‘Senior Moments’: Loss and Context

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ABSTRACT
Everyone occasionally experiences momentary confusion about the intent of an action in the midst of doing an ordinary task (“Why did I come into this room?”). As we age, these momentary confusions, referred to here by the colloquial term *senior moments* become more frequent. Lapses of this sort can also be the result of specific cognitive degeneration associated with aging and can have an impact on day-to-day living that ranges from annoying to incapacitating. This paper discusses the current understanding of senior moments in relation to cognitive decline and depicts scenarios depicting typical instances of them and common sense techniques to repair the memory slips. We present a discussion of the challenges involved in the design of a computationally based system for supporting lapse remediation, and specific implementation issues involved in providing such a system

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1. INTRODUCTION
The “senior moment’ - everyone has had them - when you walk into a room and suddenly have no idea why you have come here. In the midst of a conversation you might suddenly realize you have no idea what you were talking about. The very nickname for these ‘senior moments’ illustrates that they occur with increasing frequency as we age. This paper reviews prior research about the phenomenon, common breakdown-repair approaches, possible directions for computer-supported assistance, and several interesting aspects of the design challenge.

2. SENIOR MOMENT
“Senior moments” is a non-medical term for memory lapses. Most common of these is the temporary inability to recall a name, a number or what you were about to do. The scientific term for a common type of senior moment is: literal paraphasia. This is when we distort a word by substituting one sound for another. In healthy subjects this commonly occurs as a result of sleep deprivation and stress. Senior moments have been investigated as possible signs of mild cognitive impairment (MCI) [12, 18], a middle ground between normal age-related memory loss and dementia. Persons with normal age-related memory loss are usually able to compensate for these changes by using lists and other memory aids. In other words, the senior moments don't generally impair daily functioning. In general, senior moments can be disturbing, but are usually a result of the brain's normal aging process. Unless the phenomenon impairs one's ability to manage day-to-day activities, a few lifestyle changes should help to turn senior moments into mere occasional annoyances [2].

Since senior moments may be early warning signs of Alzheimer's disease (AD) or another dementia, it’s important not to underestimate them. Unfortunately, it is hard to tell if senior moments will persist at normal levels, or if they are the onset of something worse. Not all MCI subjects advance to Alzheimer’s disease, but patients with severe memory impairment (amnestic MCI) are more likely to progress to Alzheimer’s disease more rapidly than other MCI patients. The ability to predict which MCI subjects are more likely to progress to dementia or Alzheimer’s disease more rapidly than others, then, remains a major area of interest within the field of MCI research.

2.1 Target Population.
About 40% of people aged 65 or older have age associated memory impairment—in the United States, about 15 million people [11]. According to the Federal Interagency Forum on Age-Related Statistics[9], 5.1% of persons between the ages of 65 and 69 demonstrate moderate to severe memory impairment. This number steadily rises to 13.6% for persons 75-80 years of age and is estimated to range from 32.1% to as high as 47% [8] for persons over 85.

Findings of epidemiological studies have shown that subtle difficulties in the performance of everyday activities (e.g. complex hobbies, finance handling) are common in individuals with mild cognitive impairment 2 years before a diagnosis of dementia, whereas overt difficulties in certain abilities (use of the telephone, finances, transportation, drugs) signal the onset of dementia. The management of patients with mild cognitive impairment is currently non-specific. Many people are very aware of their difficulties and seek information about the nature of their disorder and their outlook. These people are also interested in coping strategies.

2.2 Characteristics of AAMI

Age Associated Memory Impairment (AAMI), is characterized by self-perception of memory loss and a standardized memory test score showing a decline in objective memory performance compared with normal aging persons. An associated diagnosis, Ageing-Associated Cognitive Decline (AACD), is also widely used to describe this kind of mild cognitive decline in ageing. The next diagnostic level of this deficiency is MCI, which represents a more severe form of memory loss and is often defined by significant memory deficits without functional impairments. Although patients with mild cognitive impairment are able to continue to live independently, they show objective memory impairments similar to those seen in people with very mild Alzheimer's disease. At the far end of the memory loss continuum is Alzheimer's disease and dementia. Impairment in cognitive functions due to neuropathology is linked to a growing inability to meet situational demands, and to memory, verbal, and learning deficits that are the hallmarks of dementia. As a neuropathology progresses, significant impairment in communication and daily living skills are typical.

AAMI can manifest in different ways, from aphasic moments to lost memory items to conscious confusion about the intent of a recent action. It is this loss of information about intermediate goals of a given script that the oldster is experiencing ("now why am I in the living room, what did I want to do?") which we would like to address. This does not mean that a project in this area could not include mitigators for the other manifestations of AAMI, particularly the tip of the tongue phenomenon, but the loss of information about intermediate goals seems to be the easiest to address at this time. It is the more affected range of AAMI and less affected range of MCI which is most amenable to mitigation by on the spot techniques or tricks.

In subjects with neurodegenerative diseases, relying on memory strategies can be unsatisfactory and of limited use in the long run. In this case, a device-driven memory aid may give cues that elicit memory retrieval when mnemonic strategies alone can no longer accomplish retrieval.

Health-care providers must necessarily aim their treatment goals at slowing the pace of decline, maintaining retained skills and seeking to prevent the worst disabilities predicted by a disease, since there are presently no treatments that halt or reverse neuropathology. The American Academy of Neurology of Ethics and Humanities Subcommittee [1] recommends, "care over cure" and maximizing the care recipient's quality of life by preventing excess disability

3. APPROACHES IN THE LITERATURE

It is now widely accepted that MCI is the single most important at-risk factor for AD. There are at present no Food and Drug Administration-approved treatments for MCI, no pharmacological interventions demonstrated to be efficacious in MCI. Further refinements of the criteria and the prediction techniques may be necessary for outcome prognostication [15, 21]. Fallback to biomarkers of high reliability (fMRI, PET) is still too expensive for regular use, and those still do not provide an early diagnosis. Some preventive attempts emphasize cognitively stimulating activity, nutritional interventions (healthy diet) and physical activity. But we still do not understand enough about the relationship between such lifestyle factors and MCI [3, 10] .

Strategies for coping with senior moments are usually mnemonic strategies or strategies aimed at focusing attention. Since attention and adequate sleep are strongly linked to memory encoding, some common sense suggested tips to reduce the incidence of senior moments are: get plenty of sleep; concentrate and relax; group items using mnemonics; use visual images; do one thing at a time; say words out loud and write things down; place commonly lost items in a designated spot; replay memories in your mind to reinforce them. Therapists also often suggest using memory aids such as a pocket notepad, or a personal digital assistant (PDA), wristwatch alarm, voice recorder, or other aids to help remember what you need to do or to keep track of information, so as to reduce mental clutter [7,16,20,23].

Other than that and mnemonic tricks ("where was I when I last saw my keys?"), there are many products on the market specifically designed to help an aging population with day-to-day scheduling problems, doing the kind of tasks that did not require support in their earlier years. Some of them are external orthotics conceived as compensation systems dealing with prospective memory problems [4] or portable systems, like SenseCam [14], intended to help autobiographical memory by recording life scenes. Nevertheless, a review of the literature and the World Wide Web revealed no external orthotic that is designed to fix specifically the breakdown caused by the senior moments. A Georgia Tech project with the intent to repair similar memory lapses, *Cooks Collage*[22], was domain specific (cooking in a kitchen) and "Wizard of Oz" based (a graduate student imitated computational support). *Cooks Collage* resulted in publications but no products, patents or ongoing research.

4. SCENARIOS

Seeking to solve the problem of loss of information about intermediate goals, we developed a number of scenarios to describe existing manifestations of the senior moment and existing coping mechanisms.

4.1 Loss

AAMI is noticeable when it interrupts the smooth performance of a task or script [19]. There are two common situations: performing a goal-oriented task, and in the midst of a conversation. A scenario we call *'forgetting why you are in this room'* depicts a 65 year old man working on his correspondence in his home office and needing his grand children's home addresses to send the traditional Easter candy that he and his wife send out every year. He looks through his desk for his address book and realizes that he left it in the living room yesterday when he was on the phone with a friend and was updating their address. He gets up and walks down the hall to the living room, stopping in the kitchen for a glass of juice, and as he enters the living room he stops short and with a perplexed look on his face says, "now why am I here – what was I looking for …?"

Another scenario that we call *"What were we taking about"* involves two elderly women chatting while enjoying the sun in a back yard. They are talking about places they have visited on vacation at various times in their lives. Sally was talking about her vacation in Tuscany when the phone rings and Alice (whose house this is) gets up to answer it. Returning from a short telephone conversion ("it was the plumber to tell me he was going to be late"), Sally says, "Now what were we talking about?"

4.2 Recovery

We can match loss scenarios with scenarios portraying recall using 'common sense' solutions. For the man in the living room, we can posit that his wife walks by and, seeing his perplexed look, asks him what is going on. Hearing that he can't figure out why he is in the living room she asks "*What were you doing just before you came in?"* Together they review the last few minutes and in the middle of telling her he came from the kitchen, his eyes light up and he says, "That's it – I was looking for the kids addresses!" Common-sense folk wisdom says that a person may repair the breakdown by cued retrieval of the plan through a reminder of the over-arching goal ("You were filling in a tax form"), or through a reminder of the next part of the plan ("you were filling in the tax form and you needed your children's social security numbers"). Sometimes, getting back on track requires only a reminder of the context of the original plan ("you were in the study"), or if the context involved ongoing speaking alone or in company, then the last thing said ("Now, let's see, where are the kids records?").

The conversation repair scenario, called "*Unraveling the conversation"* has the two friends discussing the lost conversation thread. First Alice says, "We were talking about driving, driving in Italy.." Then Sally says, "Yes, Italy, those roads in the north…" Suddenly she says, "Oh yes, our summer in Tuscany, and we were comparing vacations!" Thread reconnected, they continue reminiscing.

5. POSSIBLE SOLUTIONS

We now constrain the problem so that it is feasible to solve: We do not suggest attempting to infer a person's plan or goal. We posit that it would be enough to detect a breakdown and provide triggers for the subsequent unaided retrieval of intent. The system we contemplate should not replace cognitive function; it should be a cognitive orthotic, leveraging existing human ability. As such, hard AI problems with respect to plans and goals are avoided.

We can operationally define a senior moment as a break in the execution of a plan, typically at a point where a person has moved from one place or activity to another. This breakdown of smooth execution often comes at the point where the next step of the plan is to be executed. This means that people are still able to initiate an action but they don't know how to complete it, because of a lack of information related to the goal of that action. To mitigate this we propose to create a computational support for context reinstatement that puts the senior back on track to correctly complete the steps to her desired goal. A reminder of the original context of the instigation of the plan can elicit retrieval of the plan itself, its missing sub-plan and sub-plan goal [19]. We are proposing something in a way similar to Sensecam, as the hardware is designed to capture and collect external cues. But in our case, the system is not intended to improve autobiographical memory. Instead, it is a compensation system that enables users to replay useful external cues to stimulate retrieval of the goal of the intended action.

The system contemplated needs to be highly configurable, because the individual preferences and the needs of the users, and the use environment will be widely varying, as well as the users who themselves will change over time. The configuration interface should be carefully designed so that non-computer professionals will be able to use and adjust the system easily and successfully. This requirement is fundamental to wide adoption, as past experience with assistive technology has demonstrated very high abandonment rates [5]. Some experts estimate that as much as 70 percent of all such devices and systems are purchased and not used in the long term, particularly those designed as a cognitive orthotic [13]. One major cause of abandonment is the difficulty of use and configuration of the system [17].

5.1 In the Large

A computational support can come in various degrees, each degree requiring a greater amount of sensor and computer structure to be built into a senior's home. At its most complex (the domotic version) such a system would be integrated into a sensor enriched home (especially RFID for location, video cameras, and microphones) with a server that is able to recognize off-track events. When a breakdown is sensed, or when the user signals for help, then the system produces video and audio playback of the person's actions immediately prior to the confused state. There can be gradations in terms of plan repair intrusions in cases when the problem is not resolved by simpler attempts at repair.

5.2 In the Small

At the simplest level (e.g. a PDA based system) a system could allow the befuddled senior to play back audio which might provide enough of a trigger to reconstruct his plan. The user could control the activation of the reminder and its parameters (e.g. which sounds) through large buttons. Of course, a PDA/ mobile design presents particular challenges for elder users, since visual acuity is typically reduced in elders, and the use of small hardware or touch-screen buttons may be difficult.

6. IMPLEMENTATION CHALLANGES

Designing a system will entail basic research about the efficacy of re-contextualizing missing mnemonic content. The need for individualized interventions requires a flexible framework that can allow the contextual information to be presented in ways that are optimized to the specific end-user. The system must provide a very small cognitive load and provide reliable actions while delivering maximal effectiveness with minimal intrusion. Without this careful tailoring, the system would become an annoying encumbrance on the senior and be abandoned after little use.

6.1 Capturing Context

The content presented to the user for the plan repair must be captured opportunistically and presented appropriately. Because a senior moment may happen at any time the system needs to capture possible content continuously. The optimal length of queued context with which to restore audio and visual information needs to be determined. We need to investigate how to identify meaningful moments at which to capture data to support senior moment remediation . There may be further sensor-based triggers to select appropriate recording moments, e.g. presence in a room in the case of the smart-home based system. Capturing the context of a lost conversation thread may require some parsing of the audio recording to present appropriate parts of a dialog.

6.2 Sensing the Moment

The simplest approach to the problem of when to provide help to recover lost plan information would be to let the user summon the

help by pressing a button. Better would be to sense when a senior moment occurs and to offer context information automatically. The automatic offering of help requires cautious evaluation, since a botched confusion matrix (i.e. false positives and negatives) could lead to early abandonment. Imagine being hectored with 'help' to continue what you were doing when you were simply taking a short break to look out of a window.

Automatic senior moment sensing may be based on contextual features in the presence of which a behavior may produce a particular consequence, or when a particular behavior occurs more frequently in the presence of one situation than another. This could be state based, i.e. when an expected context state transition (e.g. moving form the entrance of a room to one of the walls or a chair within 5 seconds) does not occur then a senior moment is highly probable.

7. CONCLUSIONS

Mitigating the gradual loss of cognitive ability in seniors is a subtle and daunting task. To be accepted, any system must carefully balance the user's needs and abilities [6]. This paper discussed some of the preliminary design considerations for a system of contextual reminders. The issues raised in this discussion provide a basis for ethnographic explorations and research into both the human recall of goals and the hardware and software fundamentals of senior moment mitigating systems.

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