Gerontechnology

• an interdisciplinary field that combines gerontology and technology
• Goal: improve living and working environments for the elderly and their caregivers

• relatively young field (founded in Netherlands 1989-1991)
  • International Society for Gerontechnology (ISG) - established in 1997
  • quarterly journal (2001): Gerontechnology
The Meaning of Age

• How old are you?
  • Calendar years?
  • How old you feel at this time?
  • How old you look?
  • Your cognitive competence?
  • Your social role?

The Meaning of Age

• Chronological age or calendar age = surrogate variable
  • Individual differences
  • Intra-individual differences
  • Everyone does not grow old in the same way
Successful Aging

• Aging exists as a multifaceted experience

Pillars of Successful Aging

• Healthy nutrition
• Daily physical exercise
• Regular cognitive and mental activities
• Maintaining social contacts inside and outside the family
• Keeping an active interest in society
• Stress management
• Healthy sleep

Ernestine Shepherd, at age 74, said she's up at 3 a.m. every morning: runs, lifts weights and works out with other senior citizens at a local church in Baltimore. "I feel better than I did at 40"

How to Define Older Age

• When does late adulthood or older age begin?
  • Most developed countries use age 60/65+
  • Some gerontologist differentiate between
    • Young-old (60/65 - 74)
    • Old-old (75 - 84)
    • Oldest-old (age 85+)
    • Centurions (age 100+)
Age-related Changes

- Smell & Taste
- Vision & Hearing
- Muscle Mass, Strength & Mobility
- Cognition
- Everyday Functional Abilities

### 8 scripted tasks
- Fill medicine dispenser
- Watch a DVD
- Water plants
- Converse on phone
- Write birthday card
- Prepare a meal
- Sweep and dust
- Select an outfit

<table>
<thead>
<tr>
<th></th>
<th>Middle-Aged N = 22</th>
<th>Young-Old N = 44</th>
<th>Old-Old N= 22</th>
<th>MCI N= 50</th>
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<tbody>
<tr>
<td>Age</td>
<td>54.55 (50-59)</td>
<td>67.14 (60-74)</td>
<td>80.00 (75-86)</td>
<td>70.86 (53-87)</td>
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<tr>
<td>Education</td>
<td>16.95</td>
<td>16.91</td>
<td>16.77</td>
<td>15.56</td>
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<td>8 Activities Observation Score</td>
<td>11.18</td>
<td>13.55&lt;sup&gt;a&lt;/sup&gt;</td>
<td>16.45&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>18.04&lt;sup&gt;c&lt;/sup&gt;</td>
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</table>

Age-related Diseases

- About 80% of older adults have one chronic health condition, and 50% have at least two
- Most common chronic health conditions of elderly
  - Adult onset diabetes
  - Arthritis
  - Kidney and bladder problems
  - Dementia
  - Parkinson’s disease
  - Glaucoma
  - Lung disease
  - Cataracts
  - Osteoporosis
  - Enlarged prostate
  - Alzheimer’s disease
  - Macular degeneration
  - Depression
  - Cardiovascular disease
  - Hypertension
- Preventing chronic diseases is important to keeping older adults healthy
Aging and Causes of Death

- Leading causes of death, age 65+
  - Heart disease
  - Cancer
  - Chronic lower respiratory disease (e.g., COPD)

Care-partners Health

Care-partners of individuals with AD experience higher levels of emotional distress and physical health problems than other care-partners and non-care-partners.
Aging and Mental Health

• Depression
  ◦ Rate of depression declines from young/middle adulthood to older age
  ◦ < 5% of OAs in community show signs of depression; 11.5% of hospitalized elderly; 13% among those who require home health care
  ◦ OAs at risk include: those with chronic illness, nursing home residents, and family caregivers
  ◦ Highest rate of suicide seen in older white men

Improving Older Adults Health & Quality of Life

• Center for Disease Control and Prevention priorities
  ◦ Promote healthy lifestyle behaviors to improve the health of older adults
  ◦ Increase the use of clinical preventative services
  ◦ Address cognitive impairment
  ◦ Address issues related to mental health
  ◦ Provide education on planning for serious illness
Aging and Care Capacity Crisis:

- With the aging of the population we are seeing:
  - An increase in age-related disease
  - Rising costs to health care
  - Shortage of professionals and caregivers
  - Rise in individuals unable to live independently

Gerontechnology

- Technologies could offer innovations for....
  - Independent living
  - Home-based prevention
  - Early detection
  - Behavior change
  - Health and well-being
  - Social participation
  - Caregiver support
  - Safety and security
Technologies for Aging in Place

- Video & voice chat
- Screen reading software
- Door alarm
- Caregiver pager
- Talking alarm
- Picture-based phone
- Grab bar
- Automatic shut-off outlet

Gerontotechnology Impact matrix

<table>
<thead>
<tr>
<th>Life Domain</th>
<th>Health &amp; Self-esteem</th>
<th>Housing &amp; Daily living</th>
<th>Mobility &amp; Transport</th>
<th>Communication &amp; Governance</th>
<th>Work &amp; Leisure</th>
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</thead>
<tbody>
<tr>
<td><strong>Goal</strong></td>
<td>Telemedicine Internet</td>
<td>Wireless/remote (e.g., phone)</td>
<td>GPS navigation Info publ.transp</td>
<td>Mobile phone Internet</td>
<td>Digital. camera Internet</td>
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<tr>
<td>Enhancement &amp; Satisfaction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevention &amp; Engagement</td>
<td>Healthy diet Home trainer</td>
<td>Smart ventil. Safety illumin.</td>
<td>Car automation Traffic info</td>
<td>Video Links</td>
<td>Focussed lighting</td>
</tr>
<tr>
<td>Compensation &amp; Assistance</td>
<td>Passive alarms</td>
<td>Smart IADL</td>
<td>Rollator/walker Battery wheelchair</td>
<td>Hearing Aids</td>
<td>Power tools Robot pet</td>
</tr>
<tr>
<td>Care support &amp; Organisation</td>
<td>Smart intake Control-PDA</td>
<td>Electronic keys</td>
<td>Powered lifting</td>
<td>Care Networks Video links</td>
<td>Robots</td>
</tr>
</tbody>
</table>
Smart Environment Technologies

- Activity recognition, discovery and generalization
- Functional/health assessment – proactive and preventative interventions
- Prompting technologies - automated real-time interventions
Technologies across a continuum of need

Primary Prevention: Support Brain & Body Health

- Exercise
- Cognitive Engagement
- Social Engagement
- Good Eating Habits
- Good Sleep Hygiene
- Stress Reduction
Technologies to Support Brain & Body Health

• Wearable systems for tracking mobility, nutrition and other health related activities
  ▪ Fitbit, phone apps, Pulse O2 activity, sleep & heart rate tracker

• Social networking technologies
  ▪ E-mail, internet, Skype

• Intelligent systems that can learn and monitor behaviors and prompt to assist in increasing better health related behaviors (e.g., food management, mental exercise, physical exercise)
  ▪ Smart homes
  ▪ Wearable technologies
  ▪ Smart homes partnered with wearable technologies

Challenges

• How can technologies be used/designed to:
  (a) **engage** individuals in healthy behaviors
  (b) **motivate** continued engagement in behaviors that support brain health
  ▪ gamification; changing reward structures; social competitions

• How can the use of technologies for brain health be introduced into people’s everyday lives at an early age?
  ▪ Create perception of promoting successful life span development rather than center on disability and pathology
  ▪ Make brain health technology fun to use, a status symbol
Secondary Prevention: Detect Early Cognitive and Physical Changes

• Allows individual to be more proactive in their health care
• Important to introduce non-passive technologies early to encourage familiarity and development of automatic habits before cognitive skills become too impaired

Secondary Prevention: Detect Early Cognitive & Physical Changes

• Intelligent systems that monitor behaviors and detect changes that suggest deviations in a person’s health – both acute and gradual changes
  ▫ Wearable technologies
  ▫ Technologies embedded in real world
    • Computer use & game tracking, voice monitoring, EMA measures of mood, activity level etc.
  ▫ Smart Homes
    • Assess functional status from sensor data (Dawadi et al., 2013)
    • Detect and predict functional change from sensor data: variability in daily activities, change in walking speed (Hayes et al., 2008)
• Reminder Systems
  ▫ Annual checkup reminders; tele-care; automated pill boxes; call-centers; Google glasses
Challenges

- Continuous monitoring results in large amounts of data to be stored and interpreted
- Creating algorithms that will detect low base-rate events from sensor data
- Creating algorithms that will detect critical situations and avoid a high false positive rate
- Validating algorithms: demonstrating reliability and validity
- Preventing information overload for users
  - Determine most important aspects of data and best ways to present/visualize
- Reliability and longevity of sensors
- Early use of devices to promote habit formation

Tertiary Prevention

- Technologies can be used to complement formal human care
- Such technologies should:
  - Provide increase sense of safety & independence
  - Increase confidence in performing everyday activities
  - Allow adults to feel more active in their care
  - Have a positive impact on quality of life
  - Decrease feelings of isolation, improve communication with loved ones and improve social support
  - Be useful in energy and time conservation
  - Decrease feeling of imposition on family/friends
  - Decrease caregiver burden/stress
  - Be cost effective
Tertiary Prevention: Enhance quality of life for persons with dementia

- **Promote safety**
  - Night lights, flood detectors, outlet switch off devices
- **Foster social communication**
  - Picture button phones
- **Act as a memory enhancer**
  - Reminder watches, electronic calendars, item locators, pill box reminders, autographer for camera
- **Support daily activities**
  - Motion sensor facets, bidets, intelligent prompting technologies

Tertiary Prevention - Intelligent Prompting Technologies

- **At this stage, due to cognitive compromise**  a prompting device
  - Should not require user to provide feedback
  - Should alert individual to prompt
- **To be most effective at this stage**
  - Need context-aware prompting devices
  - Prompt during activity transition to avoid interrupting another activity
- **Need to consider best way to deliver prompts and delivery device**
  - Cueing hierarchy; verbal prompt versus multimodal
- **What would need to be sensed to deliver appropriate prompts**
  - Orientation of objects, safety devices use (e.g., walkers)
Can we develop prompting technologies?

What prompt types are Preferred?

**Cue types**
- Indirect
- Direct
- Multimodal

**Cued Activities**
- Organizing Medications
- Sweeping and Dusting
- Cooking Oatmeal
- Sort and Organize Bills
- Washing Hands
- Washing Countertops

<table>
<thead>
<tr>
<th></th>
<th>Indirect</th>
<th>Direct</th>
<th>Multimodal</th>
</tr>
</thead>
<tbody>
<tr>
<td>More cognitive complaints</td>
<td>15.3%</td>
<td>36.5%</td>
<td>48.2%</td>
</tr>
<tr>
<td>Less cognitive complaints</td>
<td>25.9%</td>
<td>44.7%</td>
<td>29.4%</td>
</tr>
</tbody>
</table>

$p = .032$

Tertiary Prevention: Enhance quality of life for caregiver

- Provide emotional support and information
  - Chat rooms, internet & telephone-based support groups, videoconferencing
- Decrease worry and burden
  - Tracking technologies (GPS), floor mats, video monitors, door alarms, object finders
- Decrease additional stressors
  - Tele-care technologies
Challenges

• Designing intelligent context-aware technologies
• Designing technologies that are passive - no or minimal user initiation or maintenance
• Designing technologies that require no new learning of user and that have the ability to learn about user and adjust to changing needs
• Making technologies acceptable to the end user
  ◦ those with and without cognitive impairment may have different views about what is important or a particular technology
• Designing technologies that are low in cost and protect privacy

Other Challenges

• Lack of awareness and knowledge about technologies among professionals, users and caregivers
  www.tech4aging.wsu.edu (video series)
• Need for a managed database of available devices (e.g., LeadingAge CAST)
• Access to technologies and the training/support to use them efficiently
• Partnering between different technologies
• Attitudes towards devices and self-efficacy
Questions for thought?

• What will it take for individuals to successfully age in place?

Requirements for Aging in Place Technology Market Success (Orlov, 2015)

• Technologies must be intuitive and well-supported (designed with user in mind and opportunities for training)
• Device vendors must be capable of integration and extension
• Costs to consumers must be affordable
• Products must be available on widely adopted platforms
• Upgrades must be more seamless than today
• Others??
• Consumers must be aware of benefits of technology
Ethical Implications of Assistive Technologies

• Zwijsen et al. (2011) article
  ▫ Goal: provide an overview of most important ethical considerations in the field of AT for community-dwelling elderly
  ▫ Thematic review; type of AT was not specified
  ▫ Perspectives from scholars, users and caregivers

• Monitoring devices
  ▫ Autonomy
  ▫ Privacy
  ▫ Independence
  ▫ Human contact

Did reading this article raise any ethical issues for you regarding the use of technology?

• Are monitoring devices being used for the benefit of the person with dementia or the caregiver?
• Adaptive preference versus an informed preference?
• Is the correct viewpoint that people should be independent and self-determinant; what about the idea of viewing people more as social and reciprocal?
Aging Assistive Technologies Programs

- Video intervention to increase awareness & knowledge about ASTs, promote more positive attitudes and reduce stigma among users, caregivers and professionals.
- AST phone intervention to help promote AST use
- AST Lending Program
- Visit: tech4aging.wsu.edu