

UX/UI for the Elderly

Some information gathered may overlap categories.

VISUALS (ICONS, COLORS, TEXT)

- Apply grouping design principals to organize interface when there are many app icons on one screen
- Desires for large screen and text, and buttons
- Maintain link underlined
- Because of vision differences, it should be possible for users to adjust their font sizes as needed
- Elderly need stronger color contrast, have better color discrimination towards warm colors vs cool colors
- Trouble identifying low contrast, light colors, grayscale, and objects in peripheries
- San-serif font for legibility, light gray background with black text color
- Icons minimum of 48 px/ 9mm wide
- Keep icons and buttons spaced far enough apart for touching intended buttons/ operations; Maintain minimum spacing of 44 pixels between interface elements
- Add label text to all icons and buttons. (words rather than symbols are better for understanding, symbols as simple as "back" may not be recognized) make sure to use words that suit older adults' semantic fields

UX STRUCTURE

- Elderly prefer systems of applications that are easy to use
- Outline the main features of the system
- Menus with multiple functions or sub-levels are too complicated
- Maintain the focus of the system on the current user action without displaying secondary functions
- Avoid instant features that change with each new interaction such as filters and auto-completion

NAVIGATION

- Keep the same positioning of the elements in the interface and in their respective operations
- Use the home screen menu as a safe point of return
- Maintain a "return" function apparent on the interface; a back button that is a safe guard for older adults when they are not sure how to solve a give problem

GESTURES

- Elderly have physical mobility to touch/ swipe etc, but require more time
- Elderly use one hand for typing, as in handwriting
- Keep gestures simple to perform basic commands of the system; elderly have difficulty differentiating between gestures
- Acceptable gesture is the horizontal swipe. This is a natural gesture and physically easy. Comparatively the vertical swipe requires a repositioning from a hand that is already in rest
- Avoid creating gestures with fast movement, complex positioning, or multiple gestures that combine more than two fingers and require the use of both hands, or gestures that require advanced motor controls, such as long tapping and swiping, stick to tapping
- Show visual, audible or haptic feedback when users do touch configuration
- Recommended that a zoom interface is included with something like a magnifying glass feature, or on screen zoom button, rather than standard two-finger zoom touch interface gestures
- 10.1" screen is not suitable for zooming, dragging, or scaling operations
- For a drag task, Elderly group primarily used the right index finger

GESTURES (CONTINUED)

- Users that didn't know how to perform a scroll action were able to perform this after being reminded that there was more content to see. The gesture needs to be demonstrated for older adults to realize it is an option

ASSISTANCE

- Outline the main features of the system
- Use the home screen menu as a safe point of return
- Use the back button as a safeguard for older adults when they are not sure how to solve a give problem.
- Display a help panel and tips about the features in the first user access
- Provide easy-to-understand icons followed by caption or description
- Use words that suit older adults' semantic fields
- Elderly participants read all instructions before tapping
- Prompt boxes are really helpful/ can make a big difference
- Guide the user by means of messages in clear, objective and educational language
- Temporary notices can be missed by the elderly, also notices that are positioned in the screen peripheries

MOTIVATION

- Elderly tend to use technology such as mobile phones only for emergencies
- Mobile and touch-based interfaces are suggested to be preferred by those in the studied age range, 55-75
- Motivation is essential for elderly users, which makes tablets ideal. The touch-based interface demands less little to no computer literacy, and the gestures are the most intuitive. (Werner et al.)
- Elderly have lower cognitive ability to learn, must use an approach that encourages engagement in new technology and minimizes their processing efforts
- Participants expressed desires for caller identification in chat functions
- Option for turning on/off with attention: *"We developed a module that tracks if the user is paying attention to the system. By using the Microsoft's Face Tracking SDK, we developed an algorithm that detects when the user is looking at the screen, allowing the system to perceive if users are paying attention and then act accordingly. This allows interaction scenarios such as pause media playing as the users turns his face to talk to someone, and then resume playing when the user looks at the screen again."* (Developing a Multi-modal Interface for the Elderly)

Information was compiled from the following resources:

Bong Way Kiat, Weiqin Chen, Mobile Instant Messaging for the Elderly, In *Procedia Computer Science*, Volume 67, 2015, Pages 28-37, ISSN 1877-0509, <https://doi.org/10.1016/j.procs.2015.09.246>. (<http://www.sciencedirect.com/science/article/pii/S1877050915030926>) Keywords: Mobile instant messaging; social integration; elderly; usability; accessibility; user-centered; participatory action research

Rafael Xavier E. de Almeida, Simone Bacellar Leal Ferreira, Horacio Pastor Soares,

Recommendations for the Development of Web Interfaces on Tablets/iPads with Emphasis on Elderly Users, In *Procedia Computer Science*, Volume 67, 2015, Pages 140-149, ISSN 1877-0509, <https://doi.org/10.1016/j.procs.2015.09.258>. (<http://www.sciencedirect.com/science/article/pii/S187705091503104X>) Keywords: elderly; usability; tablet; interface; ipad

Chang, Hsien-Tsung & Tsai, Tsai-Hsuan & Chang, Ching-Ya & Chang, Yi-Min. (2014). Touch panel usability of elderly and children. *Computers in Human Behavior*. 37. 258–269. 10.1016/j.chb.2014.04.050.

Ana Correia de Barros, Roxanne Leitão, Jorge Ribeiro, Design and Evaluation of a Mobile User Interface for Older Adults: Navigation, Interaction and Visual Design Recommendations, In *Procedia Computer Science*, Volume 27, 2014, Pages 369-378, ISSN 1877-0509, <https://doi.org/10.1016/j.procs.2014.02.041>. (<http://www.sciencedirect.com/science/article/pii/S187705091400043X>) Keywords: Older adults; usability tests; recommendations; smartphone; user interfaces

Élvio Rodrigues, Micael Carreira, Daniel Gonçalves, Developing a Multimodal Interface for the Elderly, In *Procedia Computer Science*, Volume 27, 2014, Pages 359-368, ISSN 1877-0509, <https://doi.org/10.1016/j.procs.2014.02.040>. (<http://www.sciencedirect.com/science/article/pii/S1877050914000428>) Keywords: Multimodal interfaces; elderly; multi-touch tablets; body gestures; text-entry performance

Diagnosis to Alzheimer's Disease (AD)

Genetic Chance	MCI/Prodromal AD	Mild AD	Moderate AD	Severe AD
EVIDENCE: Genetic testing/ family history	EVIDENCE: Episodic memory loss/ cognitive testing	EVIDENCE: Longitudinal cognitive testing	EVIDENCE: Invasive biomarkers test: Cerebro Spinal Fluid Tau counts, MRI brain imaging and PET	

Associated higher risk factors:

- Increased frequency of patient visits to PCP
- Accelerated weight loss
- Gait disturbances
- Physical frailty
- Slowed psycho-motor speed
- Head injuries
- Disordered sleep
- Lack of physical activity
- Type 2 diabetes
- Midlife obesity
- Midlife hypertension
- Midlife blood pressure and cholesterol concentrations
- Older age: incidence doubles every five years after 65

The Alzheimer's Association lists 10 key warning signs of AD10:

- Memory loss
- Difficulty performing familiar tasks
- Problems with language
- Disorientation to time and place
- Poor or decreased judgment
- Problems with abstract thought
- Misplacing things
- Changes in mood or behavior
- Changes in personality
- Loss of initiative

Alzheimer's Disease Timeline. Alzforum. <http://www.alzforum.org/timeline/alzheimers-disease>. November 3rd 2018.

Genetics

- ApoE4 (ApoE role linked to Tau clearance)
- ApoE2
- CD33 gene
- area: CLU, PICALM, CR1
- BIN1
- ABCA7
- MS4A6A
- Sorl1 variants

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Diagnosing (MCI) vs. MCI as Prodromal AD (Alzheimer's Disease)

	Testimony	Cognition	Daily Functioning	Dementia
MCI	Patient expresses about cognition decline over time	1 or more cognitive domains is performing worse than typical for age/ education	Mild problems for complex functional tasks (paying bills, cooking, shopping) May take more time, be less efficient, and make more errors. Maintain independence of function in daily life, with minimal aids or assistance.	Not demented
MCI due to AD	Testimony corroborated with caregiver, or doctor opinion, or validated with objective evidence such as serial assessments	Longitudinal studies Evidence of progressive decline in cognition especially in episodic memory	(Same)	Not demented Presents atypical impairment

Testing for MCI likelihood of progressing to AD dementia

Many cognitive tests can point to these cases. These tests share the characteristic that they assess both immediate and delayed recall, so that it is possible to determine retention over a delay. Many, though not all, of the tests that have proven useful in this regard are word list learning tests with multiple trials.

Such tests reveal the rate of learning over time, as well as the maximum amount acquired over the course of the learning trials.

- Free and Cued and Selective Reminding Test
- Rey Auditory Verbal Learning Test
- California Verbal Learning Test

Other episodic memory measures include:

- Logical Memory I and II of the Wechsler Memory Scale Revised
- Visual Reproduction subtests of the Wechsler Memory Scale-Revised I and II

Other cognitive domains to test:

- Executive functions (e.g., setshifting, reasoning, problem-solving, planning),
- Language (e.g., naming, fluency, expressive speech and comprehension),
- visuospatial skills, and attentional control (e.g., simple and divided attention).

Clinical neuropsychological tests:

- Trail Making Test (executive function),
- Boston Naming Test, letter and category fluency (language),
- Figure copying (spatial skills)

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5 step process for diagnosing AD

1: Prediagnostic Tests and Early Warning Signs

2: Screening Tools Employed by Family Physicians

3: Assessment of Daily Functioning

An assessment of daily function is vital to determine the extent of the patient's disability and dependence on the caregiver, the results of which help to enable planning to maximize patients' independence.⁴⁷ Basic ADLs, such as feeding and toileting, can be assessed with an interview or by using a tool such as the ADL Scale. Assessment of instrumental ADLs (IADLs) addresses more advanced activities, such as shopping, cooking, and managing finances. The total score ranges from 0 (independent) to 30 (dependent).⁵³ An example of the FAQ is provided in Appendix 4.

4: Assessment of Behavioral Symptoms, Psychotic Symptoms, & Depression

Symptoms may be observed by the family physician, they are more often reported by the primary caregiver.¹³ Standardized tools can be used by PCPs or clinic staff to gather information about behavioral symptoms from the caregiver and evaluate effectiveness of interventions over time. **The Neuropsychiatric Inventory Questionnaire** is a quickly administered instrument that provides reliable assessment of behaviors commonly observed in patients with dementia⁵⁷

The **Behavioral Pathology in Alzheimer's Disease (BEHAVE-AD) Rating Scale** has 2 parts: the first concentrates on symptomatology and the second requires a global rating of the symptoms on a 4-point scale of severity. The domains covered are paranoid and delusional ideation, hallucinations, activity disturbances, aggression, diurnal variation, mood and anxieties, and phobias.⁵⁸

5: Caregiver Needs and Status/Support system

Family caregivers are central to the PCP's assessment and care of the patient with AD,⁵⁹ and establishing and maintaining collaboration with caregivers is critical for care of the AD patient. In addition, the physical and emotional health of the primary caregiver is crucial in obtaining optimal care for the AD patient. Caregivers suffer from increased rates of depression and physical illness,¹³ and family physicians need to monitor regularly the health of the primary caregiver as well as that of the patient with AD (Table 1). **Assessing caregiver status can lead to the implementation of measures that minimize patient-caregiver stress and delay institutionalization of the patient.**

Practical Guidelines for the Recognition and Diagnosis of Dementia

<http://www.jabfm.org/content/25/3/367.long#T1>

May-June 2012 vol. 25 no. 3 367-382

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According to the new guidelines, probable AD dementia is diagnosed when insidious onset of decline in at least two cognitive domains with either amnesic (impaired ability to acquire or remember new information) or nonamnesic (language impairment, visuospatial impairment, changes in personality and executive dysfunction) presentation is evidenced by both subjective report (from the patient or a knowledgeable informant) and objective performance (through mental status examination or neuropsychological testing), and it affects the ability to perform ADL and is not explained by other diseases affecting

	MCI/Prodromal AD	Mild AD
Cognition	Episodic memory loss of the hippocampal type	Disorientation to time; language problems, judgment problems; mood change; social withdrawal
ADL/IADL	No limitations	IADL limitations
MMSE		21-25
CDR	Lower performance in ≥ 1 cognitive domain	1
FAST		4

cognition (e.g., cerebrovascular disease, Lewy body dementia and frontotemporal dementia). The certainty of probable AD dementia is increased by documented decline using informant report (someone who knows the patient well) and cognitive testing, evidence of a causative genetic mutation and/or positive biomarker studies. An atypical dementia course (sudden onset or unclear evidence of progressive decline) or an etiologically mixed presentation (evidence of AD dementia, but also of other non-AD dementias) would warrant a diagnosis of possible AD dementia, and certainty would be increased by AD-related biomarker evidence or postmortem neuropathological evidence of AD.

A need for education of primary care providers on both what constitutes dementia and the tools that are available to screen and diagnose AD has been identified [11]. Instruments such as the Mini-Cog and AD8 are brief and easy to administer in any physician's office, and family physicians are encouraged to become familiar and proficient in using them to screen and diagnose AD [18]. This is particularly important as it may help avoid misclassification of patients.

Therefore, at this point in time, primary care providers are advised to focus on the core criteria for diagnosis of clinical AD, which do not require use of biomarker evidence, but rely on clinical evaluation and neuropsychological testing. In fact, a practical guide to the early detection and diagnosis of AD consisting of five easy-to-follow steps has been recently proposed [18].

In those MCI subjects whose clinical and cognitive MCI syndrome is consistent with AD as the etiology, biomarkers may affect levels of certainty in the diagnosis.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4140653>

	MCI/Prodromal AD	Mild AD	Moderate AD	Severe AD
Cognition	Episodic memory loss of the hippocampal type	Disorientation to time; language problems; judgment problems; mood change; social withdrawal	Disorientation to time/place; problem-solving difficulties	Remote memory gone; language abilities gone; severe problem-solving difficulties
ADL/IADL	No limitations	IADL limitations	ADL/IADL limitations	ADL dependent
MMSE		21-25	11-20	1-10
CDR	Lower performance in ≥1 cognitive domain	1	2	3
FAST		4	5-6	7

Instrumental Activities of Daily Living (IADLs)

Not required for living, but represent functioning self-maintenance capabilities. These are activities related to independent living and are valuable for evaluating a person's ability to care for himself or herself.

- Ability to use a telephone
- Shopping
- Food preparation
- Housekeeping
- Laundry
- Mode of transportation
- Responsibility for own medications
- Ability to handle finances

<https://www.abramsoncenter.org/media/1197/instrumental-activities-of-daily-living.pdf>

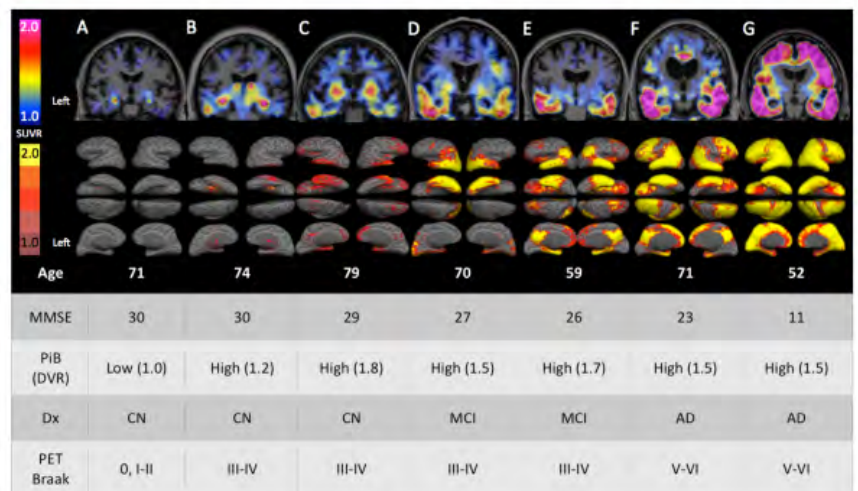
Activities of Daily Living (ADLs)

These are everyday personal care activities that are fundamental to caring for oneself and maintaining independence. Activities in which people engage on a day-to-day basis.

- Bathing
- Dressing
- Grooming
- Mouth care
- Toileting
- Transferring bed/chair
- Walking
- Climbing stairs
- Eating

<http://www.seniorplanningservices.com/files/2013/12/Santa-Barbara-ADL-IADL-Checklist.pdf>

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Biomarkers

Cerebrospinal Fluid

Starting in 2011 CSF markers begin to represent international standardization toward certified clinical diagnosing

- Tau release into CSF (Tau increased, Tau42 decrease, can identify prodromal AD signature in MCI cohorts)
- Neurogranin (synaptic protein) quantities in CSF

MRI

Shows contraction in gray matter, expansion of brain ventricles, shrinking of hippocampal volume as much as 7 years before expected age of symptom onset

PET

- FDG-PET reveals signature of brain hypometabolism
- FDG-PET tracks progression to mark glucose metabolism in the hippocampal formation
- Amyloid PET visualizes A β pathology
- Use PET for viewing PiB binding to differentiate between types of dementia
- Amyvid (florbetapir F18 injection), Avid Pharmaceuticals/Eli Lilly and Company's positron emission tomography (PET) tracer, for Tau plaque imaging in cognitively impaired patients being clinically evaluated for Alzheimer's disease (FDA approved in 2012)

Alzheimer's Disease Timeline. Alzforum. <http://www.alzforum.org/timeline/alzheimers-disease>. November 3rd 2018.