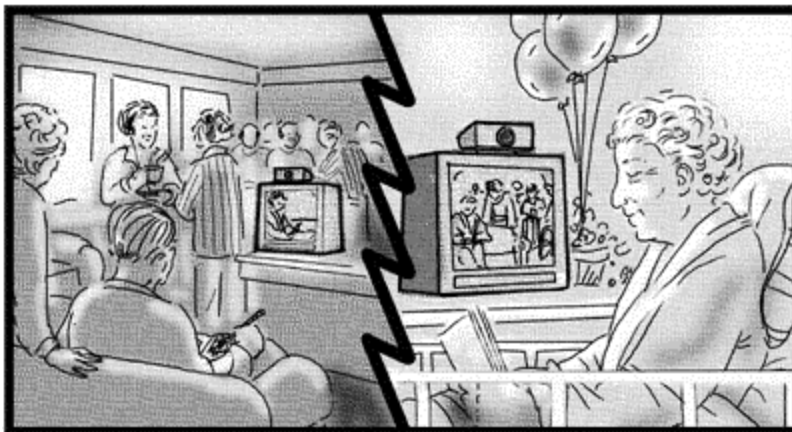PROJECT REPORT, April 3, 2001
Telewindows:
Changing the Social Fabric of Life for Homebound Elderly

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PROBLEM STATEMENT

As we age, increasing disability and loss of mobility often lead to a decline in social networks and support. The result is greater isolation and decline in mental health and quality of life. Interventions such as socialization, day care centers and senior centers are in part constructed to alleviate and delay such isolation through group activities and maintaining a social engagement with friends, family, and social volunteerism. But there comes a time, after a protracted illness, a stroke or some other life event--often an acute health problem--when many elderly people find themselves prohibited from continuing to participate in their social groups.

Emerging telecommunication technologies could help to change the social fabric of homebound and mobility-limited people's lives. Like a window in a room, a Telewindow can be opened anytime to see and hear and be seen and heard by those on the other side of the window. A Telewindow uses audio, video and network technology to open a window between two locations. Although a Telewindow could be used like a telephone to call someone to engage in conversation, we envision a different use of Telewindows. Specifically, we suggest that Telewindows be opened and kept open for long periods of time, providing a continuous social presence connecting the two locations. Sometimes there will be conversations. Other times it will be more like being in the same room together going about daily life. Telewindows can enable a new kind of social experience: an ambient presence, a shared window between one individual's life and the lives of chosen social group, friends and/or family.

Community support is crucial to the aging population (Silverstein & Litwak, 1993). Most elderly people maintain an active social life and prefer to interact with other adults their own age (Barrow, 1986). The elderly often report more satisfaction with peer friendships than with relationships with their own children (Hummert, Nussbaum, & Wiemann, 1994; McKay & Caverly, 1995) perhaps because friendship ties and social activities are voluntary and therefore allow a person to have contact with people who may share similar interests and values (Halpern, Shroder & Citera, 1996). Older adults may see a change in social networks brought about by the loss of personal transportation or physical disabilities and illness (Barrow).

Relationships with friends, family members, and health care providers are all important to the older adult. Research has shown a positive relationship between the quality and frequency of elders' relational interaction and their life satisfaction (Hummert, Nussbaum, & Wiemann, 1992). Socializing is a major motivation for most older people (Furlong, 1989), and many older adults maintain an active social life (Barrow, 1986). Older adults are more likely to find friends and sociable neighbors when they live in public housing for the aged or retirement communities, as opposed to the typical urban or suburban neighborhood with low proportions of elderly (Barrow). Friendships with

peers are more effective alternatives to marriage and work roles than are relationships with children (Barrow).

Social isolation is the absence of specific role relationships such as friendships, which are generally activated and sustained through face-to-face interaction (Bennett, 1980). People who are socially isolated spend a significant amount of time alone (Langford & Keating, 1997). Isolation, then, implies barriers to interaction. In other words, isolation is the deprivation of social contact and content. The maintenance of social connectedness is an important aspect of successful aging (Bandura, 1997). Major life changes in social ties in later years, brought on by retirement, relocation, and loss of friends or spouses, may contribute to isolation in the elderly population.

Research has shown that as many as two-thirds of older persons in the United States are isolated from the main stream of society (Durant & Christian, 1990). Studies have shown that older persons who live alone and those who have health problems are more likely to be isolated (Durant & Christian). Furthermore, studies have shown that isolation and lack of connectedness to others are predictors of morbidity and mortality (Rowe & Kahn, 1997). While isolation and loneliness are not the same thing, isolation often leads to feelings of loneliness. Rokach and Brock (1997), found that loneliness is prevalent among the elderly population, and is often associated with depression and anxiety. Loneliness has been described as painful, distressing, and disturbing, and has been linked with substance abuse and suicide. Unfortunately, loneliness often has a stigma attached to it as well. Lonely individuals are sometimes regarded as deviant or generally undesirable (Rokach & Brock). Because of this stigma, most lonely people do not discuss their actual thoughts and feelings.

The effects of isolation may be reversible through resocialization and communication (Rathbone-McCuan & Hashimi, 1982). Communication has a positive correlation with well-being (Parker & Parrott, 1995), and can be the key to social survival and the means for establishing personal integrity, maintaining self-efficacy, and exercising cognitive skills (Tamir, 1984).

The consequences for social life and daily activities of a slow accommodation to a separation from others as a result of disability are undoubtedly complex. Yet, little research has addressed this complexity and it certainly has not been studied in the light of technological opportunities that make distant social presence with families and friends more available, sophisticated, and inexpensive.

TELEWINDOWS FOR REMOTE SOCIAL PRESENCE

Little systematic research exists in the area of mental health and separated elderly Americans. Do the homebound gain a stronger sense of access to friends and family solidarity through the use of new communications technology? Can such devices bring homebound elderly closer to friends in space and time? . We do not know the extent of use or the impact of communication technologies on maintaining solidarity with friends and its relationships to sustaining mental health. Long term reorganization of a homebound individual's life around such separations from friends and family remains a little documented arena of human experience. It is vital to explore uses of communications technology to provide remote social presence as well as document the feelings of satisfaction and frustration surrounding such uses.

Studies of the introduction of the telephone suggest it solidified and deepened social relationships, most notably for women, isolated farm wives, the middle aged and the elderly (Fisher, 1990). Potential uses of computers by older adults include communication and social interaction, access to on-line support, opportunities for entertainment and for learning, and health care information (Furlong, 1989). Older adults are not only interested in learning to use computers but they are quite adept at doing so (Furlong). Online communication can provide information on specific interests to older adults, including answers to questions about finances, health care, and government legislation. An on-line network can minimize isolation and loneliness, and provide an opportunity to meet people with similar interests. Seniors in isolated areas have used communication networks to communicate with people their own age through electronic mail, computer bulletin boards and computer forums, on a wide variety of topics (Elmer-DeWitt, 1990).

Telephones and online communication are conversation-driven social experiences. We envision Telewindows being used differently to provide a new form of remote social presence. Sometimes there will be conversations, but like those physically present at the Center, homebound seniors won't close the Telewindow simply because a conversation has ended. Telewindows are a means of spending time together, and perhaps sharing an event or activity.

Because Telewindow technologies have almost no penetration in business or home markets, our Telewindow will be a dedicated information appliance only be capable of opening between two locations -- the Senior or Adult Day Care Center and the homebound elderly person's living room. It will be a little like the historic presidential hotline to Moscow: the red phone.

Much of the research on social presence has studied social presence in mediated communication between strangers who have never met each other face to face (e.g., Sudaweeks, McLaughlin, and Rafaeli, 1998). Other social presence research compares effectiveness of different technological channels for organizational communication, in a context where face-to-face and other communication alternatives (email, phone, letter) are equally possible (e.g., Rice, 1993). Our context is different. The interpersonal relationships between a homebound elderly person and the Senior or Adult Day Care Center they recently were part of are already established. People know each other. The culture of the Center is established and known. Therefore, the Telewindow technology does not need to be well suited for conveying social cues involved in getting to know someone or for negotiating and establishing community practices and goals (a function of online communities referred to by Preece (2000) as sociability).

Lombard (2000) initiated and then synthesized lengthy multiparticipant listserve discussions into an explication of presence. Lombard suggests *social presence* "occurs when part or all of a person's perception fails to accurately acknowledge the role of technology that makes it appear that s/he is communicating with one or more other people or entities." This definition implies that humans should be and are constantly

and consciously acknowledging the role of technology while we try to communicate with distant others.   Occasional lapses in this vigilance yield a sense of presence.

Lombard's definition of social presence focuses strongly on the illusion of shared physical space and not on emotional interpersonal experiences of connectedness. The goal of the homebound Telewindow user is to experience meaningful connections and feel present in time and space with the other Center participants despite the handicaps inherent in the system.   It is unlikely homebound participants will report "I forgot I was watching fuzzy, bad quality video and thought I could actually pick up the ping pong paddle and play." It's unlikely the Center participants will suggest "I forgot she was homebound, it seemed like she was sitting right here." We hope a homebound person might say "it was great to see and talk to my friends, and to find new ways to participate in some of my favorite activities." Compelling aspects of social presence relate more to exercising interpersonal relationships than to forgetting technology is part of the experience.

Being part of a Senior Center via a Telewindow instead of in person is a severe handicap, yet also a privilege to have a personal window opened to the Center. The connections only happen at periodic planned times. It can be hard to see and hear people at the center. Participants can only see where the camera is pointing and only talk to people who are near the speakerphone. The connection is asymmetrical in many respects. People at the Center see a fairly close-up shot of the homebound participant, and generally can hear what the homebound person says. But the homebound person sees a wide shot set up to show as much of the center as possible, and usually has trouble hearing people who are not near the phone. The homebound person is usually alone or with a caregiver, while people at the Center have many other physically present people to interact with.

Do the limitations of Telewindows negate their potential benefits? Our target population allows us to frame and test two dramatic competing hypotheses:

1) Telewindows cannot replace or substitute for face to face proximity in social relationships of the elderly; thus, we will observe no change or even an increase in isolation, loneliness, depression, feelings of powerlessness and a related decrease in self-esteem, morale, a sense of belonging to a community and a positive outlook on the future for the recently homebound participant as the duration of time they have been homebound continues.

2) Telewindows can substitute for face-to-face social interactions, thus allowing for positive social relationships to continue by using new media; thus, we will observe a decrease in isolation, loneliness, depression, feelings of powerlessness and a related increase in self esteem, morale, a sense of belonging to a community and a positive outlook on the future for the recently homebound participant over time.

Different elderly groups need to be observed and analyzed both during and after the demonstration in order to determine the value of each hypothesis (#1 and #2 above) and our ability to generalize its capacity to explain people's behaviors and explanations of their the experience. We expect and predict more support for the second hypothesis because: 1) people will want to sustain prior face to face relationships even if they must use a Telewindow to do so, and 2) the fact that disability and loss of mobility may be temporary (even among the aged) encourages us to think that especially people who hope someday to return to their prior lives after their recovery will actively want to sustain their relationships during their rehabilitation and recovery. Even people with a less satisfying prognosis may want to sustain their social relationships.

RESEARCH METHODS

Selecting the Telewindow Technology

Although none are optimal, a variety of technologies could be used as Telewindows. Choosing among them is a matter of balancing cost of the unit, cost of the network, frame rate/quality of audio and video, and ease of use. Figure 1 compares four of the

main alternatives available when we began the project: a self contained ViaTV picturephone that works over standard phone lines; a self contained PictureTel unit over ISDN phone lines; a portable PictureTel unit that operates in conjunction with a computer over ISDN phone lines; and computer conferencing over standard phone lines.

Figure 1: Comparing Possible Telewindow Technologies

	ViaTV Picture Phone	*PictureTel Swiftsite*	*PictureTel Live 200*	*Desktop PC Video Conferencing*
Connection	Dial-up telephone	ISDN	ISDN	Dial-up telephone
Hardware cost per node	$1,800	$8,995	$2,695	$2,300
Requires computer?	No	No	Yes	Yes
Ease of use	Easy	Moderate	Hard	hard
Audio input	Phone	Microphone	Microphone	Microphone
Video display	TV set	TV set	Computer monitor	Computer monitor
Video quality	Poor	Good	Good	Poor
Audio quality	Moderate	Good	Good	Poor
Network installation cost	$142	$630	$630	$142
Network monthly cost	$18	$42	$42	$18
Overall cost per Telewindow pair for 3 months	$4,046	$19,502	$6,902	$4,992

The comparatively low cost of Via TV would allow us to conduct four case studies within the project budget. We felt it would be easier for seniors and centers to use than either computer-based solution. The video quality was poor but could be displayed on a TV monitor of any size, and the audio was moderately good.

Selecting Homebound Seniors and Centers

Three of the case studies were planned to be of recently homebound seniors who had regularly attended Senior Centers and one case study was targeted for a newly homebound senior who had been part of an Adult Day Care Center.   Informal estimates by Senior Center Directors in Michigan suggest approximately 20 to 28% of the over 60 population in a community attends or makes use of a senior center's services for one reason or another.   At any given time, approximately 3 percent of senior adults age 60 or older have difficulty or are unable to perform activities of daily living (ADLs) or instrument activities of daily living (IADLs) without personal assistance, supervision, or cues. ADLs include eating/feeding, dressing and bathing. Therefore, they are eligible to receive adult day care services in order to prevent and/or postpone deterioration that would likely lead to institutionalization. By definition, the former senior center participants live at a higher level of functioning and better able to understand and articulate their responses to the experience. For that reason they may be more likely to benefit from a Telewindow.

The Michigan Office of Adult Services offered competitive mini-grants to Senior Centers and Adult Day Care Centers who submitted proposals to participate in the project. To be considered for participation a center needed to be willing to devote staff time to the project and they needed to have a recently homebound senior who met the following criteria:

- recently homebound

- a recent history of active and positive involvement in the center

- volunteered to participate in the Telewindows project because they wish to remain in regular communications with friends at the Center

- articulate, can narrate their experiences and their behavior in response to open-ended, semi structured interview that are audio recorded.

Three Senior Centers and one Adult Day Care Center best met the desired criteria and were selected for the study.

Ethnographic Research Methods

Because of the small sample size in the pilot ethnographic/qualitative research is an essential method for field interviewing and data analysis. It can help us understand two essential questions about the impact of Telewindows: 1) how individuals use a new technology and 2) how their personal experiences using Telewindows has both changed and permitted continuity in their social relationships (with family, friends and center staff) and their self-esteem. Hence, two main aspects provide the focus for this research: 1) their use and narrative response to the technology and, 2) their own evaluation of the impact of their experience using Telewindows on their social relationships and self-esteem.

The ethnographic component of this investigation centers around the content and meaning of each participant's narratives concerning their experiences using Telewindows. Our purpose is to get at the main significance of the experience to them when they discuss their adjustment to being disabled and homebound and the role of Telewindow technology in their daily lives. A topic-centered narrative is gathered to enable us to identify major themes, concerns and experiences that relate directly to an individual's adjustment to the new technology in light of their disability. Given the small sample for this pilot our ethnographic analysis using narratives is an appropriate method in that it will call attention to participants' own descriptions of their social relationships.

Ethnographic interview data are comprised of audio-taped and transcribed qualitative narratives from the participants (Spradley 1979, Agar 1984, Reinhartz & Rowles 1988, and Fry & Keith, 1986). Such narratives allow the participants to become aware of the significance of stories they tell about their experiences (Climo 1995, 1992, 1990, 1988). The use of open-ended questions and discussions enable the participant to describe and incorporate individual experiences with the technology in a coherent manner (Agar 1980, Agar & Hobbs 1985) Thus, each interview begins by asking the participant to use his or her own words to explain the meaning of home-boundedness and disability. Thus

many participants are "key informants" (Pelto & Pelto 1979), a participant who consciously conveys his or her experiences with the new technology to the interviewer.

Ethnography has a need to see the world thorough the eyes of the actors (Berger & Luckman 1966). A personal experience emerges through the participant's own words and language usage. In turn, the interviewer pays close attention to the participant's descriptions and interpretations of his or her experiences with the new technology. The interviewer maintains face to face communications and a dialogue with the informant to create meaning from his or her narratives (Frank 1979; Frank & Vanderburgh 1986). The participants' own words capture their sense of the meaning of their experiences (Marcus & Fisher 1986, Clifford & Marcus 1986, Swarez-Orozco, 1994). The use of open-ended question allow such meanings to emerge. Each interview will begin by asking the participant to explain in his or her own words the meaning of disability, separation from friends and family, and being homebound.

The interviewer in turn concentrates on the interview then reads the transcription to identify relevant themes and topics which will be shaped in to more focused questions in later interviews. These include incomplete thoughts and ideas saturated with emotions. By asking all four informants the same general questions their answers can be compared to illustrate a range of experiences with the technology. The ethnographic interviewer will try to reveal shared experiences, interpretations and "voices" (Climo 1992) as well as the variations within the group. Each interview requires one to two hours and focuses on a number of topics.

Three complete transcriptions were taken from each participant: the first near the beginning of the investigation and the second towards the end of the ten week study period at each case study location.   Initiating questions for semi-structured, open-ended, focused narrative interviews allowed us to measure each individual's perception and response to key experiences characteristic of physical separation from family, friends, and familial group activities:

1) Your expressed motivations for communication with friends, family etc. and continued involvement in _____center; especially the use of Telewindows: What is you family, friends response to such usages.....again, as revealed in the participant narratives.-_____

2) What is the expected, then later, what is the personal meaning of such communication in your life experience?

3) What are your personal/emotional responses to loss as a result of your disability? How long will it take before you return to prior activities? What alternatives do you see if it takes a long time or if you probably never will?

4) What is your frequency of use of Telewindows. What is satisfying about your use of Telewindows? What is frustrating about your use of Telewindows?

In early interviews, participants were encouraged to speak in reply as long as possible. (The interviewer's responsibility was to keep them on the topic.) Both negative and positive aspects of their experience needed to be included. Participants were asked to use their own language organization, words, phrases, syntax etc. to reveal their experiences and its impact of self-esteem, morale, depression, sense of powerlessness, isolation, loneliness, sense of belonging to a community. Following each interview the narratives were transcribed, the interviewer read it carefully and in the next interview followed up with new and more in depth questions from earlier relevant discussions. Using the informant's own words from the prior interview yields better results in the follow-up discussion and elaboration. The ethnographic interview brings the participant back to relevant topics that emerged earlier.

The follow-up interviews after 10 weeks of Telewindow use were intended to provide some preliminary understanding of how participants express their own emotional and social states concerning Telewindow use. We focused on emotional issues of self-esteem

and morale, depression, powerlessness, isolation/loneliness, and sense of belonging to a community of friends:

1) Discuss the meaning of disability and homeboundedness based on your experience.

2) Discuss your expressed motivations for communication with friends, family and continued involvement in _____center; especially the use of Telewindows: What is your family, friends response to such usages? (again, as revealed in the participant narratives)

3) What is the expected, then later, what is your individual sense or significance of such communication in your life experience?

4) What are your emotional responses or reactions to loss as a result of your disability? How long will it take before you return to prior activities? What alternatives do you see if it takes a long time or if you probably never will?

5) What is your frequency of use of Telewindows. What is satisfying about your use of Telewindows? What is frustrating about your use of Telewindows?

6) What was difficult to learn about the technology? Are you still having problems connection? What is problematic about using it? What seems to work well? Are there any other uses that you discovered but hadn't anticipated? How do you feel about your communications with friends/staff at the center?

7) self-esteem/morale

8) depression

9) Do you feel you have a good ability to recover? What methods do you use to help yourself recover? (e.g. exercise, food compliance with

medical regimens, will and determination) How dependent on others
do you feel?

10) Is there a difference between loneliness and isolation? Have you felt
either or both? If yes, when and why? Who or what helped you get over
it, if anything? How do you help yourself?

11) Do you have as much contact with friends now as you had before your
disability? What forms do your contacts take? Are they as satisfying
now as they were before, or more?

Measuring Telewindow Use and Reactions at the Centers

Staff at the participating centers were given a daily log form and asked to keep track of
what hours in the day the Telewindow was activated, what activities were happening at
the center during the connection, technical problems encountered, and how many
different seniors and different staff members at their center interacted at least once with
the connected homebound senior.   Staff members were encouraged to note personal
observations about how the Telewindow is used at the center in their logs.

Surveys were administered to staff and seniors at the centers at the beginning, middle
and end of the ten week the Telewindows project at each location. The surveys asked
about reactions to the Telewindows communication technology. How easy was it for
staff and seniors at the centers to use the Telewindow? Where in the home and in the
center did they place the unit? What would they change to improve the Telewindow? Is
the screen big enough? Would they like a life-sized display? Is video quality good
enough? Audio?   Did the technology work?

The surveys also asked about reactions to using Telewindows to connect to a
homebound senior. Was there a sense of being with the distant person? Was it
pleasant? Was it disruptive? Did they get a sense of how the distant senior was feeling,
emotionally and physically? Did they feel close to the distant senior? Were center staff

members able to integrate the use of the Telewindows technology with group activities taking place at the center? How did having the Telewindow "open" change the activities and experience at the center? Is it better to have the Telewindow open all of the time or just some of the time? Would seniors like to use this technology themselves someday, if life events cause them to be shut in? Would they like a Telewindow to their grown children or grandchildren?

Operational Complications

After committing to Via TV as our Telewindow technology for the project we discovered in local trials the audio and video quality are better when using two separate phone lines even though a single phone line works. Using two phone lines increased the cost (requiring installation and lease of two phone lines at each center and home instead of one and adding a small handset phone in addition to the speakerphone). It also increased the complexity of installation and use at the homes and centers. An even larger impediment we failed to anticipate was the difficulty of installing additional phone lines at residences and centers. Installation sometimes took large numbers of calls to the local phone company over several months and sometimes turned out to be completely impossible, causing us to use a single phone line at some locations.

About the Sample

Four recently homebound seniors participated in the project: three women and one man all in their mid to late 80s. They were interviewed, Telewindows were installed in their home and their Center, the Telewindow was used for at least 10 weeks, and they were interviewed again. All four centers turned in logs of Telewindow use. Survey participation by the Centers was more sporadic. 70 surveys were collected prior to installation of the Telewindow; 67 were collected partway through; and 56 were collected at the end of the Telewindow period. One center turned in only time 1 surveys. Two centers turned in time 1 and time 3 surveys. One center turned in times 1, 2, and 3 surveys.

Telewindow were used differently at each location. Ethnographic and log results will be reported for each of the four case studies. Two of the four centers used Telewindows most closely to what was originally intended. Those two centers also collected surveys when we had intended: prior to installation of the Telewindow and after the Telewindow had been in operation. Survey results in anticipation of Telewindows and in reaction to Telewindows will be aggregated across the two most successful centers and before and after reactions will be compared.

ETHNOGRAPHIC AND LOG RESULTS

Senior Center Location 1: Bob
<u>Brief description of the homebound participant</u>

Bob is in his mid-80s and became homebound following a near-fatal car accident. Before the accident he spent his winters in Florida and divided his summers between Michigan and New York. As a result of the accident he spent 30 days in the hospital, then was confined to bed for six weeks after he was released from the hospital. During this time he stayed with his daughter in Michigan, and nurses and physical therapists would visit him daily and weekly for rehabilitation. Even as he became stronger and able to move around, he was still homebound because he was not allowed to drive for several more months.

<u>Brief description of installation hassles for technology and what we used:</u>

We encountered difficulty with this installation because the home was considered a rural or remote area and the phone company had to install new lines so additional service could be delivered to the home. This took several weeks to accomplish and resulted in temporarily cutting existing service to the neighborhood.

We ended up using one phone line at this location because the service from the home to the senior center was long distance. The senior center agreed to have Bob dial in on the

center's 800 number so we only used that one phone line. The senior center was given a 27" TV and Bob was given a 20" TV for the project.

What did Bob expect from a Telewindow:

He didn't have any expectations to begin with because he didn't understand the technology. After we talked about it and brought the equipment into the home he began to ask questions about being connected to his card group. His daughter, on the other hand, was hoping to use it to connect from her office to check in on him and to watch the nurses and physical therapists during their visits. This did not happen.

Bob and his Senior Center used the Telewindow mostly for cards and socializing. One day they did exercise, but only once. They were waiting for a cart to be able to move the Telewindow around, but it did not arrive in time for the study period.

Log Analysis: How the Telewindow was used

Logs were kept from June 26 to July 29 and then again two days in August, 2 days in September and three days in October.

During the 50 days of log records, 14 attempts were made to connect the homebound senior's Telewindow to the Telewindow at the Senior Center for an average of once every 3.6 days. All of the attempts to connect were successful and no technical problems were reported in the logs.

It may be the logs are not complete – in the accompanying letter from the Senior Center, it says the homebound senior uses the Telewindow 2-3 times per week, and goes to the center once a week.   The homebound senior was elated. He can now be at home and visit with people while he is still building up his strength. Though he has used the center in the past, he is now establishing relationships from home.

During the test period, the Telewindow was connected for a total of 77 hours, or an average of 5.5 hours per session. The generally started in the morning around 9 or 9:30 and continued through mid-afternoon. The Telewindow was kept on for long periods when it was connected.   About 30% of the time some interaction was occurring. 11% of the interactions were between the homebound senior and staff at the center, 39% were with other seniors, and the remaining 51% were with both seniors and staff.

Again, no technical problems were noted, including no complaints about audio or about picture quality.

The director of the center found the homebound senior became much more social with the use of the Telewindows. It allowed him to be part of the center without being uncomfortable. Prior to using the Telewindow, he participated about once a week. After he was hooked up, he wanted to play cards every day. He even began to take organ lessons at the center. He has now bought a keyboard and practices daily.

As he became more active at the center, he wanted less to do with Telewindows. He no longer wanted to be a casual onlooker, now he wanted to participate in the center.

A personal note from the daughter of the participant – the daughter says she has seen a marked improvement in her dad's attitude towards life. She believes this is a direct result of being involved with the Telewindows project.

Their next endeavor with the Telewindow will be a client who needs follow-up physical therapy. The director believes Telewindows will be the next step in delivering services to their customers. She thinks the future will see a linkup of homebound participants to the Center via a networked Telewindows. People at home will be able to participate in fine arts, exercise or socialization activities.

After the fact, what did Bob like and dislike about using the Telewindow:

One of the major benefits that this group mentioned was that Bob became much more social as time went on. After the accident he had been quite depressed and withdrawn. As he was able to see friends he became more social and animated. The center staff reported that the Telewindow allowed him to gradually return to activities, while being able to shut it off when he felt tired or depressed. Bob said of the Telewindow: "not only could you talk to people [on the other end] but you could see the exercise class. I never played bingo before, but I could've played bingo [with this technology]."

The biggest dislike was they felt the technology was not easy enough to use. They were concerned about the number of cords required of all the equipment and would get easily frustrated if the connection did not work on the first attempt.

Bob's daughter also commented that the 20" television was too big for her home.

Other reactions/comments you gathered from family or senior center contact:

The center mentioned that the system would have worked more smoothly from the beginning if there had been a longer training program. They suggested someone from the project stay at their location for two weeks to trouble shoot any technical difficulties.

Senior Center Location 2: Helen
Brief Description of the homebound participant:

Helen, 85, had been a very active senior until about two years ago, when she began to have heart problems. She had been especially active in fitness programs at her senior center. As a result of being homebound her demeanor changed, according to staff at the senior center. She was more depressed and even aggressive at times.

Brief description of installation hassles for technology and what we used:

The installation at the senior center was uneventful. Jacks were installed both in the fitness room and in the activities' room. The center purchased a rolling cart so the television and camera could be moved between the two locations.

The installation at Helen's home was basically uneventful. Helen lives in a senior residence which at the time had it's own phone company, so we worked directly with this private phone company to install lines. This location used two phone lines; Helen was given a 20" television; the center was given a 27" television.

<u>What did Helen expect from a Telewindow:</u>

Helen expected that she would be able to use the system to interact with her fellow teammates on the senior center tennis team. She planned to continue her role as coach of the team from her living room.

<u>Log Analysis: How the Telewindow was used</u>

Helen and her Senior Center used the Telewindow for a wide variety of activities and locations including the lobby, pool room, cards, needle point, crochet, bocci, chair exercises, aerobics, table tennis, badminton, Tai Chi, an ice cream social, "String of Pearls" music choir practice, and the fitness room. The center staff moved the Telewindow around a great deal to allow the homebound senior to participate in different activities.

Logs were kept during the four week period from July 19 to August 13. During that period, 14 attempts were made to connect the homebound senior's Telewindow to the Telewindow at the Senior Center. Seven of the 14 attempts encountered at least some technical difficulties; three of the seven attempts never successfully connected and the other four eventually worked.   The first two days they could not get the system connected at all. Then it worked fine for 2 days. Five days passed when the system was not used, and the next time they tried to connect, they eventually discovered the homebound senior had disconnected the cables on the unit. After that, they would go

for one or two sessions without problem, then encounter some minor technical problems, then be fine again for a while. The cable apparently fell out once again, and a center employee drove out to reconnect it. When the participant unplugged the cables the first time, instructions were removed. The participant objected, insisting she wanted the information back. They brought the instructions back.

During the test period, the Telewindow was connected for a total of 51.8 hours, or an average of 4.7 hours per session. The generally started in the morning around 9:30 to 10:15 and continued through mid-afternoon. It was used most days, on a regular basis. About 56% of the time some interaction was occurring. 36% of the interactions were between the homebound senior and staff at the center, while the remaining 54% were with other seniors or with both seniors and staff.

Audio was a frequent problem – when the homebound senior was near her speakerphone, the sound was fine. But she frequently forgot she had to be near it, at least for the first five sessions. Then she learned and the audio got better for the rest of the trial period. Finally in the third week, she put a chair and small table near the Telewindow, and the people at the center were able to hear MUCH better.

The center wrote extensive comments every day in the log.   They suggest the Telewindow should be more different than all of the other electronic devices, perhaps with soldered cables not detachable.   The participant wanted her screen larger. The center figured out how to do that. The picture is not always clear – it depends a lot on the subject matter (light or dark, moving or still). So sometimes it is too hard to recognize who you are talking to. They also mention they had to turn off the ringer on her telephone, because she kept answering it rather than letting it autoanswer.

The homebound senior was initially frustrated at not being able to coach table tennis over the Telewindow – she was used to being active, and did not like to just sit and watch.

When she gets tired, she goes to the bedroom for a rest, without disconnecting. She has a doll she puts in camera range with notes that say "out to lunch" or "break time."

Some days and activities were more satisfying than others.   At first it was frustrating to watch sports and not be able to coach the way she used to. Depending on the camera angle and where people were playing table tennis, sometimes she actually could offer points. She enjoyed the "Tai Chi" course and the Tai Chi man. She participated in chair exercises and aerobics some of the time. And she seemed to enjoy the conversations with people.

The center staff concludes: "The Telewindow does definitely keep her in touch with the senior center she so loved coming to. White it does not quite allow her to be as active as she once was, it does give her some degree of connecting power. She does like the Telewindow and she does appear in happy spirits." Also, "some seniors are more likely to stop and talk with her, while others simply walk right on by and show no interest in what is happening."

The Senior Center director reported "I really do feel that TeleWindows has made a difference in her life by giving her access to the senior cetner itself, the staff, and her peer group... [Helen] is in very good spirits these days...just like she used to be."

<u>After the fact, what did Helen like and dislike about using the Telewindow:</u>

This location was very positive about the Telewindow experience. Although Helen was not able to resume coaching activities because the video quality was not good enough, she commented that it opened her world back up. She was able to have conversations with her friends, and even attended special events via the Telewindow system. At one point she commented that she was even able to give a local politician a piece of her mind after one such event!   Helen reported strong enthusiasm for the Telewindow experience.   "It was a wonderful experience. It opened my world."

Helen's Senior Center did not have difficulty using the system. They did, however, have to take the camera owner's manual away from Helen because she would read the manual then change the camera settings. After she would change the settings the system wouldn't work, someone from the center would have to drive to her home to reset the system.

Other reactions/comments from family or senior center contact:

Helen commented that if she was tired and didn't feel like having the camera on, she would put a doll in her chair and go about her own activities. Her friends at the center knew that the doll was her way of saying she was busy and couldn't talk right now.

Senior Center Location 3: Velma
Brief description of the homebound participant:

Velma, 86, had been very active at her senior center about 7 years ago. At that time she was a volunteer, played in the senior center band, and was active in local politics.   Her eyesight deteriorated to the point where she was not able to drive, however. Since then she has had limited contact with people at the senior center.

Brief description of installation hassles for technology and what we used:

Installation at the senior center was uneventful. The center had jacks installed in the common room and in the gym, and purchased a rolling cart so the system could be moved as necessary.   We were only able to install one line in Velma's apartment because the building did not have existing wiring for a second line. Velma was given a 20" TV; the center was given a 27" TV.

What did Velma expect from a Telewindow:

Velma expected that she would be able to see all activities at the center, including many of her friends from several years before.

Log Analysis: How the Telewindow was used

Velma and her Senior Center used the Telewindow in the evenings for nine 2.5 hour senior dances and three one hour swing dance classes. At first Velma just listened to the band play. In subsequent sessions she talked with seniors during band breaks. For the swing dance classes, staff reported that the seniors at the center loved performing on TV for Velma.

Between September 23 and December 2, 21 attempts to connect were made. Thirteen attempts succeeded (one without video). The six failed connections all occurred within about 1.5 weeks of each other. Sessions usually started at 7pm.   The Telewindow connected Velma and the Senior Center 13 times for a total of 26.2 hours. According to the logs, about 30% of the time some interaction was occurring.

During the final senior dance, logs noted Velma expressed frustration that the room at the center was dark and she had trouble seeing.

After the fact, what did Velma like and dislike about using the Telewindow:

The biggest problem at this location was that the senior center staff was not able to dedicate very much time to the project. The system was rarely used during the day and was primarily only activated in the evenings for dance night. Velma enjoyed the dances, however she had difficulty seeing the dancers because the lights were kept low. The camera was not strong enough to distinguish faces when there was limited light in the room. She did enjoy meeting new people but soon learned that many of her former friends were no longer active at the senior center. Overall, Velma was positive about the experience.   "I've learned a lot...I enjoyed watching the programs and seeing other seniors." The best part for her was "the idea that I had access to people. That's the whole thing, because I'm alone all day."

Other reactions/comments from family or senior center contact:

Velma commented that this was a positive experience, despite not being able to use it as much as she had hoped. She is very interested in trying the system at her local church so that she can be involved in church services and activities.

Adult Day Care Center Location: Joan
Brief description of the homebound participant:

Joan is in her late 80s and has multi-infarct dementia. She lives with a full time caregiver and visits her local adult daycare center two days each week through a Medicaid waiver program.

Brief description of installation hassles for technology and what we used:

This location was probably the most challenging of the project. The biggest installation problem was the local telephone company was not helpful. After several months of problems with the phone company, we were finally able to use two phone lines at this location. Joan was given a 20" television for her home; the adult daycare center was given a 27" television.

Installation at the ADC was uneventful.

What did Joan expect from a Telewindow:

Joan did not express any expectations from the project, primarily because she did not understand what was happening. The ADC staff, on the other hand, hoped it would help slow her dementia which had progressively been getting worse.

Log Analysis: How the Telewindow was used

Joan and her Adult Day Care Center used the Telewindow very differently from the other Senior Centers in the study. They connected for short periods of time, often an hour or less. In total they only connected 6 times. Rather than bring the homebound senior in to Center activities, instead twice they had the homebound senior play piano while seniors at the center listened or sang along. In addition, there were discussions, exercises, and crafts.

Again it was connected only 8 times (2 of which Joan was not at home and did not participate) for a total of 13.5 hours.

Between July 14 and September 8, 11 unsuccessful attempts to connect were made. Toward the end of August the Adult Daycare Center moved to a new location, further disrupting attempts to use the Telewindow.

During the test period, the Telewindow was connected for a total of 13.5 hours, or an average of 1.35 hours per session. They usually started at 10:30 or 11am. About 31% of the time some interaction was occurring.

Once it started working, no technical problems were noted. The Adult Day Care Center observed "if she doesn't interactive with participants, then they forget she is there. We have to cue frequently.

After the fact, what did Joan like and dislike about using the Telewindow:

As with location 1, difficulty of use seemed to be the biggest problem at this location. Joan was not able to use the technology by herself, nor was her caregiver. We ended up setting the system to autoanswer, the ADC staff would call the caregiver and tell her to turn on the system, and then they would initiate the call. Even though she may not have understood what the Telewindow was, Joan reported liking the experience of having a Telewindow. "It gave me something to do. And when you have something to do you fell better."

<u>Other reactions/comments from family or senior center contact:</u>

As I interviewed Joan at several times during the project, it became obvious that she did not understand the system in any way. She knew she was watching TV, but she had no idea she was watching her friends at the ADC. She just believed someone had given her a new TV.

CENTER SENIORS AND STAFF SURVEY RESULTS

Surveys were administered by Center staff to staff, volunteers, and seniors before, partway through, and after the Telewindows pilot study period. We reported ethnographic interview and log results separately for each case study location. Two of the Senior Centers used the Telewindow frequently, for extended periods. The third Senior Center and the Adult Day Care Center used their Telewindow less frequently and under limited circumstances and had low completion rates on the surveys. Those sets of surveys were omitted from the analysis. Surveys were aggregated for Helen and Bob's Senior Centers and comparisons were made between expectations of how respondents thought they would like a Telewindow based on a verbal description of the functionality before they had seen one and responses after the Telewindow had been in use at the center for at least 6 weeks. (The respondents who filled out before and after surveys may or may not be the same people – the surveys were anonymous.)

In the before survey, 81% of 45 respondents were female and the average age was 66. In the after survey, 70% of the 49 respondents were female and the average age was 69. In both samples, 64% of the respondents were seniors at the centers, and the remaining 36% were staff or volunteers.

It made no difference whether respondents had experienced a Telewindow or not: both the before and after surveys showed nearly half (47% to 48%) of the seniors and staff said they like to use a Telewindow themselves somewhat to very much if they become homebound. About one fourth (27%) were neutral and about one fourth (27% to 26%) did not want to use a Telewindow if they become homebound.

We asked how much they would like to use a Telewindow to connect with their adult children, friends, grandchildren, senior center, place of worship, and health care provider. Every group except for health care provider was rated higher among respondents who had experienced a Telewindow than when they had only read a description of one. Adult children, friends, grandchildren, and the Senior Center were all rated an average of between 3.6 and 3.8 where 1 is not at all and 5 is very much. Perhaps the experience of using a Telewindow helped respondents envision relating to other people in their lives using that technology.

Expectations about how well the homebound person's personality would come through the Telewindow were both better and worse in the before survey than after. Twenty-eight percent in the before survey thought personality would come through not very well; 58% expected personality would come through somewhat to very well. In the after survey, only 11% felt personality had come through not very well. But, only 46% felt personality had come through somewhat to very well. The rest were neutral. The before-after difference was significant using a Chi Square Test at p <.01.

Our original conception of a Telewindow was to leave it open for long periods of time to parallel being at the Center. We asked the seniors and staff how they thought a Telewindow should be used. Before experiencing a Telewindow, 81% said it should be used just for conversations and events as opposed to being on all the time. After experiencing a Telewindow, 73% still felt it should not be on all the time. We asked whether the Telewindow should be used for conversations, for just being there, or both. Only 15% of respondents in the before survey felt it should be used only for conversations. That percentage dropped to 10% after experiencing a Telewindow.

The expectation and the experience of a Telewindow again were very similar in terms of how much a Telewindow helps to keep in touch with the homebound person. About one fourth felt it would (and did) help not at all. Fifty-seven to 58% felt it would and did help somewhat to very much to keep in touch.

One concern was whether having the Telewindow camera pointing at people in the Center would make them uncomfortable. We asked how often they expected to (before)

and did (after) avoid being seen by the camera. The majority (59% to 60%) never or almost never tried to avoid the camera. Thirteen percent (before) expected to and 16% (after) reported they almost always tried to avoid the camera.

Among seniors and staff who had experienced a Telewindow connecting a homebound elderly person to center activities, a little more than half said they paid attention to the Telewindow most of or some of the time. Only 26% mostly ignored the Telewindow. Staff were reportedly primary users of the Telewindow about one third of the time (32%), seniors one fourth of the time, and both seniors and staff the remaining 43%.

A fairly large percent of respondents expected having a Telewindow at the center would reduce their enjoyment of the center (33%) and an even larger percentage reported that the Telewindow *did* reduce their enjoyment of being at their Senior Center (46%). Conversely, fifty-eight percent expected the Telewindow would make their Center experience more pleasant.   After the Telewindow was installed and used, 48% said it made their experience more pleasant. Despite some respondents feeling their enjoyment was somewhat impaired by the Telewindow, two thirds of the respondents who had experienced a Telewindow said the center should keep using the Telewindow (63%) or else did not care one way or the other (4%). One third wanted the Center to stop using the Telewindow.

As far as quality of the Telewindow depiction of the homebound participant, 90% of respondents at the center said seeing the homebound person was very or somewhat easy. Seventy-nine percent said hearing the homebound person was very or somewhat easy. Telewindows were better at showing one homebound person than they were in the opposite direction showing a large group at the Center to the home. About half of the seniors and staff said audio and video were fine. About half said audio and video were sometimes a problem.

Prior to experiencing a Telewindow, nearly one fourth of respondents thought a smaller screen (less than 27 inches) would be best for a Telewindow at the Center. Among respondents who had used a Telewindow, no one wanted smaller than 27 inches, and

38% recommended a life sized screen. This before-after difference was significant based on a Chi Square test where p<.01.

Table 1: Center Survey Results

	BEFORE	AFTER
(n)	45	49
DEMOGRAPHICS		
% female	81%	70%
average age	66	69
% seniors (versus staff or volunteer)	64%	64%
How much would you like to use a Telewindow if you become homebound?		
somewhat to very much	47%	48%
neutral	27%	27%
not much to not very much	27%	26%
How much would you like to connect with the following people via Telewindow?		
(1=not at all, 5=very much)		
adult children	3.04	3.83
friends	3.28	3.76
senior/adult daycare center	3.00	3.62
grandchildren	2.86	3.61
place of worship	2.42	3.07
health care providers	3.04	2.79
*How well will/does the homebound person's personality come through?		
not very well	28%	11%
neutral	14%	44%
somewhat to very well	58%	46%
How should the Telewindow be used?		
connect all the time	19%	27%
connect for conversations and events	81%	73%
Should the Telewindow be used for just being there or only for conversations?		
just being there	18%	27%
just conversations	15%	10%
both	68%	64%
How much better will/did the Telewindow let you keep in touch with the homebound person?		
not much to not at all	23%	25%
neutral	20%	16%
somewhat to very much	57%	58%
How much will/did you try to avoid being seen on camera?		
never to once in a while	60%	59%
sometimes	24%	27%
quite a bit to almost always	16%	13%

How much will/did you mostly pay attention to the Telewindow?

ignored or mostly ignored	35%	26%
half and half	26%	18%
pay attention some or most of time	39%	53%

Who will/did use the Telewindow more, staff or seniors?

staff	30%	32%
about equal	30%	43%
seniors	40%	25%

How will/did the Telewindow affect your enjoyment of center

less pleasant	35%	46%
no impact	7%	7%
more pleasant	58%	48%

Should the center keep using the Telewindow?

yes	63%
doesn't matter	4%
no	33%

How easy was it to see the homebound person over the Telewindow?

very or somewhat easy	90%
neutral	8%
very or somewhat difficult	2%

How easy was it to hear the homebound person over the Telewindow?

very or somewhat easy	79%
neutral	17%
very or somewhat difficult	2%

How often was the video a problem?

it was fine	47%
a problem sometimes	47%
a problem always	6%

How often was the audio a problem?

it was fine	51%
a problem sometimes	47%
a problem always	2%

*Would you prefer the screen size for a Telewindow be:

smaller than 27 inch	24%	
the same (27 inch)	71%	62%
larger than 27 inch	6%	38%

* indicates before-after difference significant at <.01 using Chi Square test

DISCUSSION

A Telewindow is an appealing idea for connecting homebound seniors with their Senior Center. Ten centers applied for the opportunity to participate in the project, but only four could be funded. Both before seeing the Telewindow and after, about half of seniors and staff at participating centers indicated they would like to use a Telewindow themselves if they become homebound. Only about one fourth of seniors and staff definitely did not want to use one. The three homebound senior participants who understood the device's function were enthusiastic about the experience. The two who remained homebound wanted to continue using the Telewindow after the project ended. The third recovered from his serious accident and was able to return to the Center in person. Thus, the Telewindow was not a substitute for Bob physically being at the Center – when he was capable of doing so, he preferred to attend in person. But while homebound, visiting by Telewindow was better than not visiting at all.

We posed a challenging hypothesis: that Telewindows can be a sufficient substitute for face-to-face social interaction and to reduce loneliness, depression, feelings of powerlessness and enhance self esteem, morale, a sense of belonging in the community, and a positive outlook on the future. Four case studies cannot provide a definitive answer. There is no way of knowing what participants attitudes and progress would have been without a Telewindow. We can conclude the results were encouraging. Staff at the Centers connecting to Bob and Helen reported observing improvements in their demeanor and social connections. A major apparent benefit of the Telewindow was that Bob became much more social as time went on. After a serious accident he had been quite depressed and withdrawn. As he was able to see friends at his community senior center he became more social and animated. The center staff reported that the Telewindow allowed him to gradually return to activities, while being able to shut it off when he felt tired or depressed. Helen commented that the Telewindow opened her world back up. She was able to have conversations with her friends, and even attended special events via the Telewindow system. Having been unable to attend the senior center for seven years, Velma learned when she starting using the Telewindow that many of her former friends were no longer active at the senior center. Even so, she appreciated being able to use the device to connect to the Center, and wants to try

connecting to her church. It probably helps to start using a Telewindow as soon as possible after becoming homebound, while personal connections to the center are still strong. Joan was not able to use the system due to cognitive limitations.

The experience of using Telewindows by the staff and seniors at the centers was less uniformly enthusiastic than was the response by homebound participants. Nearly half of the center staff and seniors felt the Telewindow made their experience of being physically present at the Center less pleasant, and slightly more than half felt it made their experience at the Center more pleasant. Interfering with senior's enjoyment of the Center is an unintended consequence of the Telewindow case studies. The survey question was general. It did not ask whether the Telewindow made the Center experience less pleasant once, for a little while, or always. Respondents had three choices: they could indicate the Telewindow made their experience at the Senior Center more pleasant, less pleasant, or had no effect either way. More likely the Telewindow had some enhancing and some detrimental effects for most people.   It would be useful to ask more detailed questions about how and why the Telewindow interfered and to take steps to minimize the problems. About 10% of the respondents reported being camera shy and made efforts to avoid appearing on the Telewindow. It may be the irritation for others centered around the fuss of setting up the system and getting it running. As use becomes more routine, setup would probably be less disruptive. Even among those who said the Telewindow made their personal experience less pleasant, most seniors and staff thought the Telewindow should continue to be used.

We thought we had selected an easy to use technology but we were wrong. As the project began we made several decisions intended to optimize the technical quality of the Telewindow, each adding complexity. We used a speakerphone instead of a handset so participants would not have to hold a telephone to talk on the Telewindow. Only one model of speakerphone worked well for picking up sound of a group at a distance (a Polycom phone). This device is shaped like a triangle with equal length approximately 12 inch sides. Speakers and microphones are subtly embedded in the body. The triangle includes a normal phone dial pad embedded one side, but you answer and hang up by

pushing on and off buttons, not by lifting a receiver. (There is no receiver.) The speakerphone was unfamiliar and thus had a learning curve for our participants.

Connecting a Via TV phone call seems fairly easy before we actually tried to explain it to our users. Turn on the Via TV. Turn on the speakerphone. Dial the phone number. After the other side answers (and their Via TV is on), press PoundKey 1 and then press PoundKey 1 again. Wait about 30 seconds, and you're connected with picture and sound. Each individual step in using the Telewindows was straightforward. But the number of separate devices and number of steps involved resulted in complexity. During our equipment testing phase, we discovered the audio and video quality were not as good as we had hoped. Audio and video on a ViaTV share a single phone line. We learned that splitting the signal and using one phone line for audio and a different phone line for video resulted in much better quality of both. So, we tried to add a second phone line for every center and every homebound participant. We succeeded at two centers and ended up with only one phone line at the other two centers.

Contrary to tenants of good usability, we used unfamiliar equipment and combined it with familiar equipment that had to be used in unfamiliar ways. The Via TV unit needed a TV set to display video and a telephone so a call can be answered before the video connection gets established, so we added a small handset phone to go with the Via TV for the video signal. The plan was to use that phone to achieve connection for the video, then have the homebound senior lay the phone down on the table (DO NOT HANG UP!) and ignore it until the Telewindow call is over, then hang it up. It is strange to lay a phone down on the table but not to hang it up (which would disconnect the video). Eventually for some locations we found ways to set the ViaTV to auto answer. In those cases we had to try to convince the homebound participant NOT TO ANSWER THE VIA TV HANDSET PHONE when it rang, so that the autoanswer sequence would occur. It's hard not to answer a phone! Or to explain to an 85 year why they need to answer one phone and not answer the other. The Via TV television set was intended to be a dedicated device used just for Telewindow connections. Still, in the homes it was an everyday looking object with a big 20 inch screen perfectly capable of showing broadcast and cable TV. At least one homebound participant changed the wires so she could watch

TV. So, we provided our participants with phones you don't answer and phones you leave lying on the table, and a TV set you're not supposed to watch. What were we thinking when we chose Via TV for ease of use?

Ignoring issues of cost, the best technology solution for a Telewindow using year 2000 technology would be to install a pair of PictureTel systems costing about $10,000 each, connect them over ISDN lines and pay a per minute fee for Telewindow connections. The video can be displayed at an optimal size for both locations; on a smaller television set in the home and a larger screen at the Center. Audio and video quality would be good. Once set up, the system is easy to use (though not easily portable). But when cost is an issue, the choice ceases to be clear-cut. The technology needs for the Senior Center side of a Telewindow are different than the needs in a homebound person's living room.

The experience of interacting with others over the Telewindow is asymmetrical in important ways for the homebound participant as compared to the experience for Center staff and seniors. We perceive the world from the point of view of our bodies, situated in time and space, mediated by the senses. Our bodies are our interface to the world. They represent us to the world, and they present the world to us (Heeter, 2000). Thus, analysis of the symmetries of a technologically mediated human interaction should include issues of perception, display, and other factors.

Perception		Homebound	Center
Visual	≠	Homebound has a hard time seeing due to wide, fuzzy camera shot of many people	Center can quite easily see closeup of homebound person
Auditory	≠	Homebound may have trouble hearing those far from the speakerphone or Center may be noisy and hard to hear conversations.	Center can quite easily hear homebound person because that person is near the phone and their environment is quiet.
Control	≠	Homebound person has no control over where the camera points, can only see what is in the shot. Also, no ability to touch, eat, or physically construct.	Center participants can walk or look all around the center, touch, eat, and physically construct.
Representation			
Visual	≈	Homebound is represented visually by video of their body.	Center participants are represented visually by video of their bodies.

Auditory	≈	Homebound is represented auditorily by audio of their voice.	Center participants are represented auditorily by audio of their voice.
Control	≈	Control of their representation is natural: speak, move, smile...	Control of their representation is natural: speak, move, smile...
Other Factors			
Local humans	≠	Homebound have no local humans to interact with.	Center participants have many local humans to interact with
Yearning/need	≠	Homebound have strong yearning/need to interact using the Telewindow.	Staff have commitment for the project to use the Telewindow, but seniors have little or no yearning or deep need to interact with the homebound person.

Some of the asymmetries balance each other. It is probably necessary that the homebound person be easy to see and hear, to help compensate for the comparative lack of yearning on the part of Center participants and for the easy availability of other humans. The homebound person will be more tolerant of system faults such as lack of mobility and poor quality in return for being able to connect at all.

A one paragraph description of a Telewindow lets potential users imagine the details, unconstrained by practical limitations. Helen and Velma were disappointed when they first began using their Telewindows; they had imagined the Telewindow would allow them to participate in Center activities more than it did due to resolution limitations as well as the limitations of a single fixed camera shot.   Despite the limitations, they were glad for the connection.

The activities available to the homebound person were determined by the Center staff, based on where they placed the Telewindow and what activities were planned when the Telewindow was activated. Only one center (Helen's) set up the Telewindow on a cart and moved it around for different activities. Helen's Telewindow allowed her to participate in or observe pool, cards, needle point, crochet, bocci, aerobics and fitness, table tennis, badminton, Tai Chi, and an ice cream social. The other Centers used the Telewindow a single location. Bob's Center activated the Telewindow for cards, and once for exercise. Velma's Center activated the Telewindow only at night, for senior dances and for swing dancing class. Joan's Center tried an inverse use of Telewindow.

Rather than using it so Joan could visit the Center, they used it so the Center could visit Joan who played piano in her home as people at the center listened and sang along.   It takes a substantial effort on the part of a Center to use a Telewindow at all, and even more to use it often and for diverse activities. Ways of making it easier for the staff to activate would probably increase amount and diversity of activities available to the homebound participant.

Telewindows parallel a natural body interface to the world by using a single audio and video representation of the individual and the Center. It would be possible to install live webcams in several locations throughout the Center, combined with an interface making it easy for the homebound person to select among the different windows or to view all at once. The windows become one way, looking in to the Center. How should the Center look back at the homebound person? There could be a webcam of the homebound person's living room, with privacy switch. It's more obtrusive to have always on camera, but also more available.

Many scenarios are possible where one distant person engages in relationships with a collection of physically present humans. What is needed to optimize that kind of interaction? Future research should also extend Telewindow connections to include more symmetrical pairings, such as grandparent to grandchild, one on one interactions. Possible applications of advanced technologies where the representation may be less natural but perhaps more powerful such as representation by avatars in virtual worlds or on screen may also have useful application in a one distant to many local interaction.

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