

# SP: HEALTH & SELF ESTEEM

## Technology to support persons with cognitive impairment with everyday activities

R. A. Mudar (Convener)

**Participants:** W. A. Rogers (USA), N. Charness (USA), R. M. Mudar (USA), M. van Tilborg (Netherlands), and H. Kort (Netherlands). **ISSUE** Cognitive impairment is a common age-related health issue worldwide in older adults. Currently, around 50 million live with a severe form of cognitive impairment and this number is expected to reach 132 million by 2050 (WHO, 2024). Persons with cognitive impairment (PwCI) experience changes in one or more cognitive functions including memory, attention, language, executive function impacting their ability to independently carry out everyday activities. Advances in technology offer promising avenues to support PwCI with these everyday activities provided these technologies are carefully designed to meet the unique needs and preferences of this population. **CONTENT** Our symposium is designed to bring together speakers from the USA and Netherlands on the theme of using technology to support PwCI in their everyday activities. The speakers will highlight: 1) how technology interventions can assist PwCI by addressing the challenges experienced in their everyday activities, 2) considerations for developing technology, and 3) examples of research on technology-based supports and interventions conducted in USA and Netherlands. **STRUCTURE** Rogers will discuss the development of a system to support personal activities and reinforce cognition (SPARC) for PwCI sharing insights from evaluation of the research literature on needs of PwCI, interviews with clinicians, and a focus group with technical experts. This multi-faceted needs assessment approach will guide the design of the system to support everyday activities, primarily in the home environment. Charness will outline the AUGMENT project focusing on creating tutorials for applications such as Google Maps and UBER to support mobility for people with cognitive impairment (CI). Spatial navigation is often impaired in addition to memory for those with mild cognitive impairment (MCI), post-stroke CI, and traumatic brain injury (TBI). Charness will discuss design and usability challenges for tutorial development. Mudar will talk about the MedManage study focusing on redesigning and optimizing a mobile medication adherence system for medication self-management in persons with MCI. Persons with MCI are at increased risk of medication non-adherence due to deficits in prospective memory and mobile health interventions offer promising avenue to support medication self-management. Mudar will discuss how Medication Education, Decision Support, Reminding, and Monitoring-Memory (MEDSReM-M) mobile app was developed to meet the needs of those with MCI through cognitive walkthroughs, needs assessments, and usability testing. van Tilborg will describe her current research for enhancing self-management of the use of (artificial tears) eye drops for people with Parkinson disease, to prevent visual impairment. The role of the person with Parkinson disease and that of the professionals involved will be addressed. Professor Kort, will act as the discussant, bringing together the perspective of the different Gerontechnology domains that are addressed in this symposium, namely Housing and Daily living, Mobility and Transport, and Health and Self-esteem. **CONCLUSION** The symposium will present interdisciplinary and international perspectives on developing and implementing technologies to support aging in place to support autonomy and quality of life in PwCI.

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**Keywords:** cognitive impairment, technology, user centered design, everyday activities

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### Developing an adaptive system for supporting personal activities and reinforcing cognition (SPARC)

W. A. Rogers, S. J. Czaja, W. R. Boot, N. Charness

**Purpose** Cognitive impairment is the single most important factor that threatens the function and quality of life of older adults [Stern & Carstensen, 2000]. The likelihood of developing a cognitive impairment increases with age; about 10% of those age 70-74 and 25% of those age 80-84 develop mild cognitive impairment (MCI), a heterogeneous state between normal aging and early dementia [Petersen et al., 2018]. Older adults with mild cognitive impairment (OAWMCI) experience difficulties performing a range of everyday activities and are at risk for social isolation. Technology-based interventions have the potential to improve the everyday functioning of OAWMCI. Most prior efforts have focused on the provision of cognitive training or rehabilitation and have not included other aspects of functioning such as everyday activities or social engagement. Our goal is to develop and evaluate an innovative intelligent adaptive software package aimed at providing cognitive and social support and engagement to OAWMCI. The system will be designed to adapt to the needs and abilities of the user, following the CREATE model of user-centered design [Boot et al., 2020; Czaja et al., 2019]. We will present the initial work from our user-centered approach to design the system we are calling SPARC: Supporting Personal Activities and Reinforcing Cognition. **Method** We conducted a multi-faceted needs assessment to guide the design of the SPARC system. We interviewed five clinician subject matter experts (SMEs) who had experience working with OAWMCI to obtain their insights about the needs for cognitive and social support as well as potential facilitators and barriers to adoption of the SPARC system. We also conducted two focus groups with technical SMEs, to identify the technology currently available to support the design of SPARC, as well as potential challenges in the implementation of the proposed adaptive system. **Results and Discussion** The clinician interviews identified a range of social activities that could benefit from support including forgetting people's names, missing appointments, and withdrawal from social activities which could lead to feelings of isolation, embarrassment, and apathy. Healthcare activities needing support included medication management; understanding physicians; remembering and preparing for appointments; finding specialty providers; and scheduling appointments. Other daily activities mentioned for support needs were managing finances and understanding scams/fraud; getting lost; household upkeep; and mobility and transportation. The focus group discussions yielded valuable advice, including the reminder to not try to do everything in one system; to think about how to incorporate care partners; to understand a person's current level of functioning to guide support and adaptation needs; and to capitalize on existing software that could be integrated into SPARC. This multi-faceted needs assessment approach will guide the design of the system to support everyday activities, primarily in the home environment. Our SME insights provided important information on the feasibility of using technology-based approaches to support everyday activities and cognition for OAWMCI and insights on potential barriers to the implementation of technology-based interventions. Our findings also inform the design of other technologies and interventions to support OAWMCI.

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### Designing tutorials to AUGMENT mobility for aging adults with cognitive impairment

N. Charness, M. Prevratil, D. Kossowska-Kuhn, H. Na

**Purpose** Older adults and particularly those with cognitive impairment (CI) from Mild Cognitive Impairment (MCI), Post-stroke Cognitive Impairment, and Traumatic Brain Injury (TBI) report difficulties with navigation in addition to experiencing general memory problems (Prevratil et. al., 2023). The AUGMENT (Augmenting User Geocoordinates and Mobility with Enhanced Tutorials) project, a development project within ENHANCE, is designing instructional packages to assist impaired older adults to use popular navigation software focusing on Google Maps and Uber. **Method** Initially, we assessed the nature of the difficulties that normal older adults (n=300) experienced with navigation in near and distant locations, finding that gender, spatial orientation, memory problems, and severity of memory problems were significant predictors of degree of difficulty with navigation. **Results and Discussion** A sample of 20 older adults with CI reported significantly greater problems with navigation compared to normally aging older adults, with similar patterns of prediction of navigation difficulty. Survey results from an earlier CI sample about software experience and difficulties with navigation apps provided guidance for initial design of tutorials. Our user-centered tutorial design process began with a hierarchical task analysis and then a cognitive walkthrough of typical tasks with each software app followed by design of prototype tutorial modules that minimized memory demands by breaking tasks into small steps, providing feedback at each step, and providing spaced retrieval practice for central concepts. As a result of that process, we recognized the need to design a prototype “meta-tutorial” to provide initial practice on using the tutorial software. Initial pilot participants with CI (n=2) reported minimal difficulty with the three tutorials and uncovered some flaws in the tutorial software. We are now doing formal usability testing (with observation of participants and ratings from the System Usability Survey) to assess learnability, memorability, errors, and satisfaction, stressing memorability: retention of information over a one-week delay, given the overt memory problems experienced by older adults with CI. This will be followed by redesign and a second round of user testing, followed by redesign and summative testing of efficacy in navigation tasks.

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### Developing a mobile health medication self-management system for persons with mild cognitive impairment

R. A. Mudar, W. A. Rogers, J. K. Lee, K. C. Insel

**Purpose** Mild cognitive impairment (MCI) is characterized by mild impairment in one or more cognitive functions and is associated with an increased risk for failure to take prescribed medications. A study found that 49% of persons with mild cognitive impairment (PwMCI) report difficulty remembering to take medications (Campbell et al., 2016). An underlying deficit in prospective memory contributes to such medication nonadherence (Woods et al., 2008). A strategy to support medication adherence for PwMCI is to leverage the advances in mobile health (mHealth) technology to fosters medication self-management by tapping into preserved skill learning and procedural memory (De Wit et al., 2021; Gobel et al., 2013). A theory-based, mHealth system called Medication Education, Decision Support, Reminding, and Monitoring (MEDSReM) has been developed to support medication adherence in cognitively normal older adults. For such mHealth system to be beneficial for PwMCI, it has to be carefully designed/adapted to meet the unique capabilities and limitations of this population. We will present how we addressed the unique needs for mHealth technology use in this population of PwMCI based on user-centered design to inform the redesign of MEDSReM to develop the Medication Education, Decision Support, Reminding, and Monitoring-Memory (MEDSReM-M) system. **Methods** We conducted heuristic evaluation, cognitive walkthroughs, and needs assessment to guide redesign of the original MEDSReM system. Heuristic evaluation was conducted by 4 User Interfaces/User Experience (UIUX) experts including one external to the project team guided by Nielsen's 10 usability heuristics to uncover general problems PwMCI would encounter in using MEDSReM. Cognitive walkthroughs were done by 12 subject matter experts (SMEs) with varying expertise in cognitive aging, cognitive impairment, nursing, hypertension management, human factors, and health technology to identify aspects of the interface that could be challenging for PwMCI related to 12 tasks that support hypertension medication adherence (e.g., medication reminders; track weekly progress with medication taking). We interviewed two SMEs, a board-certified behavioral neurologist, and a clinical cognitive neuroscientist, both experts in MCI and dementia, to obtain feedback about potential usability issues for PwMCI. **Results and Discussion** Outcomes of heuristic evaluations suggested areas of improvements in visibility of system, user control and freedom, error prevention, and flexibility of use. Cognitive walkthroughs revealed the need to simplify the user interface and provide more direct and prescriptive instructions to minimize decision making demands. Needs assessment involving SMEs corroborated the need to simplify the system by minimizing options that require decision-making (e.g., skip medication) to minimize errors, and improve the visual layout to ease navigation. The usability challenges identified through heuristic evaluation and cognitive walkthrough along with the SME feedback guided the first iteration of the MEDSReM-M development. Our findings also inform the design of mHealth intervention systems to support self-management and autonomy in PwMCI.

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### Self-management: The ability to use eyedrops preventing visual impairment for people with Parkinson disease

M. M. A. van Tilborg & V. Lamers

**Purpose** During this session the need for more research and understanding visual functioning and the roll of the tear film will be explored. Dry eyes are still often considered an "old age ailment" that one has to learn to live with. This while particular younger are more likely to suffer from painful dry eyes, as the cornea is still very sensitive. The symptoms of dry eye in general, and for older adults, are complex and it is not always clear exactly how they arise (Vehof et al., 2020). Moreover, severe dry eye symptoms can be triggered by medication use, especially used by the people with Parkinson Disease (PD) and due to the combination with reduce or inability to blink fully. Born's research shows that 82% of participants with PD reported one or more eye problems, with 56% specifically reporting "dry eye eyes" (Borm et al., 2020). Misunderstood complaints of pain and reduced vision not only have an emotional burden, but can also lead to the development of various symptoms such as anxiety, depression and sleep disorders (Zheng et al., 2017; Dana et al., 2020). The main causes of DED is the disruption of tear film homeostasis. Disturbed homeostasis can lead to damage to the eye surface, the development of pain sensations and an inflammatory response. Causing damage at the cornea and reduces vision enormously. Treatment of dry eyes are primarily with the use of artificial tears. The use of eyedrops asks for motor skills as well for cognitive skill of remembering to drop regularly. Due to the fact that people with PD are less likely to report pain at start or the feeling of dry eye, education is needed for the people with PD and their carers as the (eye) care professionals around them. The investigation's acronym in Dutch is Druppel means Drop: representing, **D**: Dropping at the right time and in the right way; **R** Regular preventive dripping to prevent dry eyes in people with Parkinson's disease; **U** Comprehensive knowledge about dry eyes and the negative impact on quality of life; **P** Problem recognition of the consequences of dry eyes and options for preventive action; **P** Appropriate tools for eye dripping to increase self-reliance; **E** Sharing experience expertise on preventing and living as optimally as possible with dry eyes; **L** Discussing lifestyle advice to reduce dry eye symptoms. This all to prevent damage of the cornea causing diminished visual acuity. **Methods** Literature study, Patient journey investigation, interviews and patient experience lab is used to understand the visual complaints: Patients experience lab, for the use of the existing tool enhancing the use of eyedrops. The possibility of self-management using additional help and awareness amongst the care professionals. **Results and Discussion** the outcome of this investigation will be a tool for professionals as for people with PD and their cares, to find the right information about the use of the drops. The take home message of this session will be on more awareness of the complexity of good vision and visual functioning and the tear film. The need of attention towards eye care and the understanding of the problems arising when using eye drops. Not only for people with PD. But also for all people suffering of dry eye and the skills needed to be able to use eyedrops. All for preventing visual impairment and raise the quality of life, especially of people with Parkinson's disease.

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