



# A Transformative Subfield in Rehabilitation Science at the Nexus of New Technologies, Aging and Disability

*Carolee Winstein, PhD, PT, FAPTA*

Director, Optimizing Participation Through Technology  
Rehabilitation Engineering Research Center

# Promise, Challenges, Solutions

- New technologies show real *promise*
- *Challenges* to translating advances in new technologies into practice that address real problems.
- *Solutions* will come through effective collaborations between those working in:
  - rehabilitation engineering
  - psychological science
  - implementation science
  - gerontology
  - clinical science
  - social science
  - cinematic arts
  - health economics and policy
  - healthcare industry
  - consumers

# The future is here....

- Exponential advances across myriad technological fields are conspiring to usher in an era of profound change



TO BE HONEST, MR. JOBS, THE LAST TIME AN APPLE CAUSED SO MUCH EXCITEMENT AROUND HERE INVOLVED ADAM, EVE AND A SNAKE...

# Aging –

***Our great success of the 20<sup>th</sup> Century***

# Disability –

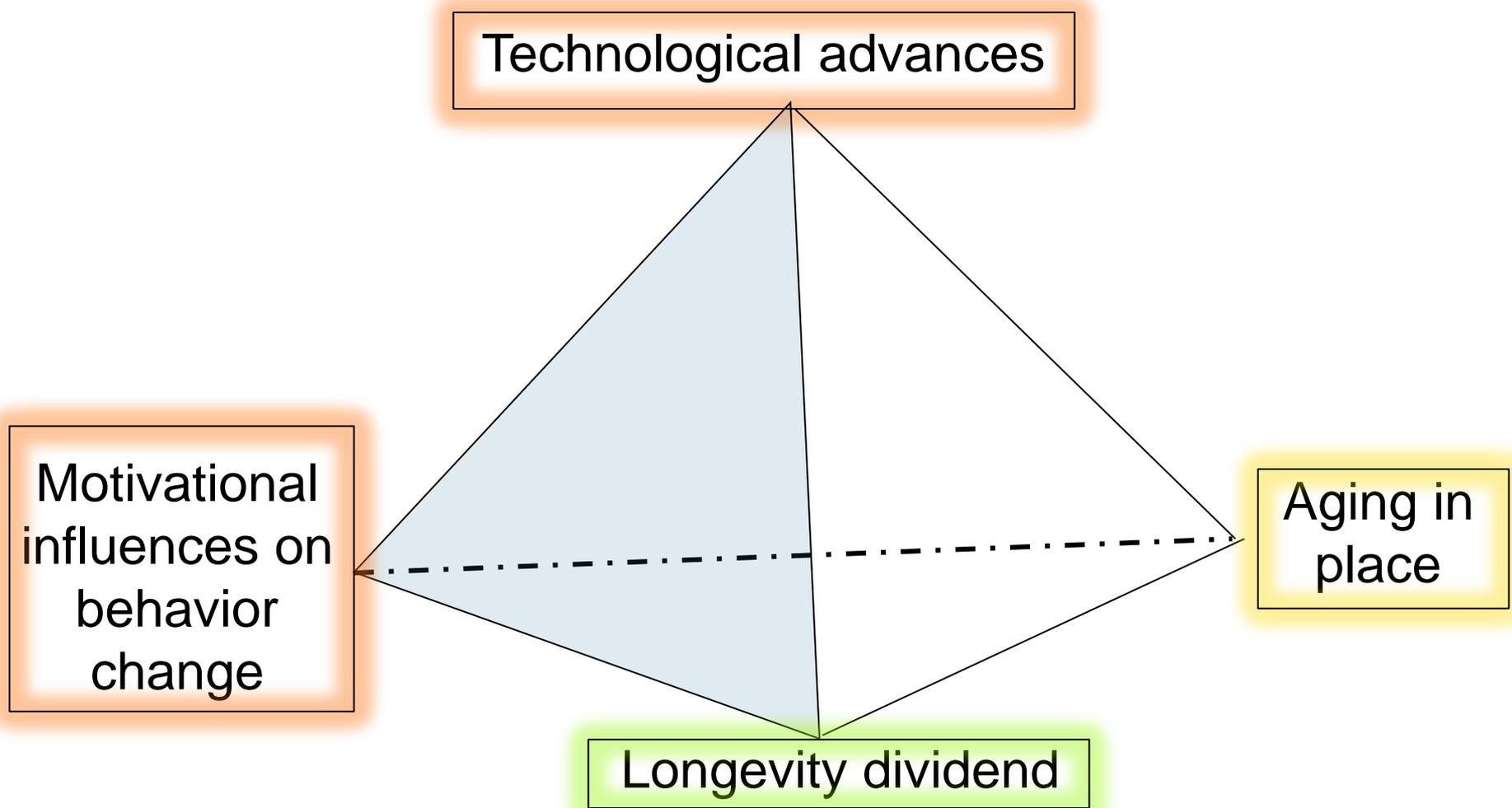
***Our challenge for the 21<sup>st</sup> Century***

## Relevant Facts:

- One in 6 adult Americans lives with a disability when defined by a limitation in function.
- Many are at higher risk for multiple chronic conditions, injuries, and increased vulnerability
- Comparatively, people with disabilities are 4 times more likely to report their health to be fair/poor and 2.5 times more likely to have unmet health care needs than non-disabled peers.
- \$400 billion is spent annually on disability-related health expenditures.

# Transformative Subfield of Rehabilitation\*

\*Winstein et al., A transformative subfield in rehabilitation. *Frontiers in Psychology*, 3:340, 2012

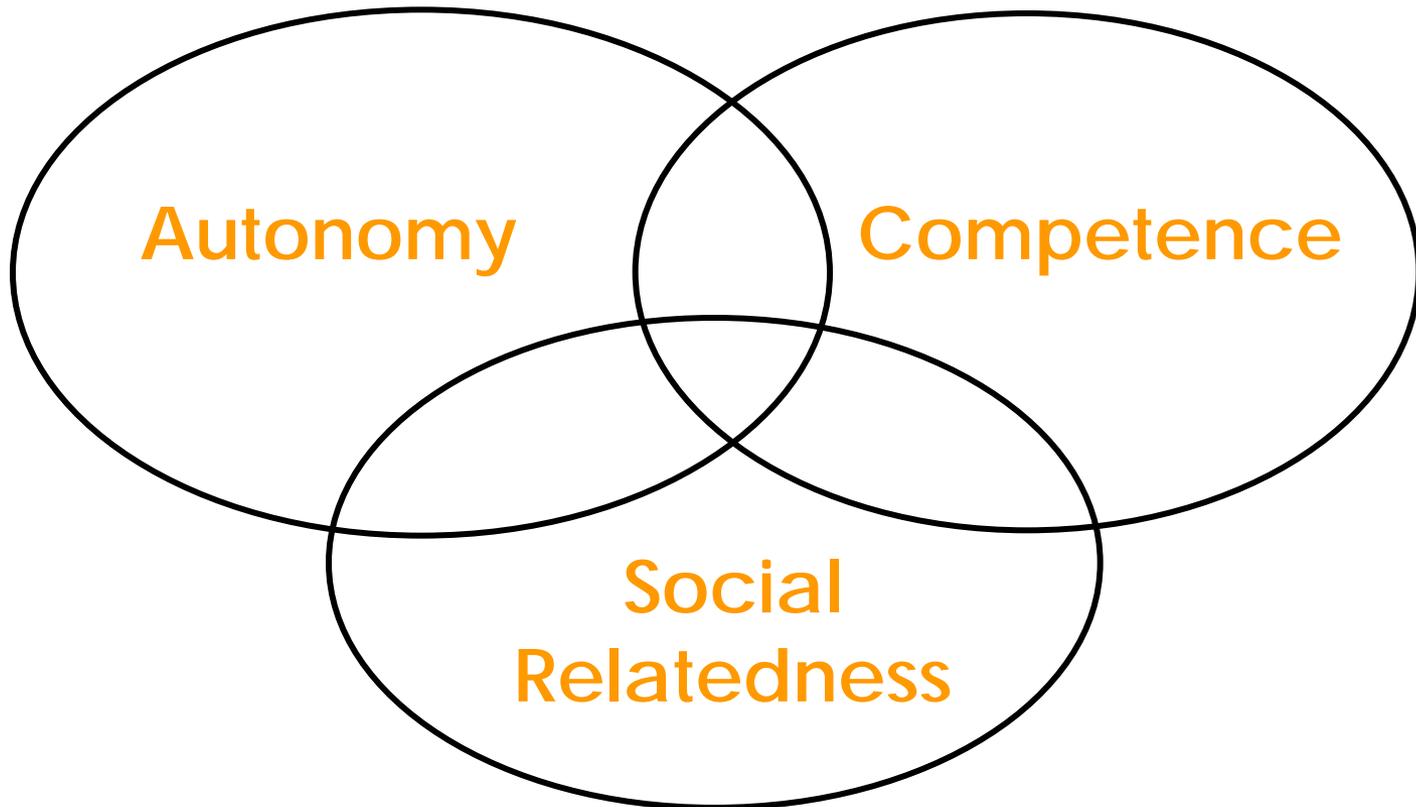


# What are the technological advances?

- Recent proliferation of low cost interactive media technologies for health and rehab
  - Mobile health monitoring devices (e.g., Lumoback, FitBit)
  - Interactive uses for the Kinect technology
  - Simple emergency notification devices (e.g. Phillips Lifeline)
  - VR and game-based rehab (e.g., YouGrabber)
  - Use of smart phones, tablets, computers (patients and practitioners)
- Developments in robotics for assessment and rehab
  - Pubmed Search
    - “robotic rehabilitation stroke”: 394 hits (196 since 2010)
    - “virtual reality rehabilitation stroke”: 146 hits

# Motivational influences on behavior change

## Fundamental Psychological Needs



# Fundamental Psychological Needs

**Autonomy**: Need to determine or feel in control of one's own actions, to be agentic (*likely why version 1 of the lokomat failed*)

**Competence**: Need to perceive oneself as capable or competent. Sometimes seen as the need to maintain or enhance competence (*feedback provides a sense of competence, fosters motivation and engagement*).

**Social Relatedness**: Need to feel included, accepted, or connected to others, to feel satisfaction in one's involvement with the social world (*social media; VR games with others*).



Virtual Reality simulation technology is Ideally suited to incorporate these basic psychological needs.

## Best Practice Rehabilitation:

- Is focused on a specific skill or task
- Has adjustable difficulty levels
- Is quantifiable in order to assess progress
- Is administered repetitively and hierarchically to allow the right amount of challenge.
- Provides the user with feedback about success (competence)
- Has some relevance to real world function
- Motivates and engages the user

# Aging (Rehabilitation) in Place

- Close the gap between evidence and practice in the community and home.
- Keep seniors and disabled in their homes longer.
- Place we call home matters--Most Americans will spend most of their time in their own home or in a rented residence (Henry Cisneros, Edward R. Roybal Memorial Lecture, 2012).
- Ask Seniors what worries you about the future:
  - Frustration at being immobile
  - Overall effects of frailty
  - Isolation (Social relatedness)
  - *Fear of falling*, getting sick and not being able to take care of themselves (Autonomy)
- Pubmed search: “*falls prevention and technology*”: 281 hits (101 hits since 2010)

# Technology-based Prevention and Health Maintenance

- Preventing falls in aged people living locally (PreFALL) project (Tilson & Mickan, 2012; Gillespie et al., 2012 Cochrane Database of Systematic Reviews; Hartholt et al., 2011)
- Interactive App and web-based system for health professionals and patients that will enable them to use current evidence to:
  - Identify and decrease risk factors for falling
  - Identify and implement behaviors to prevent falling
  - Maintain healthy behaviors after one or more initial falls
- This project ***will develop and test an interactive app and web-based intervention*** that:
  - utilises psychological theory and best evidence from implementation science
  - uses leading technology to create an interactive system that clinicians and patients can use through the convenience of their smart phone, tablet, or computer.
  - demonstrate use of mobile technology for effective knowledge translation that can be replicated to close other gaps between research and practice in care for the elderly and disabled.

# Longevity Dividend

- The Longevity Dividend refers to the economic benefits of ending aging and eliminating the associated health care costs. The Longevity Dividend has been defined as "the sum of health, social and economic benefits that result from slower aging."

Compression of Morbidity Theory

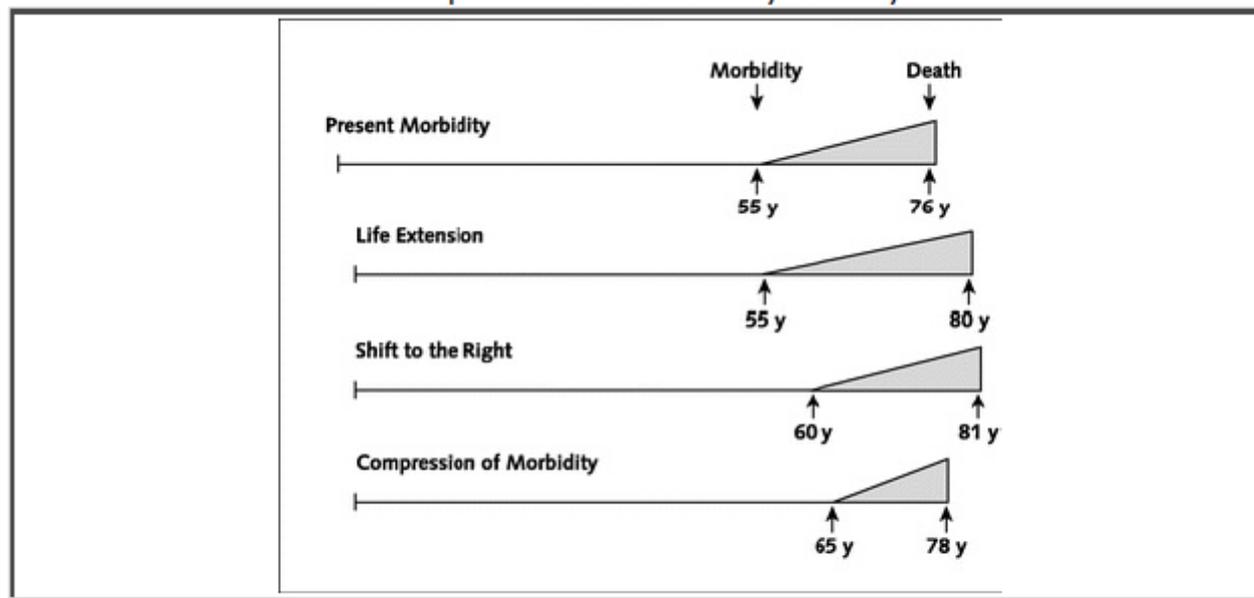


Figure 1. Possible scenarios for future morbidity and longevity. Present lifetime morbidity, portrayed as the shaded area, is contrasted with three possible future scenarios.

Source: Fries JF. Measuring and monitoring success in compressing morbidity. *Annals of Internal Medicine*. 139(5 Pt 2):455-9, 2003 Sep 2.

# Thank you

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