Aging and Cognitive Function

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Age-Related Changes in Cognitive Function: Impact of Physical Activity

Cognition: “The underlying operations utilized in the processing of information by the Central Nervous System.”

Cognitive Functions
- Memory
- Association
- Comparison
- Abstract Reasoning
- Spatial Manipulation
- Synthesis

Supporting Processes
- Attention
- Working Memory
- Information Processing Speed
- Psychomotor
- Perceptual Processes

Behavioural Speed: Reflecting Cognitive Function

Simple Reaction Time (SRT):

- Speed with which an individual can initiate a movement that requires no calculation, integration or decision making

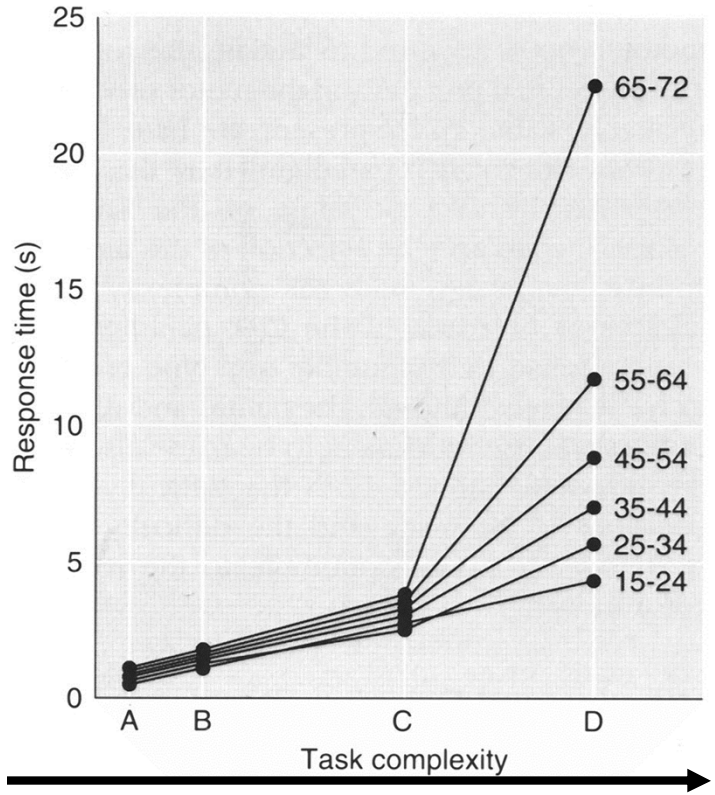
- Represents the "general responsiveness" of the central nervous system (CNS)

Behavioural Speed:
Reflecting Cognitive Function

Behavioural Speed: Reflecting Cognitive Function

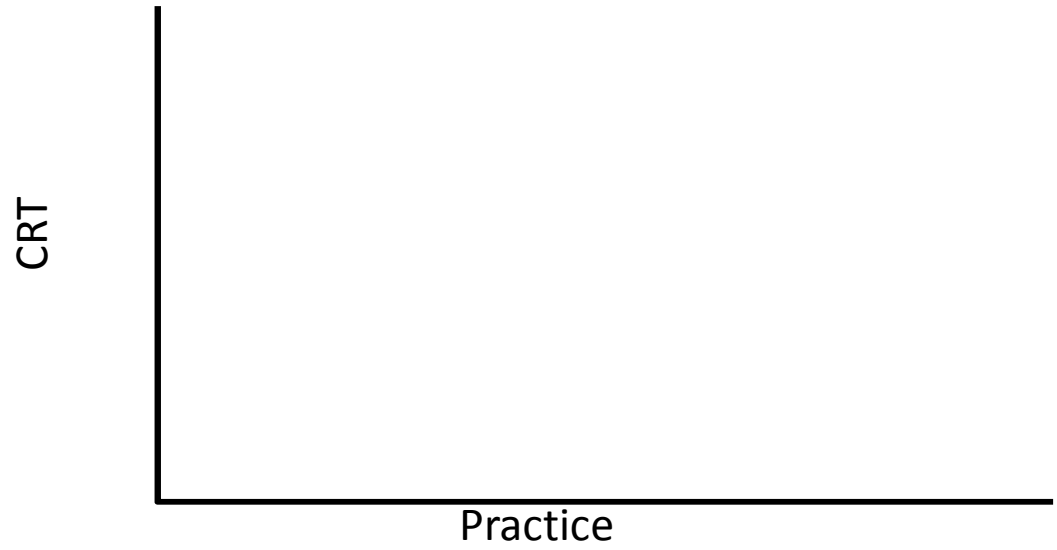
Choice Reaction Time (CRT)

- Speed with which an individual can initiate a movement that requires:



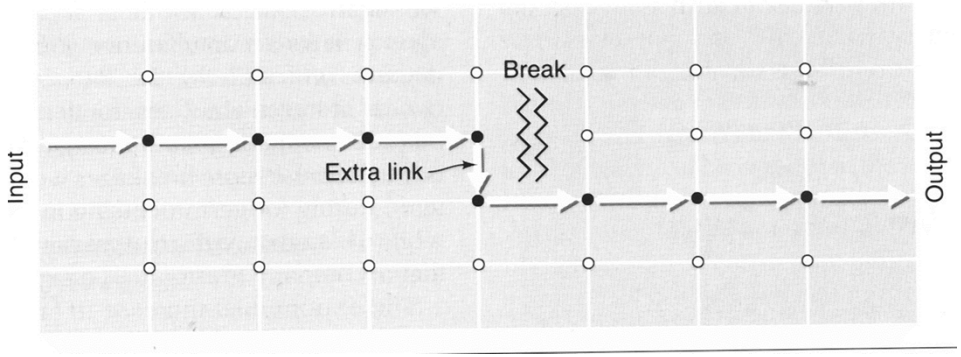
Possible Explanations For Behavioural Speed Deficits With Aging

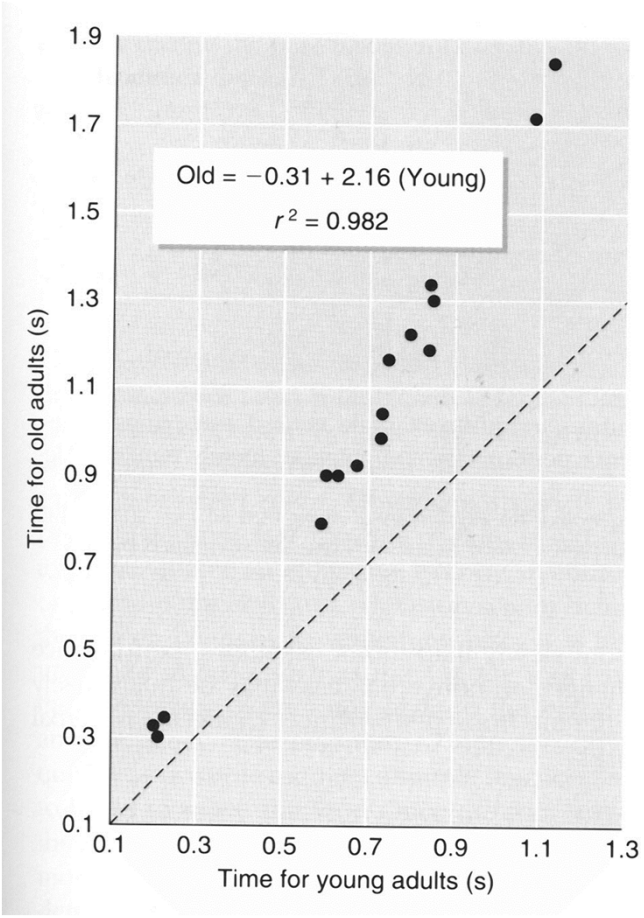
Disuse Hypothesis: Withdrawal from mental and social interaction with age results in slowing due to inequitable use of psychomotor function between old and young.



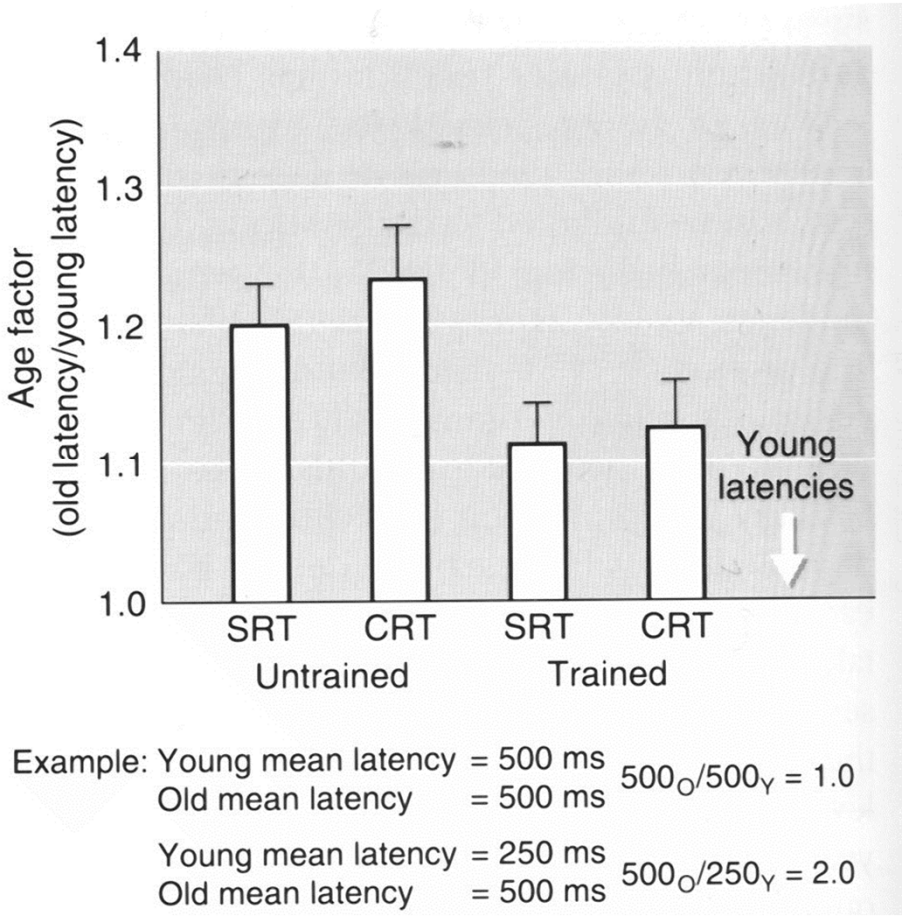
Possible Explanations for Behavioural Speed Deficits with Aging

Biological Degradation: All steps and structures involved in the processing of a task degrade equally…increased "cycle time" per operation.





Role of Physical Activity



Example: Young mean latency = 500 ms
Old mean latency = 500 ms
$500_O/500_Y = 1.0$

Young mean latency = 250 ms
Old mean latency = 500 ms
$500_O/250_Y = 2.0$

Stroop Test

- The Stroop Test is a psychological test of our mental (attentional) vitality and flexibility. The task takes advantage of our ability to read words more quickly and automatically than we can name colours.

- The cognitive mechanism involved in this task is called **directed attention**, you have to manage your attention, inhibit or stop one response in order to say or do something else.

BLUE	GREEN	BLACK	RED	BLACK	GREEN	BLUE
RED	BLUE	GREEN	BLACK	BLUE	RED	BLACK
GREEN	BLACK	RED	BLUE	GREEN	BLUE	RED
BLACK	RED	BLUE	GREEN	RED	BLACK	BLUE
BLUE	BLACK	RED	BLUE	RED	BLUE	GREEN

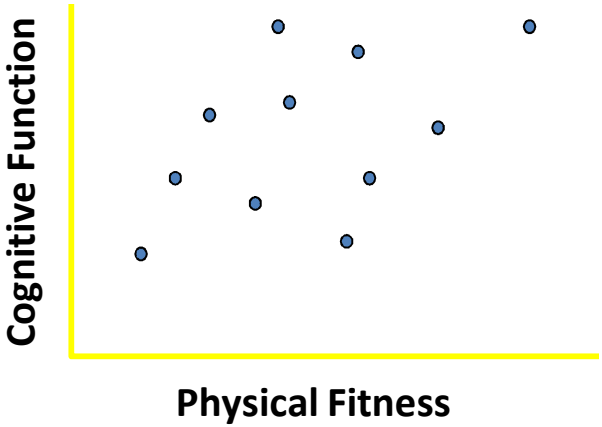
Possible Explanations for Cognitive Deficits With Aging: Biological Changes

- With aging there are declines in the CNS:
  - Neurotransmitters
  - Enzymes (these make and “mop up” neurotransmitters)
  - Neural receptors

  - Neural cells
  - Dendrites
  - Synaptic contacts

  - Deterioration of myelin covering

Biological Explanation



Cerebrovascular Integrity

- O_2 availability affects cognitive function
- CBF declines with age

Neurotransmitter Depletion and Imbalance

- Imbalance of neurotransmitters (Parkinsons's, Dopamine<Acetylcholine)

Morphological Changes

- Amount and quality of neurons and neural connections decreases

Cardiovascular Fitness Improves Higher Level Cognitive Function

Central Arrow Cue Recognition Task

<<<<< vs. >><<>>

Cross Sectional and Longitudinal (Pre vs. Post 6 Month Aerobic Training)

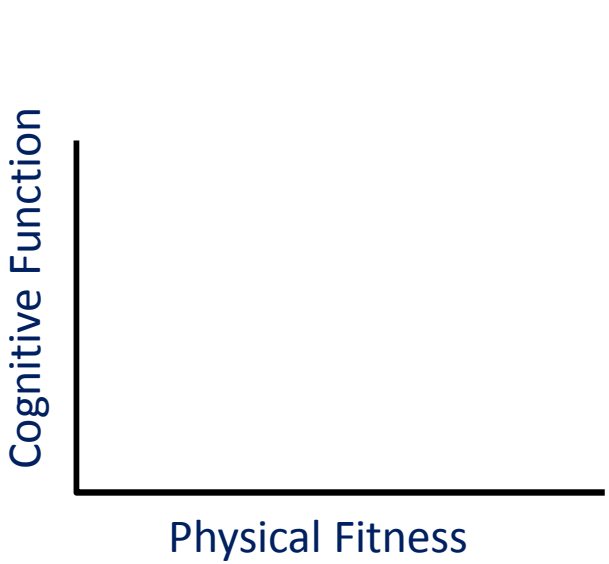
Trained vs. Untrained

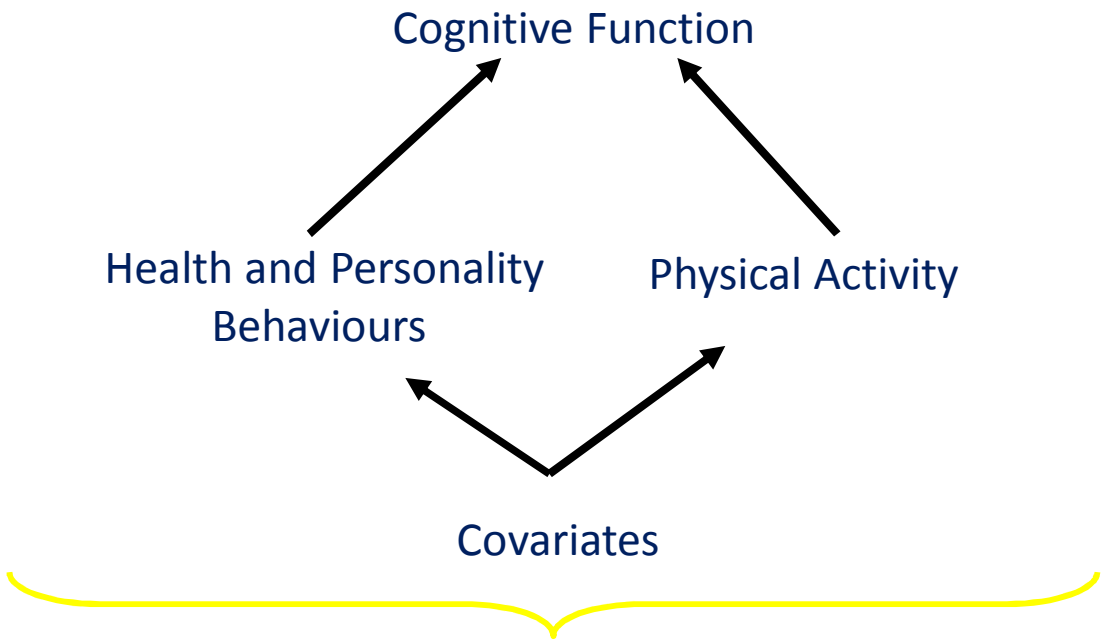
- Less “behavioural conflict”

- Greater brain activity in attention-relevant frontal and parietal lobe areas

- Less activity in behaviour conflict area of brain (dorsal anterior cingulate cortex)

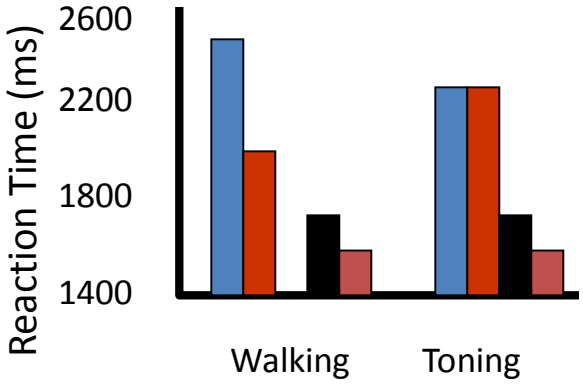
Role of Physical Activity: Cross-Sectional



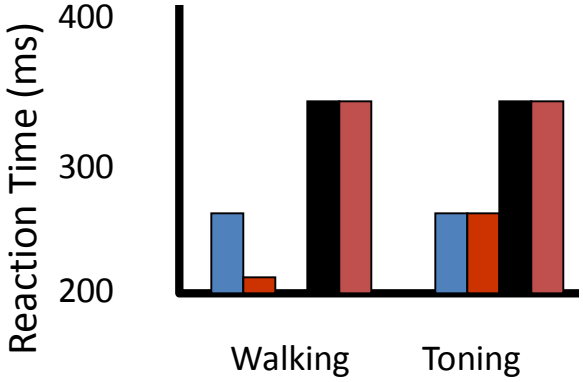


Psychosocial Explanation:

Role of Physical Activity: LongiTudinal



Switching vs.
Non-Switching Task



Stop Signal vs.
Simple Reaction Time

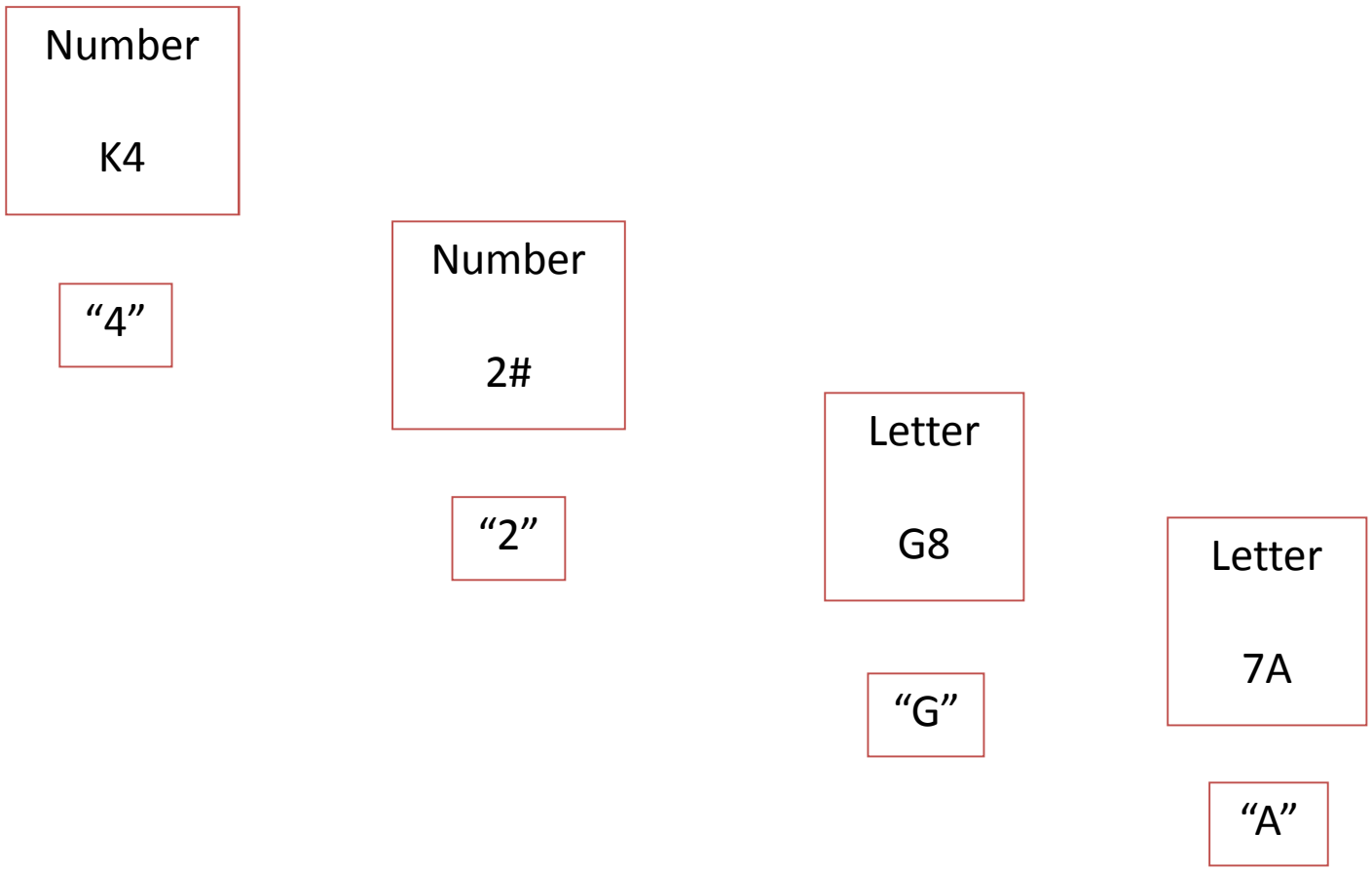
N=124
60-75 year sedentary

Walking:
5% increase in peak VO_2

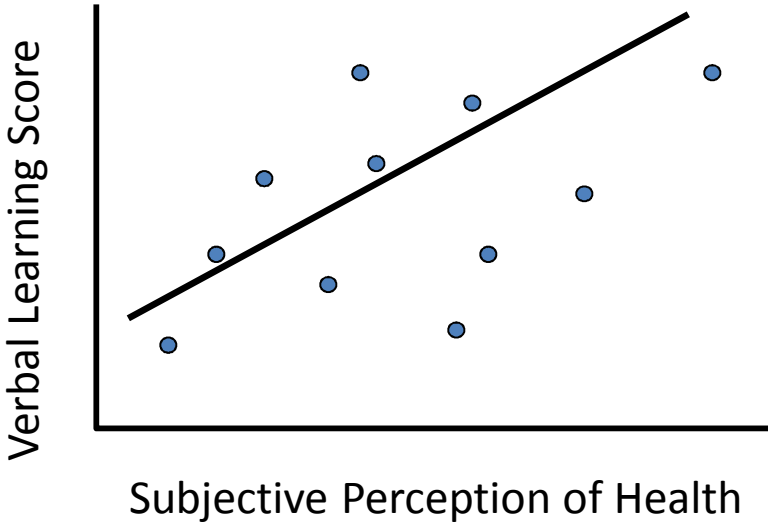
Stretching "Toning":
No increase in peak VO_2

Churchill et al. (2002)

Task Switching

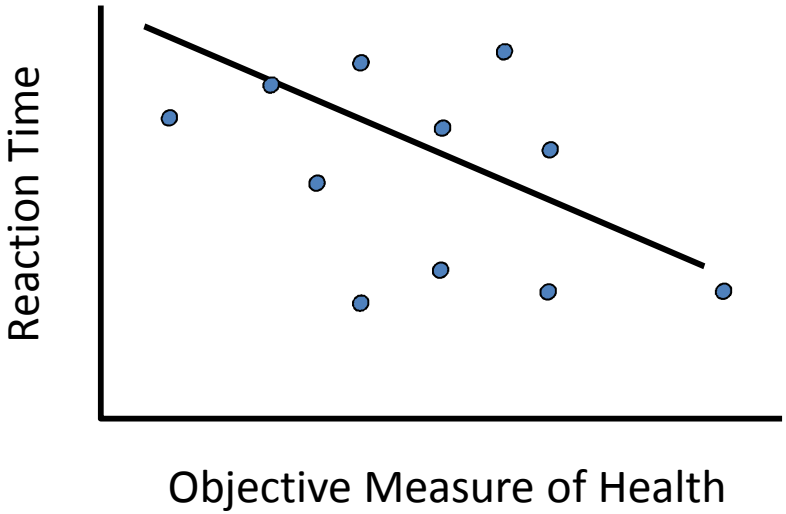


Health and Cognition: Perception Effect



Subjective Perception of Health:

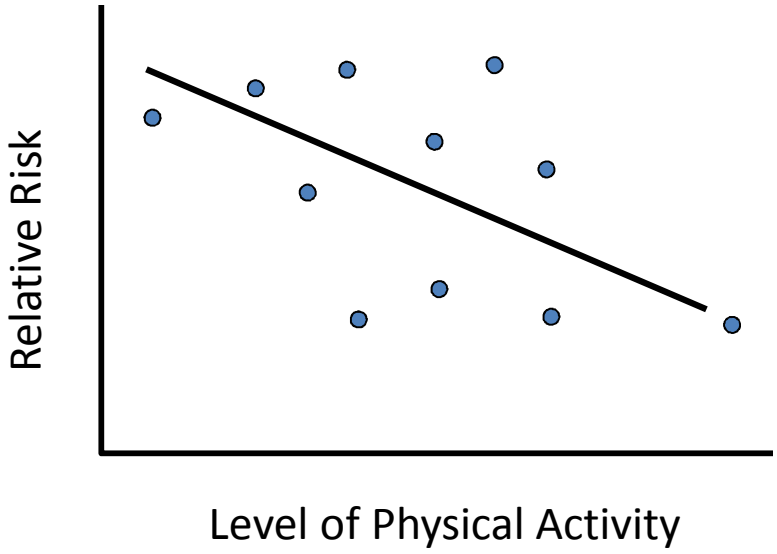
Objective Measure of Health:



Cognitive Health: Role of Exercise

Canadian Study of Health and Aging:

- 6434 cognitively normal 65+ year olds
- 4615 completed 5 year follow-up
- 436 had cognitive impairment – no dementia
- 285 had dementia



Laurin et al. (2001)