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## Crystal Memories: Capturing Our Voices - Report Series # 13

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Report Series - # 13

# ***Crystal Memories<sup>1</sup>: Capturing Our Voices***

## **Project Team**

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<sup>1</sup> Crystal Memories has been chosen as the title and name of the project related software because it has the association of crystallizing memories to preserve them. Crystal is precious as are our memories. In addition, people with dementia have more robust, long-term “crystal clear” memories.



### **About SERC (Sheridan Elder Research Centre)**

Through applied research the Sheridan Elder Research Centre (SERC) will identify, develop, test and support implementation of innovative strategies that improve the quality of life for older adults and their families.

1. Wherever possible, older adults participate in the identification of research questions and contribute to the development of research projects at SERC.
2. We conduct applied research from a psychosocial perspective which builds on the strengths of older adults.
3. Our research is intended to directly benefit older adults and their families in their everyday lives. The process of knowledge translation takes our research findings from lab to life.
4. SERC affiliated researchers disseminate research findings to a range of stakeholders through the SERC Research Report Series, research forums, educational events and other means.
5. A multigenerational approach is implicit, and frequently explicit, in our research.
6. To the extent possible our research is linked to and complements academic programs at the Sheridan College Institute of Technology and Advanced Learning.

### **EXAMPLES OF SERC RESEARCH**

<b>The Built Environment</b>	<b>Information &amp; Communication Technology (ICT)</b>	<b>Human Communication</b>	<b>Public Policy</b>	<b>Other research interests</b>
- Indoor/Outdoor Design - Graphic Design	- Accessible computing - Age appropriate games	- Hearing/low vision - Vision - Language	- Elder Abuse - Ageism	- Self image/self esteem - Care-giver support

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## Table of Contents

- 1. Purpose**
    - 1.1. SERC Framework**
    - 1.2. Pilot Testing Crystal Memories Version 1: Projects A and B**
  - 2. Methodology: Project A – Well Older Adults**
    - 2.1. Research Design**
    - 2.2. Respondent Sampling**
    - 2.3. Method**
    - 2.4. Data Collection Measures**
    - 2.5. Data Analysis Process**
  - 3. Results: Project A – Well Older Adults**
    - 3.1. Data Analysis Findings**
    - 3.2. Limitations**
  - 4. Methodology: Project B – Elders with Alzheimer Disease and Related Dementias (ADRD) and their Care Partners**
    - 4.1. Research Design**
    - 4.2. Respondent Sampling**
    - 4.3. Method**
    - 4.4. Data Collection Measures**
    - 4.5. Data Analysis Process**
  - 5. Results: Project B – Elders with ADRD and their Care Partners**
    - 5.1. Data Analysis Findings**
    - 5.2. Limitations**
  - 6. Implications for Policy and Research**
    - 5.1. Recommendations for More Accessible Software Design: User Perspective**
    - 5.2. Recommendations for More Accessible Software Design: Designer Perspectives**
  - 7. Conclusions**
  - 8. References**
-

*These two pilot studies, conducted between January and April 2006, were comprised of two independent research projects. The goal of the first project (Project A) was to assess the usability of the Crystal Memories software developed at the Sheridan Elder Research Centre (SERC) and to make recommendations for version two of the software. Three women and two men were recruited from an earlier computer study conducted at SERC in the fall of 2005; one man was recruited from the broader community of Oakville, Ontario. None of these participants had any known cognitive impairments. The 6 participants met as a group for two hours, once a week for 10 weeks. This group was facilitated by two student research assistants. The second research project (Project B) involved two participants with a diagnosis of Alzheimer's Disease and Related Dementias (ADRD), and their primary care partners. Project B focused on the potential for shared personal narratives to enhance communication between persons with ADRD and their care partners.*

## **1. Purpose**

The ability to communicate one's sense of self is essential to the enhancement and maintenance of personhood for human beings throughout the lifespan. As the loss of memory associated with ADRD impedes the ability to communicate and relate with others, ones' sense of self and others' perception of the person with ADRD can become compromised. Research on the use of reminiscence with people who have Alzheimer's disease was found to both confirm and enhance a sense of personal identity for the person with dementia while also changing others' perceptions of the person with dementia (Bachman, Haight, Hendrix, Johnson, Meeks & Wagner, 2003). More recently, computer-based reminiscence tools that use stock images of events, objects, and music from popular culture have been shown to be effective in providing the person with ADRD the opportunity to experience meaningful communication with others (Alm, Astell, Campbell, Ellis & Gowans, 2004). To date, very little has been done to develop a computer-based reminiscence tool that enables the user to engage in a more personally relevant reminiscence experience.

In response to this gap, Crystal Memories software (Version 1) was developed at the Sheridan Elder Research Centre (SERC), Sheridan Institute of Technology and Advanced Learning in the summer of 2005. Crystal Memories software was developed as an archival tool that allows the user to create a digital collection of personal artifacts as well as verbal and written narratives that can be built upon over time. Used in conjunction with a personal computer, scanner, and combination headset/microphone, this prototype was designed to be accessible for people with limited computer experience, including older adults who may or may not be experiencing one or more age related condition, (i.e. loss of vision, hearing, mobility, and/or cognitive functioning). By developing an electronic reminiscence tool that enables the users to connect with personal mementos, SERC hopes to empower older adults and their care circle to experience a meaningful activity that offers insight into personhood.

The goal of the first project (Project A) was to assess the usability of Crystal Memories

software and to make recommendations for the design of Version two. This initial follow-up study assessed the design of Crystal Memories Version 1 for use by cognitively well older adults with limited computer skills. The specific objective of this study was to assess the initial software design by observing participants' use of the software to record personal stories and to capture digital images of personally selected artifacts.

The second research project (Project B) involved two participants who had mild to moderate ADRD, and their primary care partners. Project B focused on the potential for shared personal narratives to enhance communication between persons with ADRD and their care partners.

### *1.1 SERC Framework*

In a research study conducted by SERC in 2002 (Stewart, 2005), older adult research participants identified several issues that impact quality of life within the context of aging. Of the several themes that emerged, technology, social isolation and communication (across generations and between older adults and care partners) were noted as issues that impact the quality of life for older persons. In response to the findings identified by focus group participants in Stewart's research, the current pilot projects focused on the ways in which technology contributes to enhanced communication both for well older adults and those with cognitive impairments.

As an assistive tool, Crystal Memories has the potential for use in both initiating and facilitating meaningful communication between persons with ADRD and the people who support them. If used to preserve artifacts and stories from the more distant past, Crystal Memories software empowers older adults with ADRD to build on the strengths of their long term memories which are often maintained well into disease progression. By creating accessible technology for both the older adult user and their care circle, SERC maintains its goal of including the voices of older adults in the development of technology that enhances quality of life.

### *1.2 Pilot Testing Crystal Memories Version 1: Projects A and B*

*Project A:* This study assessed the design of Crystal Memories (Version 1) for use by cognitively well older adults with limited computer skills. The objective of this study was to assess the software design by observing participants' use of Crystal Memories to record personal stories and capture digital images of personally selected artifacts.

*Project B:* Project B was initially intended to examine the potential benefits of Crystal Memories software for older adults with ADRD who used the software with the help of their primary care partner. After numerous software challenges were revealed in the initial weeks of testing with Project A (two weeks before Project B was scheduled to begin), the SERC research team concluded that it would be inappropriate to invite participants with ADRD to use Crystal Memories software at this stage in its design. Without the use of Crystal Memories, Project B focused on enhancing communication between older adults with ADRD and their primary caregiver by initiating shared storytelling through the use of meaningful personal artifacts.

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## 2. Methodology: Project A – Well Older Adults

### 2.1 Research Design

The focus of this pilot project was to determine the appropriateness of the initial software design for use by cognitively well older adults with basic computer skills. The focus and contents of each participant's Crystal Memories project was determined by the participant to ensure the most realistic exploration of the software from each of the 6 participants' individual, unique perspectives. An examination of participants' project content, themes and structure go beyond the scope of both pilot Projects A and B. Common themes and differences were explored only as a secondary finding in these project.

The qualitative orientation of both pilot Projects A and B reflect the psychosocial focus of SERC. This approach recognizes the individual variability in disease progression for the older participants from Project B, as well as the unique emotional make-up and life experiences of each participant in both Projects A and B.

Project A consisted of 10 weekly 2-hour sessions, which were held in the SERC Internet Café. Two student research assistants facilitated the Crystal Memories group by responding to technological needs as they arose during each session. The researchers' documentation focused on the technological aspect of the software as well as the psychosocial impact of the software on the users. Participants were free to discontinue participation at any time during the study.

### 2.2. Respondent Sampling

Recruitment of participants was limited to cognitively well adults 65+, with limited computer experience. Recruitment focused primarily on older adults who were in the final week of SERC's older adult computer training study, the purpose of which was to teach older adults basic computer skills (Pratten, 2006). Three women and two men were recruited from this group; one man was recruited from the broader community of Oakville.

A SERC research assistant presented the goals and procedures of the study to potential participants. Those who showed interest in participating were given a document outlining the benefits of participation and a consent form that further explained the research goals. Participants who indicated an interest in participating were contacted in January of 2006 to determine their availability to commit to 10 weekly sessions. Three women and two men were recruited from this sample.

Recruitment forms outlining the goals of the study and benefits of participation were also sent out to local seniors' recreation centers. One male participant who indicated having significant experience with computers was recruited for the project from this wider sample. He was the only respondent to contact SERC and he did so in response to a flyer that was posted in his community centre.

### 2.3. Method

To maintain continuity, data were collected during each of the ten sessions. Two research assistants recorded observations during each of the ten sessions. Participants were asked to complete a documentation log at the end of each of the working sessions.

The first week served as an introductory session for the participants in which the director of SERC further explained the history of the software's development and initiated a dialogue with participants about possible applications of the software for the future. Participants were given a handout entitled 'Creating a Digital Legacy'. This handout briefly explained how Crystal Memories software enables the user to create their personal story/legacy by documenting visual images of personal artifacts while digitally recording the unique personal memory/story that the artifact evokes for the user. A SERC research assistant then demonstrated the Crystal Memories software.

Participants were given exercises that invited them to choose personal artifacts related to the themes: *interests/hobbies*, *travels*, *favorite books/films* and *special gifts*. The exercises included questions about each theme to spark discussion and to guide participants in determining the development of their individual projects. Participants gathered as a group to discuss personal artifacts and the stories that they evoked during the first half hour of sessions 2, 3 and 4.

Each participant was assigned to a specific IBM desktop computer in the Internet Café that they used during each weekly session. A SERC research assistant installed Crystal Memories software on each participant's computer. A combination headset/microphone and a combination printer/scanner/photocopier were also installed on each participant's computer for use with the software. Each of these pieces of equipment was enabled by a 'one click' function embedded within the software design. Participants were also given the option of accessing the Internet, Microsoft Word, and a digital camera to use in the creation of their individual projects. The older adults used Crystal Memories software in conjunction with the above-mentioned equipment to document their artifacts and personal narratives. It should be noted that participants often made use of SERC's open lab time (which was held 1 hour previous to the allotted two hour session) to work on their projects. Participants spent sessions 5-10 working exclusively on their individual Crystal Memories projects.

### 2.4. Data Collection Measures

Participants were asked to complete a documentation log at the end of each of the 9 working sessions. The log invited participants to indicate comfort levels when using Crystal Memories software and any other technology they may have used in tandem with the software (i.e. digital camera, Internet). In addition, participants were encouraged to suggest improvements and recommendations for future versions of the software. The two research assistants who worked on the project also completed weekly documentation, recording observations of the participants' use of the software, as well as design implications for Version 2.



In August 2006, SERC hosted a workshop for graduate students who were trainees in a Canadian Institutes of Health Research (CIHR) strategic training grant in partnership with SERC and other participating institutions. A SERC research assistant presented the Crystal Memories software to the group, inviting them to offer suggestions for improving Crystal Memories software as a communication enhancement tool. Suggestions from the 7 graduate and post graduate level students were documented during the 1 ½ hour session (included under designer perspective).

### *2.5 Data Analysis Process*

Data for Project A was derived from the participants' weekly documentation logs as well as the researchers' weekly documentation notes. The data was summarized and coded to identify common themes for next steps in the software design. Data that indicated enhanced quality of life for the participants was also extrapolated from these sources and from each participant's Crystal Memories project.

## **3. Results: Project A – Well Older Adults**

### *3.1. Data Analysis Findings*

Several changes to the Crystal Memories design were identified by both the research participants and the researchers. These changes (section 4) focused primarily on increased accessibility for older users with limited computer skills as well as suggested improvements to allow for broader applications of the software.

While the process of testing the software in the initial stage of design proved to be frustrating for each participant at times, all participants expressed enthusiasm and a willingness to remain in the project, with the majority of the elders devoting extra time to the process. This speaks to the potential value of Crystal Memories software as a commercial product that enhances the quality of life for older adults.

Four of the participants used the software to record their personal life stories from childhood to the present. One participant commented, "It just feels good to get all of this down....I'm sure that many seniors would enjoy recording their life history. I'm enjoying it!" After sharing her project during the final session she revealed, "I didn't realize that I had accomplished so much in my life!"

Three of the six participants used the oral narration of their stories with specific family members in mind, addressing both children and grandchildren directly. These elders found value in conveying their personal stories across generations.

Feelings of increased wellbeing were noted for several participants as a result of using the Crystal Memories software. The group requested that the final session be devoted to sharing their projects with each other and the SERC research team. One participant commented "I think we're all really proud of what we've accomplished."

### *3.2 Limitations*

SERC's Internet Café provided a well-lit, quiet, inclusively designed environment for testing the software with older adults. However, ambient noise was an unavoidable distraction when participants were simultaneously recording personal stories within the 2-hour weekly time slot. Some participants noted that the 'noise' was distracting. However, the use of headsets and maximized space between each participant within SERC's Internet Café allowed participants to maintain a sense of privacy.

Glitches in the software design frequently disrupted the participant's ability to use the software effectively. Each of the 6 participants occasionally 'lost' their recent entries and had to begin the process of scanning and recording over again, thus interrupting a more natural flow of the storytelling process. This process did, however, highlight the importance of modifying the software design for future users and gave participants a sense of value in the feedback they were providing to shape future design. One participant, with a strong interest in computer technology, identified himself as being more interested in the software design process than the process of using the software to record his legacy.

## **4. Methodology: Project B – Elders with ADRD and their Care Partners**

### *4.1. Research Design*

The focus of the research design for project B was on maintaining the primary project goal: to determine if shared storytelling enhances communication between people with ADRD and their care partners. Data was extrapolated from a naturalistic setting and findings were based on observation. The focus of each session was determined by participants in order to foster independence and promote self-determination. The qualitative design of this study was based on the specific abilities and preferences of the research participant dyads. Each session was individualized to incorporate a flexible structure that allowed the research assistant and care partner to build on the strengths of the older adult's unique interests and abilities.

Project B consisted of 7 weekly 1-hour sessions with a SERC research assistant, the participant with ADRD and their primary care partner. After initial use of the Crystal Memories software in project A revealed unexpected software challenges, SERC research assistants determined that use of the Crystal Memories software was not appropriate for elders with ADRD. Project B was re-conceptualized to focus on the sharing of personal stories and artifacts between elders with ADRD and their care partners without the use of the software. By initiating shared storytelling through the use of meaningful personal artifacts, the planned research activity closely mirrored the design of the original study.

### *4.2 Respondent Sampling*

Both of the participants had been diagnosed with ADRD. Two attendees from the then Victorian Order of Nurses (VON) Halton Branch (note: now Acclaim Health), Seniors' Day Program at the SERC and their primary caregivers, (adult female children), were

recruited by a VON Seniors' Day Program staff member for the study. The suitability of participants for this pilot project was determined by VON Seniors Day Program staff. Two primary care partners were contacted by phone at which time a SERC research assistant outlined project goals and procedures. Participants were free to withdraw from the study at any time.

#### *4.3 Method*

The initial session was used to further discuss the purpose and design of the study. Participants were offered a decorative cardboard 'memory box' and a journal in order to facilitate the goals of the project. One of the two research dyads chose to use the memory box and journal to capture personal artifacts and the stories that the artifacts elicited. These artifacts and stories were shared with the researcher during the 1 hour weekly sessions. The second dyad chose to bring in artifacts and share stories in a more informal way. Sessions were held at the same time each week in the SERC multipurpose room to encourage familiarity with the researcher and the research process.

#### *4.4 Data Collection Measures*

Demographic information was collected during the first introductory session. The researcher collected field notes during each weekly session. The sessions were also tape recorded so that the narratives might be transferred to a more accessible version of Crystal Memories software in the future.

#### *4.5 Data analysis process*

Data was derived from the researcher's field notes as well as the journals, which were used by two of the research participants. Themes pertaining to the enhancement of relationships between the two research dyads were extrapolated from these sources.

### **5. Results: Project B - Elders with ADRD and Their Care Partners**

#### *5.1. Data Analysis Findings*

Communication between the older adults and their care partners was enhanced by the use of personal artifacts as a starting point for both individual and shared storytelling. Both of the elders were able to recall past events when reflecting on artifacts such as photographs and personal mementos. Both older adult participants expressed personal feelings and disclosed specific details when sharing stories evoked by the artifacts themselves and from questions that the research assistant and/or care partner asked in response to the personal artifact. One of the participants was eager to comment on the personal attributes that she recalled about several of the people captured in photographs. When looking at a photograph of her mother, she commented, "That woman could do anything but put an eye back in a goat!" She then went on to elaborate when asked to give specific examples about what she recalled her mother having done while she was alive.

A strengthening of kinship bonds was observed between the older adult and their care partner in both dyads over the 7 weekly sessions. Each older participant and their daughter shared personal stories with each other and each daughter engaged in sharing their own stories as they related to the history they shared with their parent. Both participant dyads in Project B discussed various similarities between other family members; the process of sharing and listening to family stories revealed specific personality traits and attributes that were understood to be common across generations.

One of the participant dyads in Project B chose to share and read from pre-existing family albums. The daughter revealed in a journal entry that, although she had looked at these albums with her father in the past, she found that the more structured memory sharing made the activity more meaningful for both herself and her father. Relationship building between the older adult with ADRD and their primary care partner was increased by allowing both parties the time and space to ask questions surrounding both their individual and shared histories. In her final journal entry one of the participants reflected on how the facilitated story telling enhanced her relationship with her father while providing them with a planned activity that was rewarding for both of them.

*“I feel the project has been very positive for reinforcing each of our senses of self esteem. It has added to our repertoire of activities that we can collaborate on. Whereas previously we had merely looked at photo albums together, this project called upon us to purposely select some memories and to elaborate upon them with supportive mementos. Hence, it became a creative endeavor for each of us.”*

## 5.2 Limitations

The nature of the pre-existing relationship between the participants with ADRD and their care partner is essential to the person with ADRD’s comfort level in sharing personal stories. This factor, coupled with the presence of a third party research assistant, may have hindered the process of exploration for both the participants who have ADRD and their care partners.

## 6. Implications for Policy and Research

Although there are implications specific to Projects A and B, recommendations from both projects are included in the following section. After initial use of the Crystal Memories software in Project A revealed several programming glitches, SERC research assistants determined that use of the software at this time would pose too great a technological challenge for the participants with ADRD.

- The initial pilot project (Project A) should be replicated with persons who have ADRD and a care partner using a revised version of the Crystal memories software.
- Future research studies should include more than two research dyads (Project B)

and focus on design implications for Crystal Memories Software as a communication tool for persons with ADRD and their care partners.

- Research should include a comparison of success rates for different software designs including a touch screen interface to minimize confusion relating to the use of the mouse; as well as different visual and organizational design interfaces.

Memory loss and the inability to effectively communicate one's personal stories has been found to produce a dehumanizing, devaluing and isolating effect for the person with ADRD within their social environment (Alm, Astell et al, 2004). The loss of the ability to communicate effectively can negatively affect both the person with ADRD and their care partners as traditional ways of relating, through shared stories, is compromised. As a communication-enhancing tool, Crystal Memories has the potential to strengthen caring bonds and increase empathy between the elder and those who care for him/her. This potential is especially relevant for both professional and familial caregivers for people with ADRD because increased feelings of empathy have the potential to reduce caregiver burden.

- Future research should focus on the effects of using Crystal Memories software as a personal reminiscence tool for the enhancement of communication and relationship building between persons with ADRD and their care partners. Qualitative research studies should look at Crystal Memories Software as a tool for increasing quality of life for both the person with ADRD and their care circle.
- Building on SERC's research partnership with the VON Seniors Day Program, Crystal Memories software could be used to capture the personal artifacts and stories of each person with ADRD upon entering the existing day program. A Crystal Memories program could be developed, involving the person with ADRD, a VON or SERC staff member (facilitator) and, where possible, a primary care partner. While the person with ADRD would benefit by communicating personal stories and increasing their sense of personhood, this suggested program would also provide a safe environment for the care partner and the person with ADRD to build a more meaningful relationship.

In the final stages of the disease progression, it is common for the person with ADRD to leave the immediate care of family members and enter a long term care home. Recognizing the reality that the ability to communicate is often severely compromised at this stage, previously recorded artifacts and stories within the Crystal Memories software would provide an effective reminiscence and communication tool for the person with ADRD and his/her new professional and paraprofessional care providers. One can anticipate a similar benefit for cognitively well, frail older adults living in a care home. There is often insufficient space for an older adult to keep a life time of personal momentos and their loss is felt by the older adults who would prefer to have them. This software enables the user to create a digital scrapbook which both preserves and catalogues the user's visual artifacts in a compact, accessible format.

- Future research should focus on Crystal Memories' impact on the enhancement of personhood for individuals with ADRD, and frail cognitively well older adults who live in long term care homes.
- Research should investigate the impact that Crystal Memories' software has on the effects of caregiver burden for both familial and professional care providers.

Results of research conducted in Project A suggest that Crystal Memories software could be used as a communication tool across generations. One participant in Project A suggested that the albums she produced might be added to by her children, grandchildren and future generations over time. In Project B, one of the participant dyads reported sharing their storytelling experience with a relative who lived in a distant province. This family member was able to share additional stories related to the stories that were shared within the research project. This data suggests that intentional personal reminiscence programs using Crystal Memories software may have the ability to enhance relationships between persons with ADRD and relatives across great geographical distances.

- Research should probe personal story sharing, and other methods of communication that may have a beneficial effect on the person with ADRD and/or frail cognitively well older adults and their care circle.
- Future research studies could focus on the impact of Crystal Memories software on relationship building across generations and geographical boundaries.

During discussions about the possible uses of Crystal Memories Software resulting from Project A, one participant suggested using the software to create a virtual living will. Pictures of objects that are intended to be passed on to specific people could be documented with an oral explanation of what the object has meant to the user and the reasons for leaving the particular object to the designated friend or family member. An added benefit of the Crystal Memories software as a tool for creating a living will is the user's ability to make changes to their virtual document over time.

- Future research could consider the impact of using Crystal Memories software as a tool for creating a living will with special emphasis on the psychosocial impact of creating such a document on the user.

#### *6.1 Recommendations for a More Accessible Software Design: User Perspective*

While this first version of Crystal Memories possessed many unique and useful design features, it fell short in other ways that led to the disappointment and frustration of its end users. The following is a list of users' recommendations.

1. Keep the large fonts as it is easy to read and comforting to the eyes.

2. Item's title should feature unlimited character space, allowing users to choose a title without space restrictions
3. There is a distinct need for a "BACK" option; error tolerance is not supported at all in the software especially while composing albums.
4. There is a need for a "PRINT" option in the software enabling users to print hard copies of the artifacts and text that have been added to the Crystal Memories albums.
5. The software requires an "EDIT" function so that changes can be made to entries after the album entry has been made.
6. A sound track sensitivity indicator would allow the user to easily choose an appropriate volume level.
7. The scanning function needs to be more sensitive as it occasionally displays empty screens once scanning has taken place.
8. Scanned items should appear on the users' monitor as soon as the recording takes place. The significant pause that occurs in version 1 was proven to irritate users.
9. Crystal Memories version 2 should employ a picture rotation and resizing function. The original size of some pictures caused frustration as the software limits the user to viewing only one direction of the image.
10. A drag function or an insert function would allow users to drag and drop sound and photo files in their desired album.
11. Users suggested including a miscellaneous file within the software so that the user could choose from previously scanned images within this file; using a drag and drop function to transfer data from this file to the chosen Crystal Memories album.
12. The software should be able to accommodate more than one artifact within the same album entry.

### *6.2. Recommendations for a More Accessible Software Design: Designer Perspective*

From a designer perspective, Version #1 of Crystal Memories carries too many flaws as an executable program. Currently these design flaws come close to voiding the essential use of the software. On many occasions, during project A the software was manually manipulated by a research assistant in order for the users to maintain their intended outcome. The following are some recommendations for improvements to the original software. It is suggested that Crystal Memories should be completely redesigned to accommodate for accessible use by persons with ADRD.

1. Improvements to the log-in mechanism and interface.
  - a. It is recommended that version 2 include a drop-menu in addition to the name log-in function. The software must implement a user Id, assisted by the "history-save" function drop-down menu to make it easier for the user to log-in and limit mistakes in spelling or typing an incorrect type case.
  - b. Crystal Memories should have more than one log-in path to each account. The software should include a combination username and number. This will serve as added security for the user.

- c. It would be truly beneficial to have the software utilize some kind of error detection as similar log-in names are used. If more than 3 or 4 letters match a previous log in, for example, Crystal Memories should detect that and ask the participant to retype their log-in name /digital password if it was typed differently than the password that is saved in history. This process can be repeated for 3 consecutive times and if failed then the software logs the user in to a brand new account.
2. The software has been programmed to overwrite names of pictures and files randomly. This feature needs to be organized. The store locations of the files should also be synchronized.
3. The function language in version 1 is very confusing. Buttons that execute certain functions need to be named consistently with the same function name to avoid confusion. For example, 'albums' are called 'sections' in some parts of the software.
4. The layout of the buttons should be rearranged to accommodate a more universal understanding of the software applications.
5. Crystal Memories should include an interactive software tutorial that allows the user to navigate the software prior to first using it.
6. The Exit or termination of the program needs to be better coded as C++ falls into a loop as the program tries to exit.
7. An interface that incorporates a thumbnail outlook design will make the software less confusing to manipulate.
8. The software interface should incorporate a more universal language such as "click to begin recording" instead of "start recording" and "stop recording"; this was confusing for users who thought this command was a message telling them that the recording had already either stopped or started recording.
9. A volume indicator bar should appear while recording. This gives the user a sense of how loud and clear the recording is while he/she records or listens.
10. Designing the album entries to appear in a slide show format, would create a more familiar context for the user with ADRD.
11. The function of "Creating the CD" should be placed in the initial software interface. It is counterintuitive where it is currently located, under "add or remove items".
12. Designate different saving folders for items and albums. Jpeg and audio files overwrite each other some times in version 1.

## 7. Conclusions

Crystal Memories has several applications of potential benefit to older adults and their care circle. As an archival tool, the software is an innovative and uniquely accessible product that enhances the life review process. A second benefit of the software is its potential to enhance communication and diminish social isolation through the sharing of personal stories with others, including both formal and informal caregivers. With relatives and friends of older persons often living outside of the same geographical location, Crystal Memories software has tremendous implications as an electronic



communication tool that allows users to share personal artifacts and stories across geographical boundaries, thus reducing social isolation and strengthening relationship bonds.

## 8. References

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