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## THE LIVING CENTER (TLC): A WEB PAGE THAT THINKS WITH ITS USERS

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This paper describes an interactive web experience for people who have little or no short-term memory. The goal is to support caregivers in comforting Alzheimer's patients. A suite of web applications uses AI representation and learning technology to reduce attention on specific or difficult-to-access memory-oriented activities.

Eight intelligent application activities are spatially arranged in a living room: picture selection, flower arranging, garden tool organizing, catalog shopping, puzzle, radio, an interactive kaleidoscope, striking a chime and fire stoking. The activities are designed to be open-ended with evocative content that lead to things that they can do and avoid frustration..

### 1 Introduction

People with Alzheimer's and other kinds of dementia tend to be productively challenged. They cannot find memories of the things that they care about most. How can they and their caregivers learn to enjoy their time? The movie, *Complaints of a Dutiful Child*, [2] depicts ways a caregiver can defocus therapeutic sessions by encouraging the afflicted person to try to remember things they will not be able to remember, to try to organize themselves in ways that they cannot, or to try to function in a world that is too complex for them. The book, *The Forgetting*, [7] describes many approaches that have been helpful for caregivers to work with Alzheimer's patients that might not be so stressful.

One person found carrying her purse with a napkin in it is more satisfying than revisiting the complexities of the belongings that she used to enjoy in her home [2]. They enjoy the way a Bingo card or a partially folded towel reminds them of what they are doing. Alzheimer's patients and their caregivers need to seek out activities with built-in progress and memory aid prosthetics to reduce anxiety. How can we use physical and visual memory to help people keep track of a process once they've started it?

Could a computer program include an understanding of the issues of interacting with Alzheimer's patients? This paper describes using imagery, scenario, and Artificial Intelligence (AI) to create interactive web experience for people with Alzheimer's.

### 2 Methods; designing TLC

Could a system focus users by only requiring them to react? Simplifying interaction with implicit communication is the premise of context-aware computing. This should help people who have reactions to things but little ability to remember them [7].

A computer can effectively tailor its help for a person by watching a user's demonstrated expertise and experience [6]. A goal is to demonstrate that such adaptive user model-based scenarios can be helpful for driving an interface that helps bridge cognitive capabilities. The jukebox, kaleidoscope and the picture puzzles all have adaptive behavior. In all of these activities the user criticizes the system as a way of informing it. To the extent that the system knows what a person doesn't like, it can do something else. .

A 2-D web site seemed abstract. A 3-D living room can be understood by users and conjures up a simple comforting place. Several activities include conversation-creating web content from the user's active years. Several activities focus on organizing things. The unusual learning technology is embodied in intelligent activities which watch the user and decides how to challenge and assist them. TLC is deployed on the public PBS website [1]. The following sections describe the development of the activities.

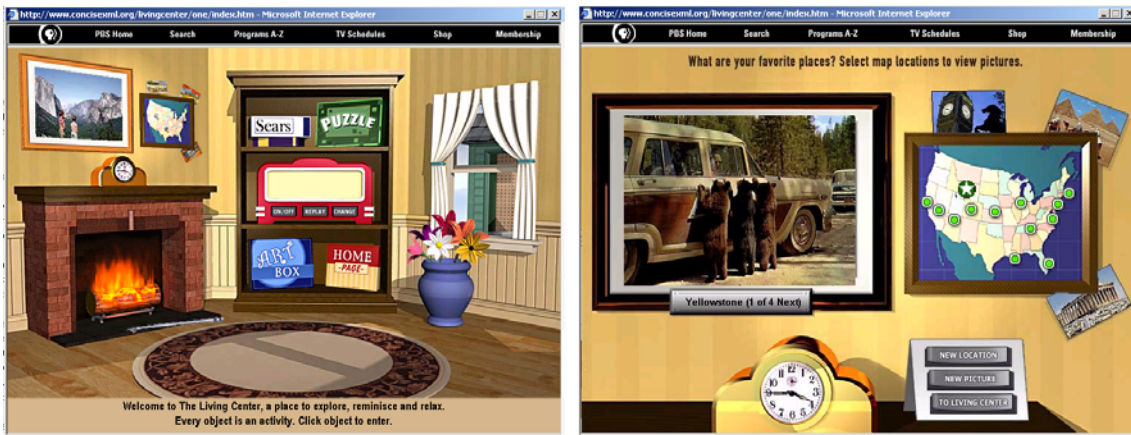


Figure 1. Left *The Forgetting*, Living Center interactive home page. Right: The Picture Activity has images to view from famous places.

### 3 Activities

The TLC is comprised of selection, organizing and creation activities. The home page is a living room (figure 1L). To help orient users, all activities include imagery showing that they are connected to the Living room.

Three mechanisms for navigation are provided: First, the mouse selects things everywhere on TLC. Every page has a legend with virtual buttons to control it or to return to TLC. Second, The largest key, the Space bar, selects focus. Pressing it gives control without making disruptive things happen. The Enter key, selects activities and actions. The Backspace button returns the user to TLC page. Arrow keys are used for fancier navigation. Finally, if the user does nothing, the living room will highlight and present an explanation bubble for each of the selectable items This progression of seeing activities followed by seeing an explanation provides a mechanism for encouraging people to do something and showing them how to do it.

The simplest activities are the chime and poker (figure 1R). Clicking on the fireplace or poker causes the poker to position itself over the fire, the fire gets bigger and makes a crackling sound. Poking a fire in a fireplace keeps the fire working, keeps you warm, and makes the room an enjoyable place to be. The chime is a similar activity that a person can make ring by clicking over the clock.

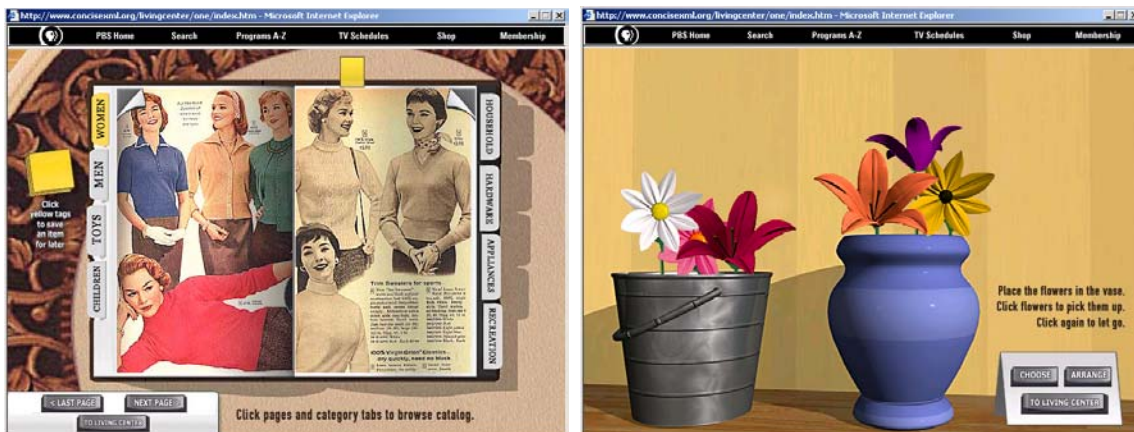


Figure 2. Left: TLC, Sear activity displays a catalog of products from the 1950s in categories that are chosen to be useful for conversation starting. . Right: The Flower organizing activity allows users to choose and arrange flowers in the vase.

A Picture can explore places. The Picture is entered by selecting a framed photograph or a map on the wall of TLC (figure 2L). The pictures were chosen to attempt to have interesting enough content and composition to start a conversation. Double circles on the map select pictures to present in the picture frame. Well-known landmarks annotate the schematic of North America: Yosemite, San Francisco, Grand Canyon, Yellowstone Park, Chicago, New York, Florida, the Smokey Mountains and the Midwest. Cards in the map frame represent famous international places: Egypt, Greece and London. Users will find themselves visiting interesting and possibly familiar places. Selecting different places on the map gets pictures from that area; selecting it repeatedly shows that place in a range of time frames in a elder person's active life.

The Sears catalog can find things users may have known of or used. The Sears catalog uses images and tabs as memory aids (figure 2L). A user chooses to browse product images from eight categories including toys, housewares, household appliances, hardware and tools, recreation & entertainment, women's, men's & children's clothes. Always-visible tabs show all the categories available.

Simplified 1950's Sears catalog pages are included for each category. The pointer on the corner of a page turns the page, the tab selects a category, the stack of yellow markers selects a tag to place on a product and the page edge is also to remind the person to of where they found something interesting.

The flowerpot mimics packing behavior with creative and beautiful consequences. Unlike packing a suitcase or moving belongings which might conjure difficult thoughts of moving or life changes, a flower arrangement allows users to engage in something positive, beautiful and optimistic (figure 2R). A user is allowed to select flowers and move them from a bucket to the flower arrangement in the vase. The system arranges flowers intelligently when a user presses the Space and Enter Keys.

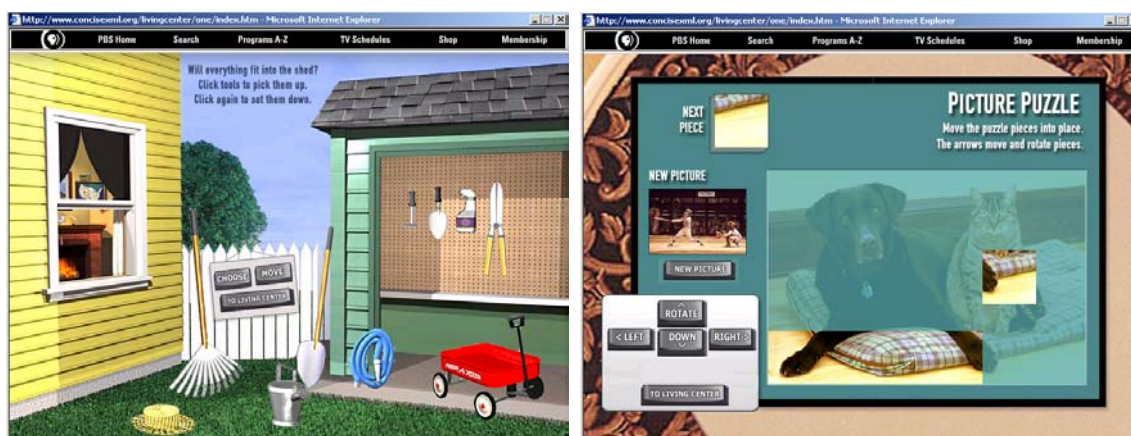


Figure 3. Left: The Garden Shed allows users to choose useful objects. Right: The Puzzle shows images in pattern matching problems

The backyard shed lets users organize yard tools in a bright outdoor setting. Selecting TLC window takes the user to the shed (figure 3L). Like the flowers, this is a organizing activity; like the Sears catalog it allows users to select and discuss things. The outdoor yard scenario attempts to elicit stories of gardening and household tools. The gender-neutral yard was chosen over a pantry, kitchen or workshop to be more inclusive and flexible. Selecting the living room through the window returns the user to TLC.

The puzzle uses intelligence to know how much help to give a user (figure 3R). This puzzle shows a faded picture that can be selected by the user. Filling in a picture with the right pieces makes those parts vivid. While other image-based activities on the site present a specific time or place or item, the puzzle pictures are simply chosen to be evocative (such as the dog and cat sitting happily together).

The user watches pieces dropping sequentially into place in a picture. The legend shows that pressing the Space or Arrow keys will help. In each case, the demonstration of moving or rotating a piece will update the computer's internal user model of what the user can do and change the way the puzzle plays. If the user fails to put a piece in the correct location, the puzzle will begin presenting easier placement problems.

The art box presents a kaleidoscope that changes and moves patterns made up of rectangles. Like the living room fire, it is a pattern that one can watch (figure 4L). When it has stopped drawing, clicking on the mouse over the image will give it positive reinforcement to make similar patterns. Clicking the mouse over the image while it is being drawn will give negative reinforcement making it draw different patterns. The kaleidoscope gets its look from recursive layers of four way reflected patterns. The Similar and Different buttons inform the AI system which changes color and size constraints of elements at various layers of complexity.

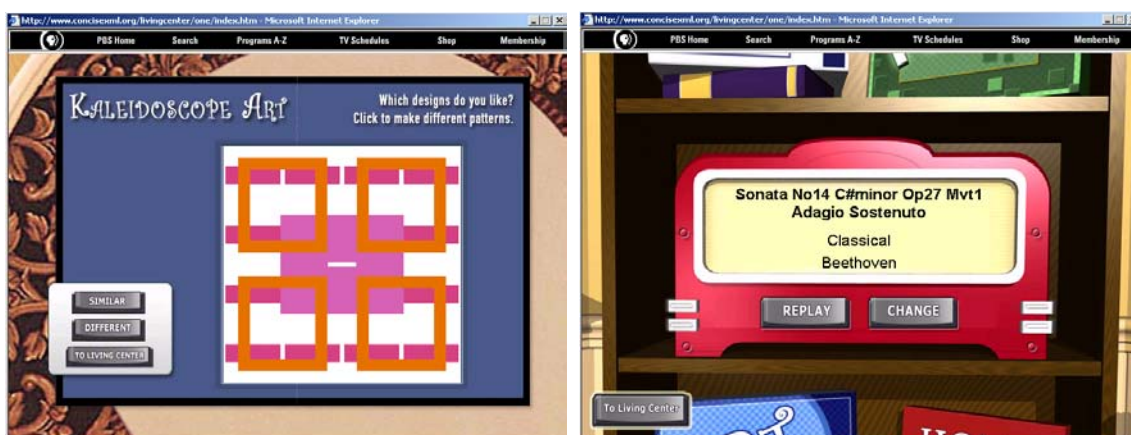


Figure 4. Left: The Art activity is a kaleidoscope pattern generator. Right The Jukebox plays piano tunes from several genres.

The jukebox, like the kaleidoscope, models user reactions recorded when they press the Change or Replay buttons (figure 4R). It also models user listening issues with six agents [5]. Does a user like to listen to songs over and over? Do they like a genre? The radio learns why a user is fiddling with the buttons to choose music that will please them. A partnership between the computer and user is not new. The idea of a computer that proactively creates experiences that a user wants is new. The reactions of Alzheimer's patients are characteristic of them even if they can't remember the decisions they make. The goal is a smart website making the users be able to better use their minds.

Together the activities in this section make up *The Forgetting Living Center*; an interactive website comprised of conversation-eliciting activities. The next section describes experiences in engaging Alzheimer's caregivers and patients with the system.

#### 4 Discussion

We have shown the website to approximately one dozen Alzheimer's patient/caregiver pairs. We universally found the approach engaging to all who were shown how to select activities.

People had warned about perceptual and computer-fear problems that did not transpire. A person with glaucoma and without their glasses was able to identify most everything on a complex faded puzzle image. Understanding images was different; people did not recognize the Twin Towers or Neil Armstrong walking on the moon but found two women at the beach interesting.

Although only one Alzheimer's user was known to have used a computer, none of the patients showed frustration looking at the screen or focusing on TLC for long periods of time. Getting Alzheimer's people to manually control the system absorbed their concentration. The caregiver is better off in the driver's seat.



Simple controls and navigation really helped. They were able to enjoy and use all of the intelligent activities without a lot of trouble. The puzzle's movement attracted everyone. The patients enjoyed interpreting the images and the caregivers would get more engaged in the act of completing the puzzle.

Strong imagery caused the best conversations. The flower arranging was extremely engaging, starting several conversations about color and flowers and arrangements. Many users spent as much time as could be allowed talking about the pictures. Testing revealed which images made this work

While the radio was very engaging it limited conversation. Adding identifiable melodies to the jukebox improved the response to the radio tremendously.

Specific objects started deep conversations. Some wanted to move things; some wanted to talk about gardening and organizing the tools in the shed. Users compared things they had owned in the Sears activity. More content could improve this. Patients liked to show when they knew the name of objects.

A professional caregiver who had worked with a patient for two years discovered three new things about the person's life and experiences in twenty minutes of using the site. A mid-level Alzheimer's patient who had been an engineer surprised everyone by talking of detailed design issues in the shed area. Several times caregivers shared that they had not heard this patient talk so much in a long time. The patients were enchanted by the imagery and actions of the site even when they had to take a break from lunch to see it.

## 5 Conclusion

TLC is an interactive web experience for Alzheimer's patients and their caregivers. It is part of *The Forgetting*, a web resource for the Alzheimer's community associated with the TV special [1]. It uses AI to augment the abilities of users, and to give them productive learning in social encounters. It relieves people from intellectual demands that are now difficult and it proposes rewarding activities. TLC shows that AI can work together with people in helping them overcome their limitations and enjoy their time. If adaptation can help keep Alzheimer's and caregivers working together, it can help orient and focus other educational conversations as well.

## 6 Acknowledgements

We are grateful for Metropolitan Life's funding. Naomi Boak brought us this opportunity with courage, infinite patience and an open mind. Erika Steinrick mediated the development process, acquired content, and solved a myriad of problems. Mike Plusch worked tirelessly to write the website to allow most of it to work on all systems. Vadim Gerosimov seemed to build the puzzle instantly and ported the smart jukebox against an impossible schedule. Lisa Gywther, an expert on Alzheimer's, helped mould many of our ideas. Elin Sjursen made early prototypes. Jay Kamins enthusiastically rendered the site to bring it to life.

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