Community Response Grids for Older Adults: Motivations, Usability, and Sociability

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Abstract

This paper discusses the motivation for a Community Response Grid (CRG) to help older adults improve their capability for coping with emergency situations. We define and discuss the concept of a CRG, briefly review the limits of current emergency response systems, and identify usability and sociability guidelines for CRGs for older adults based on existing research. The paper ends with a call to action and suggestions for future research directions.

Keywords: *Community Response Grid (CRG), emergency response, older adults, usability, sociability*

Introduction

According to a recent report from the U.S. Administration on Aging (AoA), about one of every eight Americans is now 65 years or older, and the proportion will increase to 20% by 2030 as the "baby boomers" reach later life (AoA 2005). Moreover, the U.S. Census Bureau statistics indicate that California and Florida – two geographic areas at high risk for disaster – had the largest number of senior residents in 2000, and these two States will double their 1993 senior populations by 2020 (He et al. 2005). Experts in disaster assistance often classify older adults as a vulnerable population that demands special attention in disaster situations[1] (Oriol 1999). This is due to a number of reasons related to older adults' impaired physical mobility, sensory limitation, and many other psychological barriers and socioeconomic constraints (Bengtson and Schaie 1999). As the size of this population is growing, it is becoming increasingly important to deal with the vulnerability of older adults before, during, and after a disaster.

Since the 9/11 terrorist attack, there has been a surge of research activities on emergency management systems supported by information and communication technologies (ICTs) (Schafer, Carroll, and Haynes 2005). Considerable attention has been given to integrating ICTs into emergency management systems for reliable communication and effective cooperation (e.g., Cox 2006; Huyck and Adams 2002; Turoff et al. 2004). Surprisingly, little attention has been paid to developing strong social networks empowered with ICTs to foster disaster management and emergency response throughout local communities. An emergency response system integrating social networks is particularly important to older adults because older people tend to rely on their existing social networks (family, friends, neighbors, etc.) for truthful information and reliable help to cope with disasters (Moody 2006). Also, the social capital (Putnam 2000) aggregated from daily activities of a community helps older adults reduce psychological distress and enhance positive perception on their health conditions (Viswanath, Steeie, and Finnegan 2006), which is beneficial to older adults in preparing for, responding to, and recovering from disasters.

This paper discusses the motivation for a Community Response Grid (CRG) to help older adults improve their capability for coping with emergency situations. We define and discuss the concept of a CRG, briefly review the limits of current emergency response systems, and identify usability and sociability guidelines for CRGs for older adults based on existing research. The paper ends by a call to action and future research directions.

Motivations for a CRG

Limitations of current emergency response systems

The traditional way of handling emergency responses is based on two models: a) many-to-one, telephone-based emergency report systems and b) one-to-many, top-down aid disseminating system (Jaeger et al., under review). The most well-known emergency reporting system – the 911 emergency phone service – employs a many-to-one approach. When help is needed from police, fire, or rescue services, most U.S. and Canadian residents can dial 911 to report crimes, seek medical assistance, and alert public officials to emergency situations. However, large-scale emergencies – such as natural disasters, public health threats, or terrorist attacks – can overwhelm the 911 phone system. Even when residents can get through to authorities, emergency services may not able to meet community needs. The Disaster Application Centers (DACs) established by the Federal Emergency Management Agency (FEMA) and state officials illustrate the one-to-many model. A DAC is a central hub where representatives of many different programs come together so that disaster victims may get many resources from a "convenient one-stop" service (AoA 1999, 2006). This centralized, top-down approach has its limitations in serving older disaster victims, too. For example, older persons may lack transportation to aid distribution centers, and service providers may not reach them in a timely fashion due to the impact of disaster. In

[1] There is no consensus definition of "older adults" as a population, which has often led to seemingly contradictory conclusions in the literature. This usually results from using chronological age as the single classification criterion and failing to recognize the huge diversity and rapid transformation of the population. With regard to emergency response, a typology based on older adults' health conditions (rather than age) may be useful to identify each individual's needs in dealing with emergency as well as his or her potential of assisting others. Such typology is important for CRG design and development, but detailed discussion about the issue falls beyond the scope of this paper.

addition, prior studies have shown that older adults may be reluctant to receive external aid due to a variety of psychological factors (Fernadez et al. 2002).

The utilization of ICTs in emergency management also follows these two general models described above. Both the U.S. government and non-profit organizations have been attempting to use the Internet in some form to assist citizens to deal with crises. The government efforts tend to be more oriented toward preparing citizens to be ready for potential crises (i.e., Ready America at http://www.ready.gov/america/index.html) while efforts of the non-profit organizations tend to be more oriented toward coordinating specific groups of response agencies improve services offered to victims. In neither case is the focus on preparing entire communities and coordinating between the members of these communities. On the other hand, current trends of research concerning Assistive Technology (AT) for older adults mainly focus on developing sensor-based monitoring devices that collect data from older adults and/or sends signal (reminders, warnings, medical instructions, etc.) back to them from a centralized agency (Audit Commission 2004). For example, by placing various types of sensors on everyday objects in a house, the "Aware Home" system being developed in Georgia Institute of Technology can sense potential crises and take appropriate actions (Mynatt, Essa, and Rogers 2000). Although these AT systems show great potential in improving older adults' safety and independence in both activities of daily lives and emergency cases, it still does not resolve the problems present in a centralized emergency management model. The data collected from each individual older person are transferred to a central database, which is similar to the 911 phone system that may be vulnerable to the impact of large-scale disasters. Also, in the case of an emergency, the centralized agency may not be able to reach each person in time or even transmit clear instructions to those who suffer form sensory and cognitive limitations.

Resident-to-resident (R2R) assistance with CRG

In light of the limitations with traditional approaches of handling emergencies, we propose a scalable Community Response Grid (CRG) for emergency response in a "geocommunity" (Gurstein, 2000). The geocommunity is geographically rooted in an offline physical community and is supplemented by ICT-empowered communication and information exchange. Compared to purely virtual communities such as MySpace or Second Life, the geocommunity network is an online/offline hybrid communication system built for people who are geographically proximate. "[T]he thrust is local support, local attention, and local focus: the world of interest is geographically bound, but technologically connected and empowered" (Haythornthwaite and Hagar, 2005, p.323). Notable examples of community network initiatives (CNIs) are the Blacksburg Electronic Village (Carroll et al. 2006), the Seattle Community Network (Schuler, 2005), and Netville (Hampton and Wellman 2003). These CNIs have demonstrated the effectiveness of computer networks in supporting local communities' goals and daily activities.

As a critical component of the community network, the CRG is a geographically-based sociotechnical network of citizens, supported by Internet-based and mobile technologies, who are ready to support and protect their community in times of emergency (Shneiderman and Preece 2007). One key feature of a CRG is its geographic scalability. A CRG can be developed at local (such as residence communities, college campuses, and small towns), city, state, and national levels. A CRG enables community residents to report local problems ranging from isolated emergent events such as fires, accidents, crimes, and individual health emergencies to large-scale concerns such as highly contagious diseases, natural disasters, and terrorist threats. CRGs can be implemented along with existing emergency response technologies (telephone, TV, radio, siren, etc.) to create technology redundancy needed for reliable and multimodal communication in the face of emergency.

A central idea of a CRG is to provide ICT-empowered resident-to-resident (R2R) assistance when it is needed. One notable effort toward the R2R assistance is the Citizen Corps (http://www.citizencorps.gov) coordinated by the U.S. Department of Homeland Security (DHS). Citizen Corps was created to recognize and coordinate volunteer activities in the time of emergency. Citizen Corps programs are implemented through 2,146 local Citizen Corps Councils that currently serve 74% of the total U.S. population (see http://www.citizencorps.gov/about.shtm). While programs like Citizen Corps still focus on training volunteers and preparing individual citizens, a CRG network will help those trained volunteers and first responders become more effective in identifying needs and offering help. In addition, the CRG network can incorporate everyday functions observed in other community-oriented initiatives such as Neighborhood Watch (participating neighbors agree to look out for each other and signal these proactive intentions by placing a sticker with a logo in their window) and

the Amber Alert system (http://codeamber.org/) (people sign up to get alerts about kidnapped children in their state).

How social capital can support CRG-centered community networks

This R2R assistance approach to emergency response relies on cultivating social capital and collective efficacy through a community network. Building a CRG around an existing community would leverage existing social capital and collective efficacy. Social capital includes the relationships and norms that shape the quality and quantity of a society's social interactions. It consists of the active connections among people—the trust, mutual understanding, and shared values and behaviors that bind the members of human networks and communities—and makes cooperative action possible (Cohen and Prusak 2001). While a CRG can take advantage of already existing social networks in the community, its success will depend on the development of social capital and collective efficacy among community members who trust each other to provide help when it is needed.

Evidence has shown the value of social capital and collective efficacy of a networked community in the face of large-scale emergencies. For example, the Pentalk Network was created during the foot and mouth crisis to assist isolated farmers deal with the crisis by receiving and disseminating the most recent information from government and other sources (Hagar and Haythornthwaite 2005). Moreover, the network helped cure the psychological fear that government sites failed to address. Another example is the ad hoc community organizations that emerged after the landfall of Hurricane Katrina. These local community networks, particularly those centered in public libraries, used ICTs to disseminate emergency supplies, request aid, search for the missing, and other vital functions (Jaeger et al. in press).

CRG for Older Adults

Older adults in a disaster

A geocommunity based CRG is of particularly importance to older adults in emergency situations. Insuring that older adults respond appropriately to life-threatening situations is not the responsibility of government alone. In Hurricane Katrina, all levels of government failed repeatedly (Moody 2006). Statistics show that sixty percent of Katrina victims were age 61 or older, including those stranded in nursing homes, hospitals, and private homes with no way to contact relatives or emergency personnel (ILC-USA 2006). "The more you look at the response to Katrina, the more problems you see. No one knew where the seniors lived. There was no system to track family members and doctors. … On top of that, communication systems went down so seniors couldn't call for help" (Vestal 2005). Another striking failure of centralized emergency management was illustrated by the fatalities during the heat wave in Europe in August 2003; nearly 15,000 people were killed by the heat and most of them were older adults living alone (Agence France Presse 2003).

Recognizing the failure of centralized emergency response systems in helping older adults cope with emergencies, Ready America recently added a new section on its website for older Americans (http://www.ready.gov/america/getakit/seniors.html). The message Ready America emphasizes through the website is for older adults to "create a support network for yourself before a disaster." The six guidelines for creating such a network are summarized as:

- Identify family, friends, and others who will be part of your personal support network.
- Share your emergency plan with everyone in your support network.
- Make sure everyone knows how you plan to evacuate and where you will go.
- Make sure that someone in your local network has access to your home and your emergency supplies.
- Teach those who will help you how to use any lifesaving equipment and administer medicine.
- Practice your plan with those who have agreed to be part of your network.

The "support network" promoted by Ready America is in line with our concept of R2R assistance in a CRG system. An ICT-empowered CRG will help older adults establish and sustain such support networks more effectively. For example, a Web-based CRG platform can serve both as a virtual community for social interaction and as a knowledge base for self-learning. A CRG system can also provide asynchronous and synchronous

communications via "anytime anywhere" mobile access which is more robust and reliable in the face of emergency. An effective CRG requires careful planning and continuous tuning from system developers, community monitors, and local members as the "participatory designers" (Reason and Bradbury 2001). Designing a usable CRG for older adults needs particular focus on issues related to usability and sociability (Preece, 2000).

Usability of ICT-empowered CRG for older adults

Usability is prominent in designing computer systems for older adults because physical changes associated with ageing – decrements of sight, hearing, motor functioning, hand-eye coordination, and cognitive processing – often increase the difficulty of using mainstream screen-based computer programs (Czaja and Lee 2002).

Although it is widely accepted that ICTs can be used by older adults to improve their life quality, the actual use of these products by the older population is still limited (Selwyn 2004). Poor usability is one of the major obstacles. Studies have found that older adults with poor eyesight often encounter difficulty with small fonts and icons on a LCD screens (LaFramboise et al. 2003). There is also a growing body of research literature on usability problems of current Web sites in regard to older users (Becker 2004; Nahm et al. 2004). Older adults are reported to have difficulty in navigating government websites, comprehending the large amounts of information, and completing the applications and procedures required to obtain crisis assistance (Fernandez et al, 2002). Moreover, poor usability has been identified as one of the major reasons that people do not participate in online communities (Preece, Nonnecke, and Andrews 2004).

In order for an ICT-empowered CRG to be usable to older adults, the physiological and psychological limitations associated with aging must be understood. Many older adults experience a decline of sensory capabilities as they age, including varying degrees of decline of visual acuity, dark adaptation, color discrimination, contrast sensitivity, and eye movement (Echt 2002). These changes in visual functioning have significant impact on the use of computers and mobile devices given that the interface is primarily based on visually presented information. Losses in hearing also have relevance to the design of CRG, as older people may have difficulty detecting high-frequency alert sounds that are commonly used in many computer programs (Laux, 2001). Older adults also generally have decreased movement control, especially when the movement is small and rapid (Smith, Sharit, and Czaja 1999). Further, older adults are reported to have reduced capacity of working memory, reduced ability of language comprehension, and slower information processing and knowledge acquisition (Holt and Morrell 2002).

All these age-related sensory, physical, and cognitive changes have posed a serious challenge to CRG interface design. Concepts like "universal design," "design for all" and "inclusive design" represent the academic endeavor of promoting "universal usability" (Shneiderman and Plaisant 2005) to serve traditionally marginalized populations such as older adults. On the industry side, the International Organization for Standardization (ISO) has released Guide 71 which includes a series of guidelines for developers to address the needs of older people and people with disabilities. The cellular phone industry, for example, has been trying to produce senior-friendly mobile phones. Emporia, an Austrian company that focuses on manufacturing mobile phones for older adults, has specialized phones which feature an emergency button, easy to navigate menus, large buttons, a large display with big lettering, hearing aid compatibility, and extra loud speakerphone volume and ringer settings (http://www.emporia.at/). A more radical approach was taken by Mobi-Click Ltd (a Swiss company), who designed a cellular phone that has only 3 buttons that are colored and can be programmed to include 3 emergency contact numbers (http://www.mobi-click.com).

The problem with the approach of "design for all," however, is that older users represent a diverse group with a vast range of age related characteristics. Gregor, Newell, and Zajicek (2002) categorize the older population into three groups: fit older adults, frail older adults, and older adults with disabilities. Each group has its own set of traits that challenges the "one-size-fits-all" design philosophy. It is a user population that has many types of disabilities in varying combinations and with varying degrees of severity. Therefore, CRG interface design might be facing the dilemma of approaching the lowest common denominator and satisfying the maximum number of users (Hawthorn 2003). A possible solution to this problem may come from the idea of multi-layer design in which a novice user can be provided with only a few options; after gaining confidence and experience, the user can progress to higher levels of tasks (Shneiderman and Plaisant 2005). Similarly, Newell and Gregor

(2002) proposed the "User Sensitive Inclusive Design" that encourages developers to seek out diversity in their design rather than homogenizing it.

Based on the "multi-layer" and "inclusive" design philosophy, we can develop a Web-based CRG system that integrates IBM's Web Adaptation Technology. Hanson and her colleagues at IBM have been developing software that can transform any Web page "on the fly" to make it more "senior-friendly" (Hanson and Richards 2004). The technology involves a server which stores a user's browsing preferences/capabilities and a client software embedded in Internet Explorer to adjust each Web page (such as font size and line space) before it is displayed on the user's screen. The software also bundles IBM's ViaVoice text-to-speech application in order to help low vision and low literacy users to use the Web. This type of adaptivity to the "dynamic diversity" of older population is critical in making an emergency response system usable for older adults.

Sociability of CRG-centered communities for older adults

As previously noted, the most significant value of a CRG is resident-to-resident (R2R) assistance. The willingness to offer such assistance depends largely on the quantity and the quality of social capital in the community. In order to offer R2R during emergency situations, we should strive to enhance the sociability of the CRG so that the concept of R2R is acknowledged and practiced by community members in their daily social interactions. The rationale behind this integrated design framework is that effective response to emergencies requires preparation ,such as improving social interactions among community members, identifying leaders or related experts, and educating and training older adults so that they can gain necessary knowledge and technical skills.

Having regular opportunities for interaction with other people has much significance for older adults. On the one hand, regular and effective communication is critical in promoting interpersonal trust. Trust of the sources of information available will impact participation and action inside a community. Older adults often minimize contact with society at large by creating separate social groups, seeking information mostly from within that social "small world" (Chatman 1999). Important information—even in an emergency—if it comes from someone perceived by members of a small world as an outsider, will tend to be ignored or dismissed, regardless of the content and the significance of the information (Burnett, Besant, and Chatman 2001). On the other hand, it is well-established that social interaction yields positive mental health effects (House et al. 1988) and helps to maintain or re-establish older adults' sense of empowerment and competence (Lee, Godbey, and Sawyer 2003). As the aging process continues, older adults may become socially less active and isolated by geographical distances from their family members. Maintaining a sound self-concept and meaningful connections with family and friends is essential to satisfaction in old age.

An ICT-empowered community network has the capability of providing a home-centered social network. Prior research suggests that participating in online communities will reduce isolation and provide expanded social network for older adults to share their lives with others. Although older adults may be more cautious in participating in Internet-based communications, once inside an online community older adults are usually "warm and supportive, funny and informational" (Clark 2002, p. 120). Zaphiris and Sarwar (2006) compared sociability in a newsgroup for teens (*alt.teens*) and in a newsgroup for older adults (*soc.senior.issues*) and concluded that the newsgroup for older adults was more interactive and showed a stable and consistent environment with a high level of activity, with greater reciprocity through more repliers, returnees, and fewer unreplied messages. Older adults like the feeling that they can contribute to a group, give and receive support from the community, and help others cope with problems.

In this sense, older adults, especially "fit older adults," may be considered an underutilized resource for local communities in coping with disasters, given the fact that 65% of American Red Cross disaster volunteer workers are age fifty-five or above (Oriol 1999). In a recent National Council on Aging (2006) survey, older adults commonly indicated that participating in meaningful volunteer experiences were among the most preferred activities. High volunteering rates among older adults are likely due to more free time their desire to be socially connected, and their altruism (Wilson 2000). The same incentives that cause such participation during ordinary times apply even more during disasters and their aftermaths. Older adults could be a valuable resource for younger adults in emotional coping in the face of disaster. They may be able to impart a perspective based on lifetime experience and to suggest effective practical coping strategies (Zeiss, Cook, and Cantor 2003). Like online engagement, volunteering is a way for people to become integrated into their community. It provides

opportunities for older adults to sustain their sense of well-being, as well as opportunities to serve their communities. The offline volunteering activities in the older population lays a solid foundation for their active participation and high collective efficacy in an online/offline hybrid CRG-centered community network.

Conclusions and future research

As a new approach to emergency response, a geocommunity based CRG system is centered around the concept of R2R assistance provided *by* and *for* the fellow residents in the community. The CRG system empowered by appropriate technologies would be able to provide needed help to older adults in a timely and meaningful way. Moreover, a Web-based virtual community built around CRG system provides a space for social interaction which would strengthen social ties among residents and cultivate social capital inside the community.

However, designing a "senior-friendly" CRG system is no easy task. We need to consider many factors that may impact the system's usability and sociability. Based on our conception of the system and previous research, we have identified the following key considerations:

Usability considerations

- Older adults' sensory, cognitive, and physical capabilities (Czaja and Lee 2002).
- Multi-layer design accommodating the dynamic diversity of users (Shneiderman and Plaisant 2004).
- Adaptive technologies for customizable interface (Hanson and Richards 2004).
- Seamless integration of hybrid communication technologies (Web, mobile phones, etc.) (Shneiderman and Preece 2007).
- Robustness of communication in various types of emergencies (Cox, 2006).

Sociability considerations

- Focusing on local interest, local need, and local assistance (Haythornthwaite and Hagar 2005).
- Integration of existing social activities with CRG.
- Cultivating trust and social capital (Cohen and Prusak 2001).
- Incentives for initial participation & sustained engagement (Constant, Sproull, and Kiesler 1996)

Few systematic studies have been done to investigate the potential and possibility of R2R assistance in emergency situations, and even fewer (if any) have focused on older adults. This paper provides a starting point for research on how an ICT-empowered community network would help to prepare older adults for emergencies. Future research is needed to empirically test a CRG system and verify ideas proposed in this paper. Some key questions to be answered are:

Key questions

- What are older adults' information needs related to emergency preparation and response?
- What can be done through CRGs to help older adults and what cannot?
- What technology is best for which strata of older adults?
- How can the effectiveness of the CRG system be evaluated, especially in terms of its effectiveness for helping older adults?

Certainly, there are many other considerations and questions that need to be addressed in the process of planning and developing a CRG, such as logistics, cost, training, government involvement, and other contextual factors. Developing such a complex sociotechnical system calls for a collective endeavor from researchers, developers, federal, state and local agencies, and older adults themselves as participant designers.

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