

# Telewindows: Case Studies in Asymmetrical Social Presence

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**Abstract:** Emerging telecommunication technologies could extend participation in social groups for homebound and mobility-limited people. 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. In ten-week case studies of four recently homebound elderly, Telewindows were opened and kept open for long periods of time, providing a continuous social presence connecting home with senior center. Telewindows enable a new kind of social experience: an ambient presence, a shared window between a homebound senior’s living room and the senior center they used to frequent.

Most studies of social presence consider symmetrical interactions. Our Telewindow intervention is extremely asymmetrical, connecting one virtual participant with a group of physically present seniors. Being part of a senior center via a Telewindow instead of in person is both a privilege (compared to being home alone) a handicap (compared to being at the center in person).

The interpersonal relationships between a homebound elderly person and the senior center they recently were part of are already established. People know each other; they have accumulated what Clark and Brennan [1] describe as common ground – “mutual knowledge, mutual beliefs, and mutual assumptions” exchanged through ongoing social encounters which lead to “a mutual belief that they share a common understanding” [2]. The homebound participant has a vivid mental model of the senior center physical and social space. The accuracy of the common ground is likely to decay based on how long ago the homebound person actively participated in the center, how many people have joined or stopped coming to the center, and also whether the center has experienced social-cultural (or physical) changes since the homebound person was last physically present.

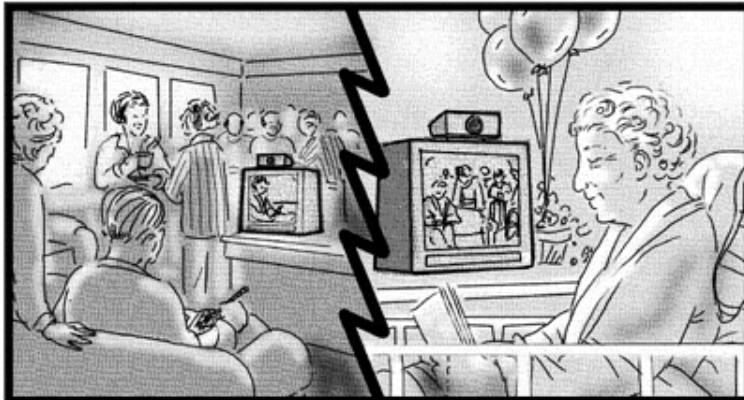
Ethnographic interviews with the homebound seniors and quantitative data on senior center reactions and usage logs are analyzed and conclusions drawn about the potential appeal of asymmetrical social presence and ways to optimize the experience. Ethnographic interviews provide the key -informants approach for collecting data. Key -informants are selected because they are knowledgeable about the topics being researched. They are also able and willing to communicate their knowledge [3]. According to Borg and Gall [4], using the key -informant approach has many advantages. Key -informants can "provide insights that no amount of observation would reveal. They can also provide insights into processes, sensitize the researcher to value dilemmas, and help the researcher see the implications of specific findings" (p. 399).

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## 10.1 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 senior centers are in part constructed to alleviate and delay such isolation through group activities and maintaining a social engagement with peers and center staff. 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.

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. Do the homebound gain access to friends through the use of communications technology? 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 [5]. An on-line computer network can also reduce 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 [6].

Emerging telecommunication technologies could extend participation in social groups for homebound and mobility-limited people. A TeleWindow is an idea for using technology, not a particular technology. It can be thought of as an extension of the existing infrastructure of a home. 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 and 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 two locations. Sometimes there will be conversations. Other times it will be more like the participants are in adjoining rooms together

going about daily life. Our trial for this concept is to introduce it to homebound seniors and connect them with the senior or adult day care centers they used to frequent.

### 10.1.1 Common Ground

The idea of social presence has been studied before, but not in the context provided by a Telewindow. Much of the research on social presence has studied mediated communication between strangers who have never met each other face to face (e.g., Sudweeks, McLaughlin, and Rafaeli [7]). 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 [8]). Our application is different. Telewindows are not being used to introduce strangers. 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; they have accumulated what Clark and Brennan [1] describe as common ground – “mutual knowledge, mutual beliefs, and mutual assumptions” exchanged through ongoing social encounters which lead to “a mutual belief that they share a common understanding” [2]. The homebound participant has a vivid mental model of the senior center physical and social space. This familiarity with the physical space and with some or all of the participants reduces the burden on the technology. The Telewindow is not the sole source for physical and social orientation.

The accuracy of the common ground is likely to decay based on how long ago the homebound person actively participated in the center, how many people have joined or stopped coming to the center, and also whether the center has experienced social-cultural (or physical) changes since the homebound person was last physically present. Believing there is common ground (perceived common ground) presumably has more impact on sense of social presence than the accuracy of shared beliefs and values.

### 10.1.2 The Illusion of Social Presence

Lombard [9] 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 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 (whether due to compelling special effects or the human's power of imagination) yield a sense of presence.

Compelling aspects of social presence via a Telewindow relate more to exercising interpersonal relationships than to forgetting technology is part of the experience. The goal of the homebound Telewindow user is to visit the center and experience meaningful connections with other center participants despite 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.”

Lombard's definition of social presence focuses strongly on the illusion of shared physical space (“being there”). Telewindows are intended to provide emotional interpersonal experiences of connectedness (“being with”). In a dyadic telephone conversation, both parties converse in a shared audio space, separate from each individual's local audio space. They meet in an abstract audio

space. Conversely, Telewindows draw attention to differences in participants' local spaces by showing video of each individual and their surroundings. Furthermore, users have the option of viewing either only the distant party or else a split screen showing themselves and the distant party. Using the split screen helps participants know whether they are centered in the camera image as well as how much of the room can be seen by the remote location. Seeing oneself while talking to someone is unnatural, not how we experience face to face communication. Using the split screen allows the local participant to optimize how they are seen, at the cost of increasing their awareness of the technology. Do Telewindows provide more or less social presence than a phone call? According to Daft and Lengel's [10] schema, a Telewindow is a richer medium than telephone because it has both audio and video, and thus provides more social bandwidth. Yet the video draws attention to a lack of shared physical space, possibly inhibiting rather than enhancing social presence. The Telewindow presents proof of not being there.

### 10.1.3 Asymmetry

Being part of a senior center via a Telewindow instead of in person is both a privilege (compared to being home alone) a handicap (compared to being at the center in person). The connections only happen at periodic times planned by center staff or when requested by the homebound participant. Participants can only see where the camera is pointing and can 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. Therefore, people at the center appear smaller and it may be harder to distinguish their facial expressions or even recognize people over the relatively poor quality video, unless the person at the center is directly in front of the camera. It can be hard for the homebound person to hear participants at the center who are not near the phone. The homebound person is usually alone or with a caregiver, while people at the center can interact with many other physically present people. The need and desire for social connection is much stronger for the homebound person than for physically present center staff and seniors.

Most studies of social presence consider symmetrical interactions. Is it possible to experience social presence with the extreme asymmetry of Telewindows as we plan to apply them? 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 [11]. 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 close-up 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	Center participants can walk or look all around the center, touch, eat, and physically construct.

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		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.

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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.

## 10.2 Technology and Methods

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. The comparatively low cost of POTS-based 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 a 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.

Because ViaTVs have almost no penetration in business or home markets, our Telewindow will be a dedicated information appliance only 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.

Competitive mini-grants were offered to 3 senior centers and one adult day care center with 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.

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 and the Telewindow was used for at least 10 weeks. Participants were interviewed again at the midpoint and conclusion of the project. Staff at the participating centers kept a daily log of

Telewindow activities, and surveys were administered to staff and seniors at the centers at the beginning, middle and end of the ten week project.

### **10.3 Ethnographic Interview and Log Results**

#### *10.3.1 Senior Center Location 1: "Bob"*

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. When in Michigan, Bob attended a local senior center where his favorite activity was playing cards. 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.

Bob didn't have any expectations about Telewindows 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. Bob and his senior center used the Telewindow mostly for cards and socializing. One day he did exercises, but only once. The center staff was waiting for a cart to be able to move the Telewindow around, but it did not arrive in time for the study period.

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

During the test period, the Telewindow was connected for a total of 77 hours, or an average of 5.5 hours per session. They 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. Staff keeping the log reported about 30% of the time some interaction was occurring between Bob and someone at the center.

One of the major benefits 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 the Telewindow off when he felt tired or depressed. As he was able to become 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. "I'll tell you, it was good for people that were really confined...I think for a bed patient it would work good. I was stuck here for quite a while."

Bob's daughter indicated 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.

The biggest dislike center staff mentioned was 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. The center suggested that the system would have worked more smoothly from the beginning if there had been a longer training program.

#### *10.3.2 Senior Center Location 2: "Helen"*

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. According to staff at her senior center, Helen's demeanor changed as a result of being homebound. She was more depressed and even aggressive at times. Helen expected that she would be able to use the Telewindow 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.

The center staff located the Telewindow on a cart and moved it around a great deal to allow the homebound senior to participate in different activities. 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. Helen said the other seniors at her center were very positive about using the system, and enjoyed seeing themselves on TV. "They get a kick. They'll come by and say 'it's Helen'. They'll get all excited, you know, and I know so many of them."

Logs were kept during the eleven-week period from July 19 to October 8. During that period, 44 attempts were made to connect the homebound senior's Telewindow to the Telewindow at the senior center. Twelve of the 44 attempts encountered at least some technical difficulties; six of the twelve attempts never successfully connected and the other six 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. When the participant unplugged the cables the first time, instructions were removed. Helen objected, insisting she wanted the information back. They brought the instructions back. 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.

During the test period, the Telewindow was connected for a total of 152.7 hours, or an average of 4.8 hours per session. They 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 31% of the time some interaction was occurring during the first five weeks. The amount of time interacting dropped in the second six weeks, averaging 13% of the connected time in conversation. The proportion of homebound interaction with staff compared to homebound interaction with seniors at the center also shifted between the first five and second six weeks. In the first five weeks, 74% of the interactions were between the homebound senior and other seniors at the center. In the second half, that amount was 46%. The duration of connection was comparable in both periods, as was the range of activities and reports of Helen being happy with the experience. There were some serious technical problems (the phone network had to be fixed by AT&T and the video camera had to be replaced). Even before those problems, Helen seemed to observe more and participate less in the second half of the study period, though she enjoyed observing and was reportedly in high spirits.

At first 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, Helen 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 look more different than other home electronic devices, perhaps with soldered cables not detachable. Helen 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. The staff also mentioned they had to turn off the ringer on her telephone, because she kept answering it rather than letting it autoanswer.

Some days and activities were more satisfying than others. At first it was frustrating for Helen 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 coaching 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. “I tell every senior I come in contact with this sort of thing is tailor made for seniors. Puts the whole world at your, when you're a shut in as I am now, puts the whole world at your fingertips.”

The center staff concludes: “The Telewindow does definitely keep her in touch with the senior center she so loved coming to. While 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.” When Helen 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.”

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 center itself, the staff, and her peer group... [Helen] is in very good spirits these days...just like she used to be.”

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.” The senator was there, and a cable executive, for some reason or other. They were there to celebrate the opening of our senior centers' program to teach people how to use computers. And they came over and talked to me. And I was real thrilled with that...So I explained to them what the purpose of this was and all. And they thought it was a fine idea!”

### *10.3.3 Senior Center Location 3: “Velma”*

Velma was not the original participant chosen for location 3. The original participant had recently become homebound due to limited walking ability. After several weeks working with phone company technicians, it was determined that the senior housing building of the original participant did not have the wiring capacity for an additional telephone line for the POTS unit. The Telewindow could be connected to the senior's own phone line, however, this would tie up her telephone whenever the system was active. This created a potentially hazardous situation in the event the senior needed to make or receive an urgent call while the system was active. Rather than possibly create a risky situation, an alternate participant was selected for the project.

Velma, 86, had been very active at her senior center about seven 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. Velma expected that she would be able to see all activities at the center, including many of her friends from seven years before.

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. The biggest problem at this location was that the senior center staff was not able to dedicate very much time to the project. Velma appeared more hostile toward her senior center than the other participants were toward their centers. She commented that she feels they haven't tried to keep in touch with her over the years, and aren't really trying with this new technology. "I've enjoyed watching the programs, yes. I was a little disappointed because the people would only talk to me that first program, and then of course they got used to seeing it. And they would look at it but they wouldn't talk to me. And that was the object of the whole thing, with me being a shut-in. And seeing other people, which I haven't seen." 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."

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.

#### *10.3.4 Adult Day Care Center Location: "Joan"*

Joan is in her late 80s and has multi-infarct dementia. She lives with a full time caregiver and visits her local adult day care center (ADC) two days each week through a Medicaid waiver program. 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 progressively had been getting worse.

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 six 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 Joan was connected by Telewindow only six times for a total of 13.5 hours. Once it started working, no technical problems were noted. The adult day care center observed "if she doesn't interact with participants, then they forget she is there. We have to cue frequently. 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 feel better."

As we 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.

#### **10.4 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. One 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 six 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 would 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  $p < .01$ .

## 10.5 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. Due to cognitive limitations, Joan was not able to use the system interactively as planned, though she did enjoy having it in her home.

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, and would in fact wish to use it if they became homebound.

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. The color of the phone, dark gray, also made it difficult for seniors to read the numbers on the keypad.

Connecting a Via TV phone call seemed 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. Due to hardware restrictions in individual homes, we succeeded in adding a second line at two centers but 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.

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.

The amount of conversation Helen engaged in with staff and seniors changed about halfway through the study period. She interacted less overall, and proportionately less with seniors than she had earlier. She still reported being happy with her Telewindow, and continued to use it four to six hours at a time. No obvious explanations for the change are present. The finding suggests eleven weeks is not long enough to understand how Telewindows would be used long term.

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 in the homebound person's living room, with a privacy switch to cover the lens when privacy is desired. A camera which is always on is more obtrusive than a connection which must be initiated, but the continuous connection does make the homebound participant more accessible.

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.

The Telewindow case studies were extremely asymmetrical. What if many homebound participants could connect to a center? What if they could also connect to each other? Would participants gravitate toward symmetrical interactions, preferring to interact with other homebound individuals? Is the physical center important? Is it necessary? Is the common ground of having attended the center before becoming homebound a critical element to the success of the Telewindow experience, or could homebound seniors beneficially port into a senior center they had not previously attended? Could a virtual senior center be constructed which becomes a social space for homebound individuals?

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