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Designing effective risk communications for older adults

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ABSTRACT

Older adults make daily decisions concerning risk communications about product use, activities, or emergency situations. Appropriate compliance with warnings and notifications depends on comprehension of the hazard. Unfortunately, risk communications are often designed without considering the physical and cognitive changes that can accompany aging. This article details age-related changes and their relation to risk communication and includes examples and recommendations for design. It is proposed that designers consider these age-related changes within the larger system of the risk environment and risk communication demands. Iterative design is stressed.

1. Designing effective risk communications for older adults

The question of how to design risk communications for older adults has never been less academic: increased lifespan means a larger and larger percentage of the population qualifies as older, many of whom will experience age-related changes in capability. The United States population over 65 is predicted to increase 15% in the 10-year span between 2000 and 2010, or roughly five million persons, and then another 36% increase in the decade after (AoA, 2007). This includes a large percentage of the *oldest old*, defined as persons over age 85 (AoA). Worldwide, an eighth of the population will be aged 65, with the most rapid increases in developing countries (Dobriansky et al., 2007).

While the increasing lifespan of the population is not in question, we are still trying to determine the factors that will facilitate *independent living* for this rapidly growing portion of the population. Risk communications are of vital importance for independent or partially independent older adults. These adults choose products and activities that require interpreting and complying with warnings and alarms by their own choice. Examples include pesticides, cleaners, medical devices, and electronics. They may also need to respond to emergency situations, as during Hurricane Katrina in 2005 or the Thailand tsunami in 2004 (see Mayhorn & McLaughlin, current issue, for further discussion of disaster warnings). There are a number of age-related changes that can influence the perception, interpretation, and compliance of older adults (refer to Table 1). Risk communication can become more effective for an older audience when age-related changes are considered in the design stage and most importantly *iteratively tested* on an older population.

1.1. Perceptual changes

It is relatively easy for designers to suggest changes for improvement of older adults' comprehension of risk communications, as all perceptual and sensory systems can be impacted by the aging process (see Schneider and Pichora-Fuller (2000) for a comprehensive review). Let us begin by considering design changes to accommodate age-related near and far vision. As the eye ages, the lens tends to lose accommodative flexibility, results in presbyopia – an inability to focus on objects, text, or pictures placed in the near visual field. A frequent companion to presbyopia is myopia (near sightedness), where the eye cannot focus on far objects. A common solution for many older adults suffering from both myopia and presbyopia is the use of bifocal or trifocal lenses. However, these lenses do not solve the problem completely. For example, if a large image or other information is paired with print, the older adult may need to alternate looking and reading through different parts of his or her glasses/contacts. Although visual acuity declines with age, there are dangers with changing designs according to this simple heuristic. As one example, consider the debacle of the "butterfly ballot" that occurred in the state of Florida during the 2000 U.S. presidential election. Ballot designers increased the font size of candidate names on the ballot to aid the older electorate (Dent, 2008). To do this, the designers moved half of the names to one side of the ballot, making it difficult for older people to line up the voting indicator with the appropriate name. Thus, to achieve a perceptual improvement, they imposed a higher cognitive load and violated voter expectancy, which resulted in a

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Table 1
Age-related changes influencing risk communication.

Age-related changes influencing risk communication		
Abilities/limitations	Description	Risk communication example
Perceptual		
Visual acuity	Myopia and presbyopia result in difficulty reading or perceiving pictures	Would have to approach a warning on avoiding an area
Contrast sensitivity	Blurred lines or poorly colored text increases perceptual difficulty	Black text on white background more easily perceived than on orange background
Hearing acuity	Soft sounds or tones less likely to be detected	Distant alarm less likely to be heard
Hearing range	Sounds in the extreme ranges less likely to be detected	High pitched whine meant to induce compliance through unpleasantness no longer effective
Temporal resolution	More difficult to resolve flickering/blinking text or pictures	Blinking alert takes more time for interpretation and response
Skin conductance	Difficulty activating sensors that depend on skin conductance	A thumbprint entry system frequently fails to detect contact
Tactile sensation	Difficulty judging how much force is being applied	May not be able to enter code correctly or in time for an alarm system
Cognitive		
Response time	Slower decision time between communication and action	Car warns of approaching curb while parallel parking
Working memory	Fewer items able to be accessed when no longer in the environment	A warning contains several "if... then" statements
Inhibition	Difficulty in ignoring unimportant stimuli	Unable to interpret ticker warning during broadcast of other programs
Visual search	Difficulty searching a visual list for a target	Cannot locate the button on a controller in time to activate it
Crystallized intelligence	Large amounts of accessible prior experience	Able to apply previous experience to new problem, accurately or inaccurately

significant number of ballot marking errors. The lesson from this anecdote is that it is not sufficient to merely increase font size as font size interacts with other aspects of the communication system, both perceptually and cognitively.

The second age-related visual change important to risk communications is the perception of colors. As the eye ages, short wavelengths of light (at the blue/violet end of the spectrum) tend to be misperceived. In part, this is due to a gradual yellowing of the cornea. The standard blue of internet hyperlinks is a widespread example of how this change is typically ignored. Detecting whether words on an Internet page are presented in a blue font (the hyperlinks) or black font becomes increasingly difficult as the cornea yellows, making website navigation more difficult. The likelihood of misperceiving the color may be further exacerbated by an accompanying decrease in contrast between words or icons and the background, a problem for older adults with declining contrast sensitivity.

Contrast sensitivity refers to the ability to perceive images or text in low-light or low contrast environments (Schieber, 2006). Contrast sensitivity tends to decline with age and has been shown to explain the difficulties older adults tend to experience with facial recognition (Owsley and Sloane, 1987). Many risk communication guidelines already call for high contrast between words, icons, and background. However, even standards published by the American National Standards Institute (ANSI Z535.4) sometimes recommend contrast levels that might not be optimal for older adults. Current formatting guidelines for the use of the signal word WARNING, for example, recommend presenting it in black text on a medium orange background. Changes in color perception and contrast are exacerbated when glare is present, for example when warning signs are laminated (see Fig. 1 for a representation of how a warning sign may appear under glare). This confluence of factors serves to further reduce the likelihood of a correct perception (Fozard and Gordon-Salant, 2001).

A final design consideration relating to age-related changes to vision in older adults overlaps with an age-related cognitive change: temporal resolution or the decline in the ability to perceive flickering images. Flickering images include blinking, animation, and slow film for images or text. Perceptual declines in this ability are important as blinking is frequently used to enhance the conspicuity of a warning or alarm. For instance, incorporating a "blinking" feature into pedestrian traffic signals to increase their salience may be counterproductive to the safety of older pedestrians, particularly if the pedestrian is unfamiliar with the other conventions of these signs.

Age-related changes in auditory perception should be considered concurrently with visual changes, as interactions between these two sensory modalities are common. Older adults generally have trouble discerning sounds and voices in the extreme frequency ranges, though the upper ranges tend to be affected first. This includes sounds above 4000 Hz, frequencies common to human speech. Warning systems that include attention capturing alerts or voice information should be carefully tested to make sure they meet the needs of older users. For example, automotive warnings deployed in the noisy environments of vehicles frequently utilize auditory components that have not been evaluated for effectiveness in alerting older drivers (Edworthy and Hellier, 2000).

Age-related changes in humans are also evident for the tactile sense, including declines in the ability to accurately judge force. Such declines can result in over- or under-gripping by older adults. A frequently used example involves the amount of force people apply when gripping a wineglass: over-gripping may cause the wineglass to break, whereas under-gripping may cause it to be

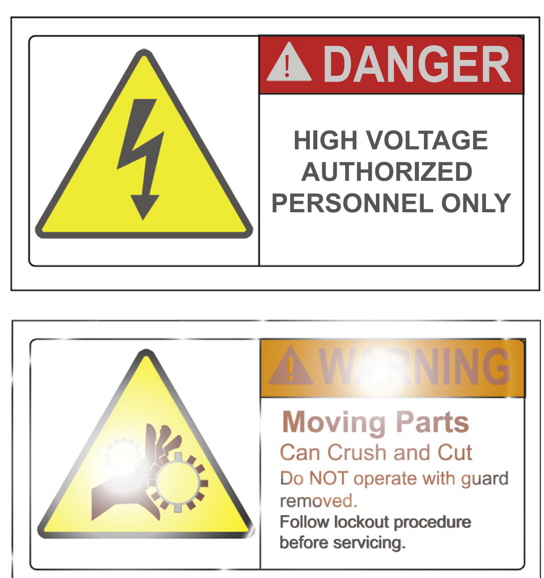

Fig. 1. Conceptual illustration of ANSI standard warning with low contrast text and under glare.