

Plasticity in Old Age: The Influence of Lifespan Theory

Sherry L. Willis

University of Washington

APA Symposium: Forty-five Years of Influence of the Lifespan Developmental
Approach: Past, Present Future: Intervention, Modifiability, and Plasticity



First Presentation of ADEPT: Paul Baltes, Rosemary Blieszner, Steve Cornelius, Margie Lachman, Brian Hofland



Ray Cattell & John Nesselroade



Carolyn Nesselroade – ADEPT Coordinator



Training at Shell Point



Mike Marsiske, Carolyn Nesselroade



Manfred Diehl, Mike Marsiske, Carolyn



ADEPT & SLS Groups



ACTIVE
Group

Plasticity in Cognitive Aging: Two Theoretical Perspectives



I. Magnification Perspective

- Training would magnify individual differences (e.g. age) in cognition
- More able would exhibit greater plasticity
 - Outcome: Level of performance
- Design: Cross-sectional. Compare young & old
 - Life-span
- Intervention: Practice on task with no strategies or instruction
- Target:
 - Cognitive abilities
 - Neural plasticity precedes behavioral/cognitive change

Plasticity in Cognitive Aging: Two Theoretical Perspectives



I. Compensatory Perspective

- Focus on elderly, not young-old comparison
- Focus range of plasticity in elderly
- Individual differences reduced, not magnified as functioning of training – low functioning gain more
- Design: Treatment – control group comparison
- Intervention: instruction & strategies, rather than practice
- Target:
 - Cognitive abilities
 - Neural plasticity – low functioning may increase activation while higher functioning may decrease activation – outcomes vary with baseline level

Rebok, Marsiske, Willis, Belleville, Schaie, Gross, Parisi, Bier, Labouvie-Vief, Boron, Saczynski

Types of Behavioral Interventions



I. Strategy training – Compensatory Approach

- Episodic memory (Rebok,)
- Reasoning/Executive training (Willis,)
- Transfer – transfer to tasks of same ability; limited transfer to other abilities

II. Whole Task Practice – Magnification Approach

- N-back (working memory)
 - (Jaeggi, 2008; Au et al, 2015)
- Transfer – considerable debate regarding transfer

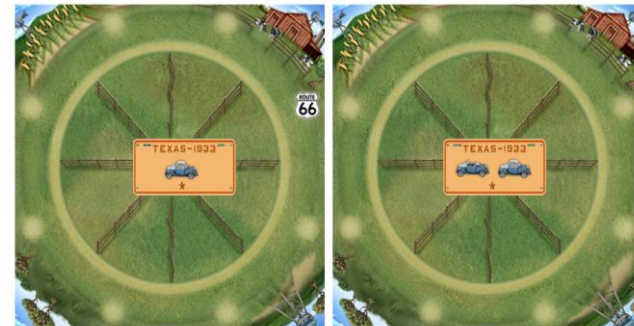
Types of Behavioral Interventions

III. Component-specific & Variable Priority

- Reduce complexity of task by successively focusing on different components of task (Kramer, Boot, Bherer,)
- Adaptive training – individualized training
 - Calibrate change in item difficulty and speed
- Speed of Processing (UFOV) – variable priority
 - Ball, Edwards, Ross, Wadley

Transfer – Transfer within multiple components. No transfer to memory or reasoning in ACTIVE trial

- Increase attention in dual task – MCI
 - Gagnon & Belleville, 2012



Types of Behavioral Interventions

IV. Multiple Domain Training – Combine Strategy & Component-Variable Priority

- MEMO (Belleville) – Utilization of multiple strategies
 - Loci, face-name, imagery
 - Pretraining on attention
 - Practice in Real life situations

V. Computer & Mobile Training: Two Approaches

1. Research-based cognitive training
2. Commercial product – casual video gaming

Types of Behavioral Interventions

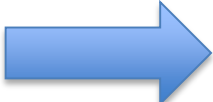
V. Computer & Mobile Training: Two Approaches

1. Research-based cognitive training
 - Enhance training via technical resources
 - Adaptive training, graphics
2. Commercial - Casual video gaming
 - Unclear specific abilities being trained by games
 - Findings not reported in High impact journals
 - Consensus reports – Express concerns
 - Lower satisfaction among elderly users



Neuroimaging: Predictor of Training & Outcome of Training

I. Baseline Neuroimaging as Predictor:

- Baseline Hippocampal volume predict 
Episodic memory training effects
- Striatum volume predict 
Attention Control

II. Neuroimaging as Training Outcome:

- Training can increase or decrease neural activation on task, depending on baseline level of activation

Success of Cognitive Training

- Cognitive plasticity has been shown for a number of different abilities, involving a variety of intervention approaches
- Training effects have been shown for:
 - Cognitively Normal
 - MCI
 - Demented
- Training effects in normal elderly are durable
 - ACTIVE trial reported maintenance of training (compared to control) at 10-year follow-up

Issues in Behavioral Interventions

Training Success BUT:

Various Approaches Focused on Different Cognitive Domains:

- Strategy training – episodic memory, reasoning
- Whole task practice – n-back, working memory
- Component-variable priority – attention, speed of processing,

Comparisons are Difficult!

Limited comparison of training same ability with different approaches!

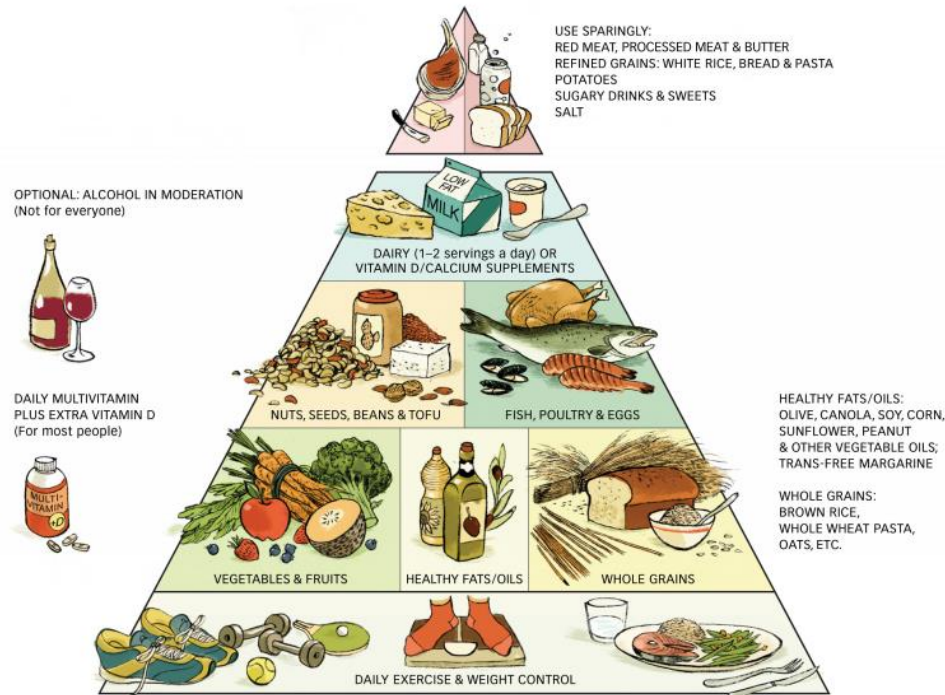
Current & Future Directions

- Neural – Brain Stimulation
- Training & Real World Tasks
 - Cognitive Engagement and Leisure Activities
 - Quilting, Photography (Park)
 - Senior Odyssey (Stine-Morrow)
 - Cognitive Engagement & Volunteer Activities
 - Experience Corp (Carlson, Rebok)
 - Job Training & Everyday Tasks with Seniors
 - CREATE

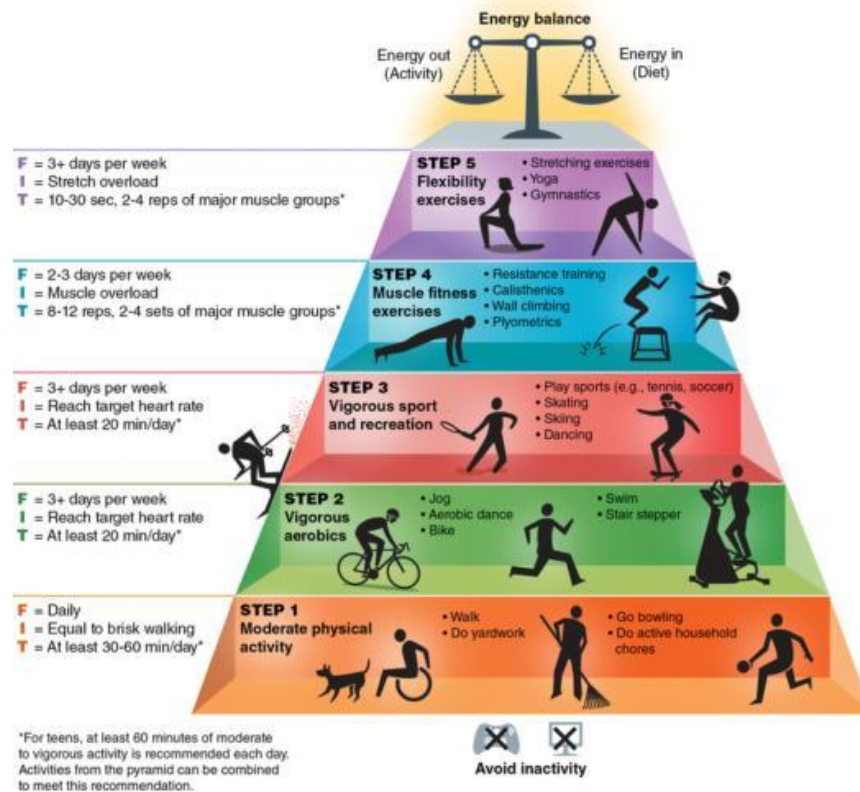
How to Embed Cognitive Engagement in Elderly's Daily Life?

THE HEALTHY EATING PYRAMID

Department of Nutrition, Harvard School of Public Health



Nutrition & Exercise Pyramids?



Embedding Engagement in Daily Life

- What are the basic components of cognitive engagement?
 - Primary abilities?
 - Executive Functions?
 - Frequency?
 - Intensity?
 - Physical & Social Context
 - Individual Differences?
 - Personalized or Individualized?
 - What is Successful Aging?