or perhaps more than nominal credit for co-production interactions in which the recipients were difficult to enumerate. This is complicated by observation of the opposite pattern among minority users of one time bank; namely, receiving more services than they provided (Collom, 2008).

Cahn (personal communication) added to this his observation that members often do not bother to account for services they render to or participate in producing with other members who they regard as personal friends. He also mentioned that time bank members may donate time credits that they have eared back to the time bank, and that this is a standard practice in time banks. Both of these points also identify sources of unused time credit that could be invested in generalized co-productions. Finally, Cahn mentioned that the pay-forward pattern (Table 3) technically requires deficit spending in that people are provided services first, and then subsequently are given an opportunity to co-produce and earn time credits.

Our analysis of co-production scenarios for time banking indicated that co-production is already pervasive in time banking, that it is not a single pattern or interaction, and that it can be problematic. Time banking is not just the substitution of hours for dollars; it is intended to signal an alternative foundation for exchange and for services. We all already have time; we can invest it, exchange it, share it, and donate it. Doing with is more inclusive, participatory, and empowering. It affirms skills and knowledge, efficacy and control. Nevertheless, in a global context in which governments are reducing resources for social services there is an inherently coercive edge to co-production if one must cooperate with the development regime to get services; there is the risk that "empowering" recipients to co-produce their own social services will encourage government bureaucrats not to encourage and support co-production, but to use it as justification for further resource reductions. These downsides must be monitored by socio-technical designers.

Our scenario analysis of requirements for mobile time banking initially focused on individual value exchanges, person-to-person interactions. Identifying the importance of co-production specifically strengthens and simplifies some of our problematic initial ideas. For example, we had identified having someone else wait in line to purchase tickets as a plausible mobile time banking interaction, but also identified as one downside the fact that a significant amount of money might be involved. An interesting co-production variant of the purchase ticket scenario is finding someone to wait *with you* in the queue: Viewed as a service, the doing with alternative is more modest, but it is also more social, and does not put anyone's money at risk.

The other co-production patterns we identified provide specific ideas to explore in design. One implication of co-production is that the time bank itself should hold time credits that it can invest on behalf of the community to provide recognition for generalized co-production contributions, to support pay-forward interactions, etc. The exact way this should be implemented is not clear at all, but it is an important direction for us to investigate through prototyping.

5 Discussion and Implications

Contemporary life can be busy and alienating. Putnam (2000) detailed the decline of civic and political participation, neighborliness, sociality, and volunteerism, as well as citizen perceptions of trust, honesty, interdependence, and social and moral values in contemporary American society. Putnam analyzes these patterns as evidence of a decline in *social capital*, defined as societal norms of generalized reciprocity (Coleman, 1988; Putnam, 2000: 18-27). The famously dystopian title of his book, *Bowling Alone* (Putnam, 2000), depicts a world of solitary individuals who trust, care about, depend upon, and interact with one another less than their parents did. Time banking is a remarkable counter-current to this dismal social trajectory.

Co-production and time banking are key elements of an alternative social/economic paradigm for social service provision, community service exchange, and personal/community health and well being in which community members collaborate with

one another and with service professionals and institutions to produce and exchange services and other contributions throughout the community. Our objective is to contribute to these social movements through designing and developing a socio-technical infrastructure that mutually leverages both to build up the *core economy* (Cahn, 2010) of family and local community, and to enable societal-scale time banking.

In this paper, we described the scenario analysis front-end of a project to develop mobile time banking infrastructures, focusing on the distinction between service exchange scenarios and co-production scenarios. As we began this work, we focused on service exchange scenarios, and from that perspective, broadening consideration to co-production scenarios seemed at first a modest elaboration. However, through the scenario work and our prototyping (still underway) we have come to regard this distinction as more fundamental. Service provision scenarios can surely strengthen an alternate economy of people helping people in a value framework of unusual equity that gauges contributions to the collective good purely with respect to the time required to make the contribution. Strengthening networks of such person to person helping generates social capital and enhances communities. Better software infrastructures to support such service exchanges can contribute to this social innovation.

However, co-production scenarios of mobile time banking are more than a modest elaboration of this paradigm. Co-production seems to be governed by a logic of recognition not contribution: Members who contribute to a collective good are recognized, but not necessarily compensated hour-for-hour. Thus, the elderly neighbors who keep an eye on street activity and enhance neighborhood safety are not actively producing a service for someone in particular; rather, through their awareness and local knowledge, they are co-producing a generalized public good. Publicly recognizing such co-production is itself a generalized public good – a validation and encouragement for civic responsibility.

Our analysis of co-production scenarios for mobile time banking has specific design implications for our prototype. Our current approach, as described earlier, was based directly on Community Weaver (2013). It involves a closed exchange loop initialized by posting of service requests and offers for time bank members to accept, followed by a confirmation handshake (optionally including dyadic message exchanges, setting times and places, and checking one another's profile information), the service exchange itself, and then closed with the service recipient notifying the time bank to award time credit to the service provider's account, and to debit the recipient's own account (Bellotti et al., 2013; Carroll et al. 2013).

Based on the foregoing analysis of co-production scenarios we suggest that all stakeholders in a service be enabled to allocate credit – for co-production. Thus, as in Table 2, after Frank helps Tony with the tiling, Tony would notify the time bank to award credit to Frank, and to debit Tony's own account; this is standard time bank protocol. In our design proposal, Frank would be also be able to notify the time bank to credit Tony's account for his co-production of the tiling. Similarly, as in Table 4, the housebound member would award time credit to the person who called him/her for a chat, but that person, the caller, could also award credit to the housebound person who reciprocates and calls back.

Interestingly, and more challengingly, the notion of "stakeholders" in the service appears to be broader than that of stakeholders in the exchange itself, as in the original co-production scenarios from Ostrom and Jacobs. The retired couple in Table 5 are co-producing safety for their neighborhood but, in our example, have neither accepted an explicit request or made an explicit offer. They have not initiated or responded to a time bank interaction. Similarly, as in our mobile extension of community awareness scenarios, members who are out and about throughout the community, whose presence is continually co-producing community safety, are not doing so because of an explicit time bank interaction. In our design proposal, any member can assign nominal time bank credit for this sort of generalized co-production. For example, any of the neighbors up and down the street can assign Harry and Maude credit for their street life vigilance. As in a standard time bank interaction, the service that was co-produced (e.g. street life vigilance) would be entered into the system, and the co-producer(s) would be notified of the time credit.

Time credits earned through co-production interactions would appear, categorized as such, in a member's profile. Thus, when any member was checking another member's profile in the course of confirming a service arrangement (or in the course awarding co-production credit), he/she would see prior time bank activity, including prior co-production contributions. This elaboration of the basic time bank interaction is our initial design proposal for responding to the challenge of co-production. Although it seems odd at first to contemplate the approach of having exchanges of time credits beyond the basic recipient-to-provider exchange, broadening the concept of legitimate credit is, we believe, what the logic of recognition is telling us. Perhaps it is just odd in the context of a lifetime of socialization into a hard currency world of zero-sum economic games.

Community informatics is action research; it does not merely seek to understand community and technology, it seeks to transform and enhance community through new information infrastructures (Gurstein, 2007). Time banking and co-production are social concepts and mechanisms, but also social movements; they are alternative paradigms for economic exchange and social service provision, respectively, and they both entail and require new information infrastructures. By pushing beyond the basic "doing for" mobile time banking scenarios, as in Table 1, and extending our tools and infrastructure to address co-production scenarios, Tables 2-5, we are moving, in the terms of Glynos and Speed (2013), from *additive* to *transformative* conceptions of time banking. That is, we are investigating not just how voluntary time banking exchanges can exist within the broader context of a bureaucratic and market-based framework for social services and exchange, but how time banking and co-production could change our sense of value and valuation, and the ways we exchange services, appreciate one another, and develop as human beings.

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