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Design Recommendations for Recreational Systems Involving Older Adults Living With Dementia

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Abstract

As the population ages, an increasing number of people will be diagnosed with dementia. Studies have found that insufficient activities are offered in memory care units to people with dementia, even though people benefit tremendously from participating in recreational activities. Information and communication technologies (ICT) can potentially facilitate activities in this setting, yet there is little guidance for designers to develop systems that can support people with dementia in engaging in recreational activities. To fill this gap, recommendations were generated through fieldwork and refined in two rounds of expert feedback. Areas covered include hardware, content, applications, and navigation. Systems should be usable by people with dementia, in addition to staff, to counter disempowerment by not enabling people to use their full abilities. In addition, a diversity of materials is needed to appeal to individuals with dementia who have widely varying backgrounds, abilities, interests, and preferences.

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Introduction

Almost 15% of U.S. adults above the age of 70 years have dementia (Hurd, Martorell, Delavande, Mullen, & Langa, 2013). Dementia is associated with age, with one in eight people aged 65 years and older affected by dementia and one in two people aged 85 years and older affected by this condition (Alzheimer's Association, 2012). Thirty percent to 40% of people with dementia live in assisted living or nursing facilities, compared with just 2% of older adults without dementia (Alzheimer's Association, 2012). One kind of assisted living facility specifically for people with cognitive impairment is a memory care unit (MCU; also called special care units, Berg et al., 1991).

Older adults with dementia living in assisted living facilities and MCUs may lack access to activities (Hancock, Woods, Challis, & Orrell, 2006; Moyle et al., 2011). This is concerning considering that according to activity theory, older adults benefit from doing as many of the activities that they enjoy as possible as they age (Havighurst, 1961). Researchers and practitioners have adopted activity theory in the field of dementia care (Phinney, 2006). For the purpose of this article, we focus on a subset of activities—recreational activities. We define recreational activities as those that are, to an individual, meaningful or enjoyable. This definition includes activities such as reminiscence (defined broadly as recalling past memories) or listening to music, which may be referred to as therapies in the literature.

Certain recreational activities have been found to be extremely beneficial with people with dementia: They are associated with increased positive affect (Schreiner, Yamamoto, & Shiotani, 2005) and well-being (Brooker & Duce, 2000), delays in cognitive impairment progression (Volicer, Simard, Pupa, Medrek, & Riordan, 2006), and a reduction in antipsychotic medication administration (Rovner, Steele, Shmuely, & Folstein, 1996). Activity programs can help people with dementia manage symptoms such as agitation, restlessness, and irritability and should be utilized before pharmacological approaches (Feil, MacLean, & Sultzer, 2007). The importance of recreational activities is recognized by federal agencies and guidelines: The Centers for Medicare and Medicaid Services (CMS) requires long-term care facilities that receive aid to provide "an ongoing program of activities designed to meet . . . the interests and the physical, mental, and psychosocial well-being of each resident" p.26 (Department of Health & Human Services & CMS, 2006). It is concerning that despite the benefits of recreational

activities, they are lacking for older adults with dementia in assistive living facilities (Hancock et al., 2006; Moyle et al., 2011).

Technology can provide a means to facilitate recreational activities (Wey, 2005). However, studies to design and evaluate technology with people with dementia primarily focus on safety needs or the needs of caregivers, rather than recreational activities (Topo, 2008). One reason researchers may hesitate to examine recreational technologies with people with dementia may be due to the myriad of ethical, logistical, and methodological issues that arise when conducting research with this population (Berghmans & Meulen, 1995; Lazar, Thompson, & Demiris, 2015). Given that designers may not have the resources to involve people with dementia extensively in the initial stages of design, detailed recommendations are a helpful starting point for designers of technologies to support recreational activities that can be used and evaluated in MCUs.

Related Work

Recreational Systems Involving People With Dementia

We define recreational systems as information and communication technologies (ICT; technologies that create, store, and transfer information) that support people in engaging in recreational activities such as social interactions with friends and families or playing games. This type of system contrasts with ICTs that focus on the detection of cognitive impairment (e.g., Brinkman et al., 2014) or cognitive training (e.g., Papastefanakis et al., 2011) and focus on measuring or addressing cognitive symptoms of dementia. A variety of recreational systems have been developed and evaluated with people with dementia.

One stream of research focuses on the design of new recreational systems. Researchers created a recreational system with a suite of applications such as arcade games and creative activities such as playing musical instruments (Alm et al., 2009). Another system includes both recreational components such as playing music as well as functional assistance such as reminders (Mulvenna, Sävenstedt, Meiland, Marie, & Craig, 2010). These recreational systems are generally designed to house a small number of applications which are thoughtfully developed but may not be suitable for people of all interests and backgrounds.

Other research has evaluated existing systems such as tablets and used them for recreational purposes such as to play music or games with people with dementia (Lim, Wallace, Luszcz, & Reynolds, 2013). In our earlier work on which these recommendations are initially based, we evaluated a commercially available system designed for use by older adults with dementia. The

system is composed of a touchscreen monitor and includes a large number of applications in areas such as social involvement (e.g., video calling and Facebook) and entertainment (e.g., games, puzzles, and movies) (Lazar, Demiris, & Thompson, 2016).

Guidelines for Recreational Systems Involving People With Dementia

Although recreational systems involving older adults with dementia do exist, the majority of systems focus on caregivers and safety (S. K. Smith & Mountain, 2012). Thus, there is a need to focus on the design of recreational systems that promote recreational and leisure activities with people with dementia (S. K. Smith & Mountain 2012; Topo, 2008). Guidelines are beneficial for designers of systems for different populations. Although guidelines exist for designing for the general older adult population (e.g., Fisk, Rogers, Charness, Czaja, & Sharit, 2009; Pak & McLaughlin, 2010), recommendations for the design of systems that involve older adults with dementia are less developed. Specific guidelines are needed as older adults with dementia have unique challenges with memory, language, calculation, and problem solving (Bird & Miller, 2010).

One broad framework exists on the design of tailored computer activity interventions involving people with dementia (Tak, Zhang, Patel, & Hong, 2015). According to the framework, format, content, and procedure affect engagement and consequently health outcomes, when individual characteristics are kept in mind during the design process. This framework is useful to guide researchers and designers, but does not have specific, concrete, and actionable recommendations within these different categories.

Researchers have also generated more specific recommendations for designers of systems involving people with dementia, primarily as requirements that guided the design of a specific intervention or as part of a discussion of an intervention deployment. Criteria for one recreational system include guidelines to support customization and people with dementia in having an equitable role in conversations (Gowans et al., 2007). Guidelines for a system that assists people with dementia in performing daily activities stress the importance of clear instructions and an intuitive system, as people with dementia may forget how to use the system repeatedly (Mayer & Zach, 2013). In addition, these guidelines highlight the need to involve others in using the system with the person with dementia as their condition progresses (Mayer & Zach, 2013).

In addition to generating novel principles, broader design principles have been modified or emphasized for use with people with dementia. The

Universal Design Principles, which urge designers to ensure that designs and environments are usable by as many people as much as possible without the need for specialized design (Connell et al., 1997), have been used to structure guidelines for videophones (Boman, Rosenberg, Lundberg, & Nygård, 2012) and a karaoke system for people with dementia to use (Outi & Päivi, 2009). Examples of Universal Design Principles highlighted for design involving people with dementia include creating opportunities for meaningful and pleasurable activities, providing only positive feedback, and promoting a sense of independence in users with dementia (Outi & Päivi, 2009).

Although the above recommendations are useful as guiding principles for designers of systems that involve people with dementia, they target specific components of a system and lack comprehensiveness across different aspects that must be considered by a designer (e.g., navigation of the system). In addition, they do not focus on design for the MCU environment, and many are intended for individual use of the system, as opposed to a shared system. As a third of people with dementia live in assisted living facilities such as MCUs (Alzheimer's Association, 2012), there is a need for recommendations that focus on systems specifically for the memory care setting.

Method

Initial Draft Recommendations

Initial draft recommendations were generated based on a field test of a commercially available system designed to promote engagement in recreational activities with people with dementia in MCUs. The system, described in the related work section, was evaluated in multiple settings: one on one with individuals with dementia in weekly sessions, during group use with staff, and in a smaller activity group for people with less severe cognitive impairments. Data were gathered through interviews with people with dementia, staff, and family members, and detailed notes taken during sessions. Altogether, seven people with dementia, nine staff, and four family members took part in the study over a period of 6 months. The general findings of this study are described elsewhere (Lazar, Demiris, & Thompson, 2015, Lazar et al., 2016). The recommendations were generated through content analysis of interviews as well as detailed notes taken in observations of system use in these settings. Recommendations were grouped into categories (e.g., accessibility) and then larger sections (e.g., navigation) after they were created. Interviews and notes were analyzed using NVivo Version 8.

Four principles emerged from the data and literature that guided the recommendations. Table 1 provides a description of each principle. These

Table 1. Guiding Principles and Descriptions.

Principle	Description
Facilitator	Assume that a facilitator will need to be present to use the system with the person with dementia given the level of cognitive impairment of people in MCUs. The facilitator is also important to avoid the technology being used to replace human care. A facilitator might be a staff member, a family member, or a volunteer.
Ownership and control	Despite the presence of the facilitator for assistance, the user with dementia should have as much ownership and control over the system as possible to reinforce autonomy.
Ability-based	Focus on what people are able to do rather than what they cannot do (Wobbrock, Kane, Gajos, Harada, & Froehlich, 2011). This involves viewing the environment as needing to changed to match the needs of the person with dementia rather than the other way around (Downs, 2000) and explicitly focusing on the strengths and continuing abilities of people with dementia (Sifton, 2000).
Mobility and flexibility	Take into account aspects that are likely to exist in an MCU, such as the need for mobility and flexibility given the time pressure felt by staff. One element of flexibility in this setting is the scenarios of use: It is possible that they system would be used with a group of users with dementia, as well as with an individual user.

Note. MCU = memory care unit.

principles relate to the role of the facilitator, control over the system, the importance of the technology being ability based, and the setting .

Expert Review

These initial draft recommendations were then vetted with a group of experts in two areas: gerontology (n = 3) and human computer interaction (n = 4). Inclusion criteria for experts were that they had published several first authored papers in their field (similar to criteria for experts in Delphi studies, for example, Jeste et al., 2010; Snelson, Rice, & Wyzard, 2012). The average age of the experts was 44.2 (SD = 12.7). Three of the experts were female, four were male, and all were based in the United States. All participants were professors at research universities.

Feedback from experts was solicited in two rounds: In the first, experts were interviewed for 30 min, reviewing the recommendations and offering

feedback on their clarity, usefulness, and validity. The recommendations were then revised based on expert feedback and a second draft was sent to experts to review along with an online survey with three questions which asked experts to rate the clarity, usefulness, and validity of the recommendations on a 5-point Likert-type scale (1 = *lowest score*, 5 = *highest score*), as well as provide additional feedback. The average of expert's scores for usefulness was 4.3 (*SD* = 0.95, range = 3-5, median = 5); clarity 4.4 (*SD* = 0.79, range = 3-5, median = 5); and validity 4.6 (*SD* = 0.79, range = 3-5, median = 5). Recommendations were revised again to feedback from the second round.

Results

The recommendations are grouped into five categories: hardware, content, applications, specific applications, and navigation. Below, sections of the recommendations are presented and expanded upon. Note that the term user refers to the individuals with cognitive impairment and the term facilitator refers to the individual using the system with the user.

Hardware

Hardware recommendations relate to the type of system that should be used, peripherals such as keyboards, and system elements such as the mobility of the system (see Table 2).

Content

Content recommendations cover appropriate and engaging types of content and suggestions for how to engage multiple senses without overstimulating or confusing users (see Table 3).

Applications

Application recommendations pertain to accessibility, language, wording and instructions. Other recommendations in this section are regarding avoiding issues and additional elements to engage people with dementia and their family and friends (see Table 4).

Specific Applications

This section has two categories of recommendations, for games and media.

Table 2. Hardware Recommendations.

Recommendation	Explanation
System	
Consider using a touchscreen system	Touchscreens are intuitive for older adults with dementia (Smith, Mountain & Hawkins, 2013).
Take into account the trade-offs of different types of systems	A handheld tablet is more mobile and enables more privacy than a larger screen, but may be difficult for collaborative use or for a user to hold.
Make system robust	In MCUs, it is important to have a waterproof system that is easily cleaned, and can be dropped (e.g., in a case) or does not drop easily (e.g., affixed to a sturdy cart).
Make system approachable	Users may hesitate to use systems that appear complicated or unfamiliar. Systems that appear similar to known systems (e.g., TV) can be less intimidating.
Peripherals	
Include a wireless keyboard	A wireless keyboard is easier for users and facilitators than a wired keyboard that must be within a close proximity of the system.
Consider simple alternate forms of input	Regular keyboards can be confusing for users; keyboards with large characters and clearly labeled keys are more suitable. Simple individually held devices (e.g., Wii remote) may be helpful to engage and empower users in controlling the system.
Simplify process of connecting system to monitor	Many structured activities in MCUs are done with a group, often using monitors. Staff should be able to plug the system into a monitor in as few steps as possible.
System elements	
Make system mobile	If used in a group setting, it is essential that a single facilitator can move the system from room to room (between a common area and individual users' rooms). One way of doing this is securing the system to a cart that can be wheeled. If the system must be plugged in, the cord should be long enough that the system can be placed in a variety of locations.
Avoid large and bulky system	Systems that are large and bulky are difficult for facilitators to move. In addition, storage space may be limited in MCUs, and staff may already have many materials they use with residents; the system should not take up too much room when stored.

(continued)

Table 2. (continued)

Recommendation	Explanation
Accommodate seated people	Nine in 10 people with dementia in long-term care have mobility impairments (Williams et al., 2005), and people with dementia are more likely to be mobility restricted (Wettstein et al., 2015). Accommodate seated users and wheelchairs.
Accommodate reaching issues	Given the high level of mobility impairments, some users may have impairments that affect their ability to reach. Systems can be made more accessible with a system that can be moved to various positions, or with a device that extends reach (e.g., straw).
Design for the environment of use	Various aspects of the environment that may affect use of the system, such as the light, glare, and the amount of noise in the background.
Simple on and off	Make it easy to turn the system on/off for the facilitator (as it is likely that they will be the ones turning the system on and off). However, it should not be easy do so accidentally.

Note. MCU = memory care unit.

Games. Recommendations in this section cover evaluating gameplay and how to avoid highlighting challenges of people with dementia, using an appropriate amount of difficulty, and scaffolding games so that gameplay is intuitive and error is minimized (see Table 5). In addition, types of games and additional features of games are described. It is important to keep in mind that the games that designers choose to put on their systems may be a diverse array, including puzzles, trivia, group games such as "Family Feud," and individual games such as Solitaire which come pre-loaded on many computer systems.

Media. Guidelines for media content, length and timing of media, and additional features are covered here. Recommendations regarding reminiscence media and other types of media (e.g., current movies, music or photographs) are grouped, as newer materials may evoke strong memories in people with dementia, for example, when viewing YouTube videos of babies, participants began recalling raising their children (Lazar et al., 2016; Table 6). On the contrary, older materials are not always evocative or remembered—we observed instances where trivia on topics that were intended to provoke reminiscence resulted in frustration when people did not recognize the topic (Lazar et al., 2016).

Table 3. Content Recommendations.

Recommendation	Explanation
Appropriate content	
Include options for applications and content	Dementia affects people across a number of decades, interests, life experiences, and cultural backgrounds. Not all users will have experienced the same historical events or appreciate materials from the same era. Include content that can be used by people along a spectrum of ability, as well as content that is diverse in terms of interests, culture, and gender (e.g., content traditionally perceived as masculine and feminine).
Accommodate consistent interests	As dementia progresses, people's interests narrow, but those that remain are consistent with what was appreciated before (Hughes, Berg, Danziger, Coben, & Martin, 1982). Include a variety of content that pertains to different interests or utilize a learning system that understands interests and presents content that is likely to be desired by the user.
Screen content	Staff can be wary of what they perceive to be inappropriate (e.g., sexual content), particularly when accessing freely availably content online. Consider screening applications and making this clear to staff.
Senses engaged	
Make different forms of media congruent	Multiple forms of media used together (e.g., audio, video, images, and text) can be engaging, but may be confusing if presenting different messages (e.g., audio playing while other text is shown).
Include images and music	Images and music can be especially evocative for people with dementia.

Navigation

This section presents recommendations for how to provide access to applications, present applications, and configure interactive elements and icons, as well as recommendations specific to touchscreens (see Table 7). These recommendations take into account the assumption that the system will be used one on one with a resident directing use, as well in a group with a facilitator directing use, therefore, for example, we recommend multiple modes for accessing applications depending on who is using the system.

Table 4. Applications Recommendations.

Recommendation	Explanation
Accessibility	
Use large sizes and enable size and contrast increases	Provide the ability to adjust size and contrast and start out with large sizes as people with dementia are likely to have vision impairment (Cohen-Mansfield, Marx, Regier, & Dakheel-Ali, 2009).
Intuitive audio control	Allow user to easily adjust the audio (e.g., on-screen control or a clearly marked knob) as hearing impairments are common for people with in long-term care (Cohen-Mansfield & Taylor, 2004), and people with dementia who have hearing impairment are less likely to join activities (Cohen-Mansfield et al., 2009).
Provide a way to turn off background music	When a system is being used in a large group, application background music can make it difficult to hear users.
Language	
Use language that provides context	For example, an icon that says "next" may not be understood if users do not realize that there is additional content. Instead use "Next picture."
Use short simple sentences and familiar language	Avoid complex language, abbreviations, metaphors, and technical jargon, as many people with dementia experience challenges with language (e.g., "click" will cause a user to look for a mouse rather than realizing it refers to a touchscreen).
Words and Indicators	
Avoid words that are not essential	Avoid any written information that is not absolutely necessary as people with dementia are likely to read both relevant and irrelevant text (Passini, Pigot, Rainville, & Tetreault, 2000).
Keep orienting information present	Include information about content to orient users during use of an application (e.g., the country in a travel video). However, users may read text every time it appears, even if it is the same text they read moments before. If the information is more than a word or two or stands out and will be read each time, consider an icon such as a question mark that can be tapped for more information.
Distinguish similar content	Users may become confused if there are similar items on a screen (e.g., the amount of money won in a game and the numerical value of a bet made in a game). Eliminate similar content or distinguish clearly between them (e.g., through clear labels or icons).
Avoid indicators that do not lead to understanding or engagement	Avoid making changes on the screen that are not essential as they may result in confusion (e.g., highlighting the last pressed icon).
Instructions	
Embed instructions	The pathway for next and possible next steps (as well as the objectives) should be scaffolded and obvious, as instructions may be challenging to remember for users with dementia.

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Table 4. (continued)

Recommendation	Explanation
Provide precise instructions	If instructions cannot be embedded, utilize step by step instructions, with steps only appearing when they are to be used. If this is not possible, have instructions accessible by an icon that is consistent in placement and appearance throughout the applications.
Avoiding issues	
Avoid technical risks	Users may become bored or frustrated easily or lose track of what they are doing when a system freezes or takes long to load. In addition, facilitators in an MCU are likely to stop using applications that do not consistently work due to a sense of time pressure. Pre-load content rather than depending on Internet access, and use well-established applications rather than beta versions. When technical issues are unavoidable, offer an easy way to switch to a working application.
Avoid interruptions	Screens should not popup during use, as this can interrupt a user and make it challenging to remember what they had been doing. Instead, overlay text on a blurred background to avoid disorientation.
Employ consistency across and within applications	Users with dementia are able to learn, but can have significant difficulty changing modes of interaction. Use consistent elements and interactions (e.g., if most applications use the touchscreen, do not require a mouse for another application).
Additional opportunities	
Enable remote content loading	Allow people such as family members to asynchronously load content remotely and asynchronously for additional interaction opportunities.
Embed additional information and interactions in applications	Users may seek out additional ways to learn or interact with applications. Provide additional opportunities for interaction (e.g., make images in slideshows clickable). However, some users will find additional opportunities confusing, especially if the application has an overarching goal (such as a game); consider an alternative mode with additional interaction opportunities where the goal of the application is less important.

Note. MCU = memory care unit.

Discussion

Seventy-seven specific and actionable recommendations for designing recreational systems involving older adults with dementia in MCUs have been generated through a Delphi-based approach. These recommendations are organized in the categories of hardware, content, applications, and navigation.

Table 5. Games Recommendations.

Recommendation	Explanation
Evaluating Gameplay	
Keep feedback neutral to positive	Users with dementia may misestimate how challenging an application is for them and become distressed if they receive low scores. If scores are needed to monitor progress, store them where they can be retrieved by the facilitator instead of showing that percentage at the time of play. Another way to minimize failure is utilizing an avatar; that way it is the avatar doing something wrong, not the user.
Employ positive feedback	The system should demonstrate enthusiasm when the user succeeds. Varying feedback (e.g., more points resulting in louder cheering) can help the user identify what actions are more successful. If a user is not successful, use encouraging feedback (such as "You're almost there!").
Elucidate scoring and why a user's input is correct/incorrect	Avoid games with complex scoring (e.g., a game where different arrangements of icons lead to varying amounts of points, such as a slot machine). In addition, users may wish to know why an answer was wrong, especially with facts from everyday life (such as trivia).
Difficulty	
Involve challenge	Although there is sometimes a focus on "failure-free" design for people with dementia, games without goals (e.g., a game where the goal is to tap shapes on the screen) can be boring for some (note that this does not include immersive environments, which are considered media rather than games). Casino-style games, where success or failure depends on chance, are especially engaging.
Determine appropriate difficulty levels	An MCU will have people with varying levels of cognitive ability, and users' cognition will fluctuate due to various factors throughout the day. Approaches to finding the correct difficulty level include having a learning system automatically adjust to find an appropriate level of difficulty and allowing a facilitator to select a difficulty level ahead of time. Avoid setting the difficulty at the time of play, as users with dementia may misestimate their abilities significantly.
Scaffolding	
Reduce need for memory of past actions	Do not rely on users to remember previous guesses, even those made seconds before (e.g., in a game like "Family Feud," list previously guessed words).
Provide example round	Users with difficulty understanding written instructions may appreciate experimenting with a game without "keeping score" or viewing a virtual user playing a round.
Utilize clues	Assist users by providing clues or scaffolding guesses to provide guidance, support, and context. One way of doing so is using an additional medium (e.g., pictures in addition to words).
Provide secondary information	Audible cues are an especially effective way to provide this type of information (e.g., a sound when a puzzle piece clicks into place).

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Table 5. (continued)

Recommendation	Explanation
Recap	Users may forget what action they had just made in a game. Consider providing information about the previous action (e.g., "Correct! Scissors can cut paper!").
Types of games	
Include games that do not bring the focus to challenges associated with dementia	Users may be aware that they are not able to play certain games as well as they think they should. Games that draw on creativity place a user and facilitator on a more equal footing as opposed to a game alphabetizing words.
Promote collaboration	Seek games that encourage collaboration between facilitators and a single user, as well as between facilitators and a group of users.
Error avoidance	
Consider allowing error correction	Users may wish to correct errors to feel a sense of having learned.
Support synonyms	In word games, systems should accept similar words as users with dementia may be challenged in coming up with the exact right word.
Avoid cascading errors	Games should not rely on prior steps being correct to be able to proceed correctly to the next right answer (e.g., crossword puzzles).
Make things work the way they do in the real world	Users may bring in notions of how things should work from real life and have a hard time remembering the alternate way the game words (e.g., users may have difficulty understanding that puzzle pieces cannot rotate in a puzzle game).
Minimize number of steps	Added steps increase complexity and likelihood of error. Aim for one to two steps by avoiding steps like confirming choices (instead offer "back" buttons).
Additional features of games	
Provide pause	Provide users or facilitators with a way to pause a game. This is especially important when a system is used in an MCU, and staff must interact with users during system use.
Show how many questions or items are left in a game	Providing information about how much is left may help users decide if they wish to keep going or do something else.

Note. MCU = memory care unit.

These recommendations are intended to improve the ability of the designer to create systems that support the needs of people with dementia, staff, and family members. Recreational systems that support activities are aligned with activity theory, which recognizes the benefits of activities for older adults and the need to modify activities that are difficult due to age-related factors, and,

Table 6. Media Recommendations.

Recommendation	Explanation
Media content	
Utilize mysterious content	Content that leaves room for imagination (e.g., a picture that shows a group of people having some type of party) can place users with dementia on equal footing with facilitators, create opportunities for conversation, and encourage "figuring it out" together.
Utilize dementia friendly questions types	If reminiscence media includes questions, avoid fact-based questions (e.g., "What are your sisters' names") and yes or no questions (e.g., "Do you have sisters"). Instead, use questions that encourage discussion (e.g., "What was it like growing up with sisters?).
Be aware that not all memories are good memories	For example, reminiscence materials may focus on wartime, but some users will have negative memories of this period. Even seemingly innocuous material can trigger distress; have a facilitator on hand to comfort users.
Length and timing	
Include highlight of shorter clips	Longer media (~20 min) may be appropriate for group use, but short highlight reels (30-60 s) may be more useful in a one-on-one setting.
Avoid intros	Sequences that play at the beginning may cause confusion in users (who may think they have seen a certain video if the intro is the same as a video they have seen).
Consider repetition	Repeating media brings out new memories or allow a user to embellish a story. However, this may be inappropriate for some users or facilitators tire of content.
Provide control of timing of media	Allowing control of playback speed and a skip function will allow more talk about evocative media and less about uninteresting media (e.g., in a slideshow).
Consider autoplay or continuous content	Autoplay or scrolling content reduces the numbers of steps required. Consider an interface that gives the user/facilitator time to exit, then plays the next segment.
Additional features	
Consider previews	Clearly marked previews of content can help users decide what to choose.
Use ad blockers	Much free and Internet content have advertisements designed to draw attention. These are likely to distract users and affect their ability to direct their attention.

Table 7. Navigation Recommendations.

Recommendation	Explanation
Access to applications	
Include multiple methods of access	Free exploration (e.g., via categories of applications) is suitable when users are navigating as they may not remember a specific application to look for, though staff may prefer a search function to find a specific application.
Provide intuitive way to exit	Make it easy and obvious how to exit out of an application.
Make it easy to switch within an application	For applications with a variety of content (e.g., a casino application with several slot machines), allow users to switch content with ease.
Presentation of applications	
Provide a way to easily hide applications	Users may forget that they did not like an application and repeatedly attempt to use it. Provide an intuitive way to hide the application during use.
Present a subset of the available options	A large body of applications and content can provide novelty, meet diverse needs, and give users choices. However, people with dementia can experience challenges when choosing between options. Ways to reduce the number of options yet offer choices include allowing facilitators to customize user profiles with favorite applications, or using a learning system that finds content similar to favorites. Consider introducing random content occasionally to discover unexpected interests.
Avoid many layers	Multiple sub-folders may cause confusion for users. Limit to 1-2 layers. Make it clear where users are within they system (e.g., utilize breadcrumbs).
Include history of enjoyment	Users may not remember if they enjoyed an application. Allow users or facilitators to note enjoyment and have this information affect which applications appear.
Interactive elements and icons	
Use icons that precisely represent the application or content	Users may assume that icons represent an application (that clicking on a dog image will lead to a dog picture, not a dog puzzle).
Make interactive elements obvious, large, and far apart	Distances between elements should be at least 1" so users are unlikely to tap the wrong one accidentally.

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Table 7. (continued)

Recommendation	Explanation
Have different types of touches register	Given users' likely physical impairments, permit short and long touches, as well as double taps, taps with multiple fingers, and tremor.
Clarify what is interactive	Users may have difficulty distinguishing between interactive and non-interactive elements, especially for interactive images (e.g., images that link to videos).
Make it clear when an action is completed or not	Users may otherwise not realize when their touch is not registered on a system.
Touchscreen	
Do not make a mouse necessary	As the mouse requires coordinated activities (clicking and dragging), it may be more difficult for users than a touchscreen.
Simplify scrolling	A touchscreen scroll bar is more intuitive than dragging a page down.

in this case, cognitive impairment (Havighurst, 1961). Recreational systems can facilitate modified activities better suited to the needs of people with dementia, particularly when attention is paid to supporting autonomy and control, avoiding usability issues that make activities difficult to carry out, matching activities to an individual's unique interests, and negotiating the role of the facilitator.

The role of the facilitator is highlighted within the recommendations. One reason for this is that it is likely that it will be challenging for most people with moderate to severe dementia to operate a system completely independently, even when the system is designed for independent use (Meiland et al., 2012). Involving a facilitator is also beneficial for the purpose of increasing opportunities for people with dementia to interact with others. Although movies and other passive activities can benefit people with dementia, it is important that the technology is not solely used to provide entertainment that decreases a person's active engagement level. Indeed, an ethical concern of using technology for people with dementia is that the technology will replace human interactions such as those with staff (Marshall, 1996). Thus, these considerations highlight the need to balance how engaging and immersive applications are with how much they enable conversation and interactions between the facilitator and the person with dementia. Including the facilitator can benefit not only the individual with dementia but also family members who may desire to have a structured activity to engage with their relative.

People with dementia can experience frustration at a loss of abilities (Kitwood, 1997). One way of restoring a sense of autonomy, dignity, and self-esteem is by enabling people with dementia to have decision-making power and control when possible (van Gennip, Pasman, Oosterveld-Vlug, Willems, & Onwuteaka-Philipsen, 2014; Zingmark, Sandman, & Norberg, 2002). Offering the person with dementia control has been identified as important within the context of the design of technologies, as the "experience of competence is crucial to users" (Outi & Päivi, 2009, p. 73). Indeed, the use of technology has been identified as a way to help people with cognitive impairments retain independence and control (Newell, Carmichael, Gregor, & Alm, 2002).

A guiding tenant of the recommendations is to provide the person with dementia control over the system to the maximum extent possible. Some may seem extremely, such as making the audio control easy to use so that a facilitator does not need to assist. However, even small instances of doing something *for* someone with dementia when that individual could have done it themselves (referred to by Kitwood as "disempowerment"), over time, can damage the self-esteem and emotional well-being of people with dementia (Kitwood, 1990). Therefore, we stress the importance of making the system as usable for the person with dementia as possible. Even with the system designed for the person with dementia, facilitators may take control or do things for people with dementia even when the person could do it themselves (Kitwood, 1990). Future research should investigate how system design can encourage facilitators to offer control to people with dementia.

The amount of technical or usability issues encountered greatly affects the experience of a user. This is widely recognized in the field of human factors, but we emphasize that with a population with dementia, usability is even more important than with the general population given challenges with memory and processing that affect use of the system. It is important to avoid technical risks such as beta-testing applications with this population, particularly in the MCU setting. Although there are benefits to using early versions of applications or including additional applications that have usability problems but might be otherwise enjoyable, the difficulty this population experiences recovering from errors is too high to justify doing so. Technical and usability issues should also be minimized for staff, who may feel an intense sense of time pressure (Edvardsson, Sandman, Nay, & Karlsson, 2009).

The diversity of applications and content is critical for several reasons. First, people with dementia have varying and individual interests, backgrounds, differences, and preferences, and respond to different kinds of activities (M. Smith, Kolanowski, Buettner, & Buckwalter, 2009). Second, interest in different applications can vary with severity of dementia (Tak, Zhang, &

Hong, 2015), and people with a range of dementia severity may live in the same MCU. Individualized activities that match the interests, abilities, and self-identity of people with dementia can increase the positive affect and enjoyment experienced (Cohen-Mansfield, Parpura-Gill, & Golander, 2006; Gitlin et al., 2009; Tak, Zhang, Patel, & Hong, 2015; Van Haitsma et al., 2015). Finally, people with dementia may hesitate to take initiative or be unable to overcome usability issues to use the system on their own, especially as the condition progresses. It is key to make the system usable and enjoyable for the facilitator so that they will be likely to use the system with the user with dementia (Mayer & Zach, 2013). One element of what makes a system enjoyable for staff is diverse content, as staff note that though people with dementia may not remember content, staff tire of using the same content repeatedly (Lazar et al., 2016).

The recommendation to include a large body of applications discussed above is at odds with some of the other recommendations that stress keeping the system as simple as possible for use by people with dementia. Although this tension is somewhat resolved with several proposed ideas (e.g., only showing a subset of the applications), in general, there are tensions that the designer will have to resolve based on the specifics of the environment and users.

Although these recommendations have been generated based on field experience with a technology and the input of experts, the ease with which system designers can apply them has not been tested. Next steps involve refining the actionability and ease of implementation based on the input of designers. In addition, it is important to obtain feedback from people with dementia themselves to ensure that the recommendations meet the needs and preferences of people with dementia. Next steps also involve using these guidelines in the design of a system, gathering feedback to iterate on the design, and then implementing the system in an MCU.

Conclusion

Informed by activity theory and research, our work is based on the knowledge that people with dementia benefit tremendously from recreational activities, but opportunities to engage in these activities are lacking in MCUs. Technology has the potential to support recreational activities that are enjoyable and can foster interactions between people with dementia and staff or family members. In this article, recommendations for designers of recreational systems for people with dementia in MCUs are presented. These recommendations were generated through a 6-month study deploying a recreational system in a MCU and evaluated and revised with expert input. Recommendations encompass areas of design such as hardware, content,

applications, and navigation. By using these recommendations, designers will be able to create recreational systems that better address the needs and support the abilities of people with dementia.

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Note

1. "User" is used interchangeably with "older adult with dementia." Facilitator refers to another individual, most likely a staff member, using the system with the user.

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