November 2008, Vol 7, No 4

www.gerontechjournal.net

AGE-RELATED CHANGES IN COGNITIVE ABILITIES AND TECHNOLOGY

The European Silver Paper[1] recommends facilitating and enhancing social activity in older persons, to support voluntary initiatives, and to prevent social exclusion, without mentioning the methods and technologies to be implemented. Nowadays, establishing and maintaining social contacts depends heavily on the use of mobile phones and Internet[2-4]. In order to use this technology efficiently aging involved changes of peoples' physical, perceptual and cognitive abilities have to be considered in the design of communication technology. This comment focuses on age-related changes of three central cognitive abilities; attention, memory, and language comprehension, and provides recommendations for technology design.

Selective attention is the ability to concentrate on a specific stimulus, sensation, thought, or activity task while distractors are present. Older people have difficulties in selecting relevant information and ignoring irrelevant information[5-12]. *We suggest:*
(i) Provide audio headphones for reducing noise, and use plain, non-patterned background for visual information; (ii) Reduce number of options and choices. Display only frequent and necessary commands or information and hide others; (iii) Use simple layout and short menus with a clear structure; (iv) Reduce distracting stimuli and irrelevant details; (v) Highlight important information or controls by color, shape and/or size, to ease selection.

Divided attention is the ability to attend and process more than one source of information simultaneously[7,8,13]. Generally, older people have difficulty with this. *We suggest:* (i) Automate certain processes or input sequences to reduce cognitive load; (ii) Sequence processes instead of having them parallel to make the user attend to one item at a time; (iii) Allow self-paced input or provide enough input time.

Memory performance is related to attention. Age-related memory decline becomes often apparent in tasks that require divided attention[14-16]. When cognitive resources are needed for the processing of incoming information, fewer resources are left for keeping information in working memory (WM)[14,16-19]. *We suggest:* (i) Present information in meaningful, distinct chunks of 3-4 items by spatial arrangement, drawing boxes, organizing them in menus or by providing a meaningful context; (ii)Train users in chunking or provide mnemonic tricks, for instance, for the memorization of phone numbers or passwords; (iii)Reduce the amount of information to be processed; (iv) Provide external memory aids such as memory cues, automatic reminders, or step-by-step instructions thus reducing WM load; (v) Build on users' experience and expectations. Follow common color coding conventions and use familiar layouts for controls. Organize sequences in a logical and natural way.

Language comprehension in older age tends to suffer because of physical constraints (low vision, presbyacusis), attention deficits, and memory limitations. Then, fewer cognitive resources are available for language comprehension, such as in understanding speech with low signal-to-noise ratio, rapid speech[9], or grammatically complex sentences[11,12,14,20]. *We suggest*: (i) Use headphones to reduce distraction; (ii) Use simple language: short sentences in active tense; (iii) Auto-repeat messages until a desired action is carried out.

Conclusion Age-related changes in cognitive abilities affect older people's performance when using technology. Older peoples' specific needs and requirements have to be considered in technology design.

References

1. Cruz-Jentoft AJ, Franco A, Sommer P, Baeyens JP, Jankowska E, Maggi E, Ponikowski P, Ryś A, Szczerbińska K, Milewicz A. European silver paper

on the future of health promotion and preventive actions, basic research, and clinical aspects of age-related disease. Gerontechnology 2008;7(4):331-339; doi:10.4017/gt.2008.07.04.001.00
2. Czaja SJ. Using technologies to aid the performance of home tasks. In Fisk AD, Rogers WA, editors. Handbook of human factors and the older adult. San Diego: Academic Press; 1997; pp 311-334
3. Quadrello T, Hurme H, Smith PK, Veisson M, Vidal S, Westerback S. Grandparents use of new communication technologies in a European perspective. European Journal of Ageing 2005;2(3):200-207; doi:10.1007/s10433-005-0004-y
4. Whitney G, Keith S. Active ageing through Universal Design. Gerontechnology 2006;5(3):125-128; doi10.4017/gt.2006.05.03.001.00
5. Connelly SL, Hasher L, Zacks RT. Age and reading: The impact of distraction. Psychology and Aging 1991;6(4):533-541; doi:10.1037/0882-7974.6.4.533
6. Kemper S, McDowd J, Kramer A. Eye Movements of Young and Older Adults While Reading With Distraction. Psychology and Aging 2006;21(1):32-39; doi:10.1037/0882-7974.21.1.32
7. Tun P A, Wingfield A. Does dividing attention become harder with age? Findings from the Divided Attention Questionnaire. Aging & Cognition 1995;2(1):39-66
8. Verhaeghen P, Steitz DW, Sliwinski MJ, Cerella J. Aging and dual-task performance: A meta-analysis. Psychology and Aging 2003;18(3):443-460; doi:10.1037/0882-7974.18.3.443
9. Wingfield A, Tun PA, O'Kane G, Peelle JE. Language comprehension in complex environments: Distraction by competing speech in young and older adult listeners. Advances in psychology research 2005;33:3-38
10. Greenwood PM, Parasuraman R. The scaling of spatial attention in visual search and its modification in healthy aging. Perception & Psychophysics 2004;66(1):3-22
11. Kemper S, Herman RE, Nartowicz J. Different effects of dual task demands on the speech of young and older adults. Aging, Neuropsychology, and Cognition 2005;12(4):340-358; doi:10.1080/138255890968466
12. Wingfield A, Peelle JE, Grossman M. Speech rate and syntactic complexity as multiplicative factors in speech comprehension by young and older adults. Aging, Neuropsychology, and Cognition 2003:10(4):310-322; doi:10.1076/anec.10.4.310.28974
13. Tsang PS. Age, attention, expertise, and time-sharing performance. Psychology and Aging 1998;13(2):323-347; doi:10.1037/0882-7974.13.2.323
14. Brebion G. Working Memory, Language Comprehension, and Aging: Four Experiments to Understand the Deficit. Experimental Aging Research 2003;29(3):269-301; doi:10.1080/03610730303725
15. Craik FI. A functional account of age differences in memory. In Klix F, Hagendorf H, editors. Human memory and cognitive abilities. Amsterdam: Elsevier; 1986
16. Morris RG, Craik FI, Gick ML. Age differences in working memory tasks: The role of secondary memory and the central executive system. The Quarterly Journal of Experimental Psychology A: Human Experimental Psychology 1990;42(1A):67-86
17. Cavallini E, Pagnin A, Vecchi T. Aging and everyday memory: The beneficial effect of memory training. Archives of Gerontology and Geriatrics 2003;37(3):241-257; doi:10.1016/S0167-4943(03)00063-3
18. Craik F, Salthouse TA. The handbook of aging and cognition. Mahwah: Erlbaum; 2000
19. Madden DJ, Allen P A. Attention. In Birren JE, editor. Encyclopedia of Gerontology. San Diego, CA, US: Academic Press; 1996; pp 131-140
20. DeDe G, Caplan D, Kemtes K, Waters G. The Relationship between Age, Verbal Working Memory, and Language Comprehension. Psychology and Aging 2004;19(4):601-616; doi:10.1037/0882-7974.19.4.601

Jacqueline Waniek PhD
Keio University, Kanagawa, 252-8520 Japan
E: waniek@sfc.keio.ac.jp
doi:10.4017/gt.2008.07.04.015.00