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LA PRÉVENTION AU CŒUR D'UNE MEILLEURE SANTÉ
BETTER HEALTH THROUGH PREVENTION

CIHR IRSC
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Cognitive considerations in the assessment and improvement of dual-task mobility and cognition in older people

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Selected cognitive tests should be …

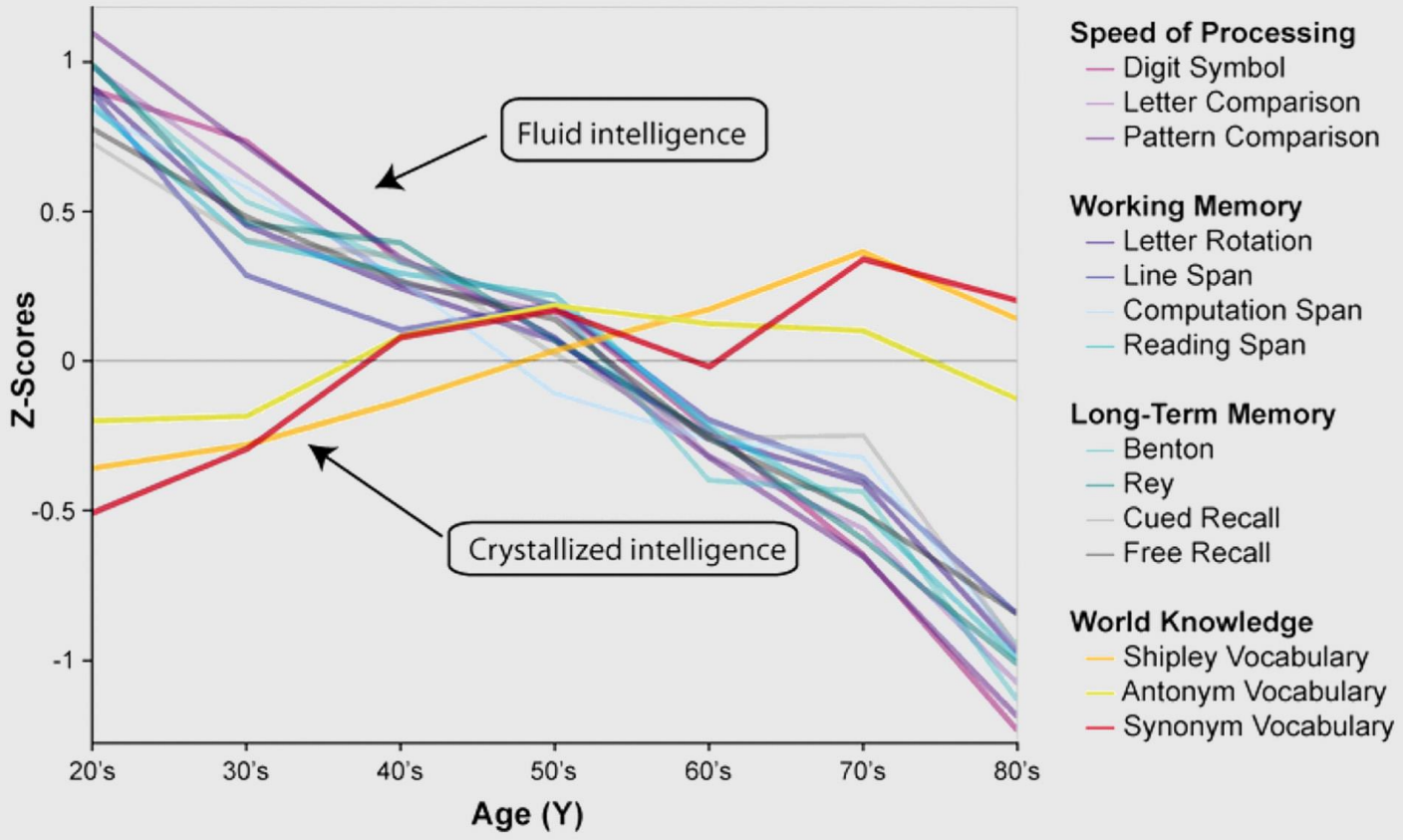
- Sensitive to changes in mobility and cognition
- Sensitive to change with interventions including exercises and cognitive remediation
- Feasible to apply across research studies and in clinics
- Inexpensive, ecological and easy to perform and require minimal expertise to be administered
- Transcultural

Outline

- Conceptual framework
- Assessment
- Intervention
- Other considerations

Conceptual Framework

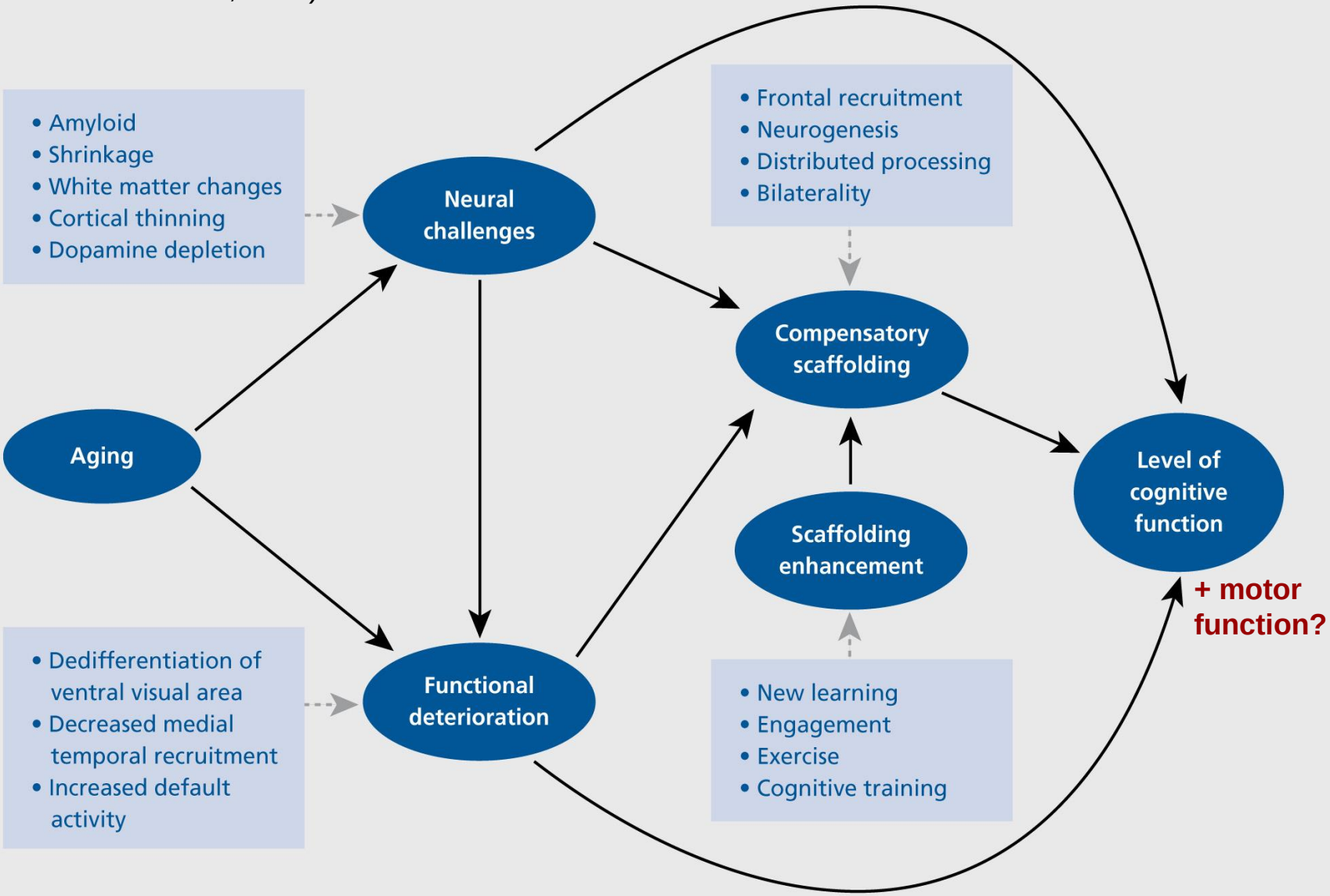
Cognitive decline varies by ability



Park & Bischof (2013) *Dialogues Clin Neurosci*

Scaffolding Theory of Aging and Cognition (STAC)

(Park & Reuter-Lorenz, 2009)



Relation to dual-task cognitive-motor performance in aging?

- Tendency to conceptualize mobility as the primary task and concurrent cognitive load as secondary
- Concurrent cognitive load may alone require cognitive "scaffolding"
- Competition for scarce resources (i.e., dual-task costs)

Assessment

What cognitive measures are sensitive to mobility decline ?

Cognitive correlates of gait

- **InCHIANTI study** (Ble et al., 2005*):* ΔTrails B-A predicts fast walking over obstacles but not usual simple walking
- **Einstein Aging Study** (Holtzer et al., 2006; 2007): processing speed/EF (Digit Symbol, Block Design, Trails A&B, B-errors) and memory (FCSRT, category fluency) factors predicted falls and dual-task gait velocity
- **Tel-Aviv Sourasky** (Hausdorff et al., 2005; Herman et al., 2010): EF (go-no-go and Stroop interference) predict stride time variability and falls 2 years later
- **Nijmegen group** (van Iersel et al., 2008): EF (Trails and Stroop pdiff) predicted dual-task stride length variability
- **Health ABC study** (Atkinson et al., 2007; Watson et al., 2010): global cognition (3MS) and EF (clock drawing, Executive Interview) predict gait speed; additionally change in verbal memory and visuospatial ability predicts rate of gait speed decline over 5 years
- **Gait and Brain Study** (MMO et al., 2009, 2011, 2014, Muir et al 2012): Executive dysfunction (TMTAB), working memory (LNS), attention (Digit Symbol) and semantic memory (RAVLT) is associated with slow gait speed, higher dual-task cost in a dose response manner when comparing cognitive healthy, MCI ans older adults with dementia

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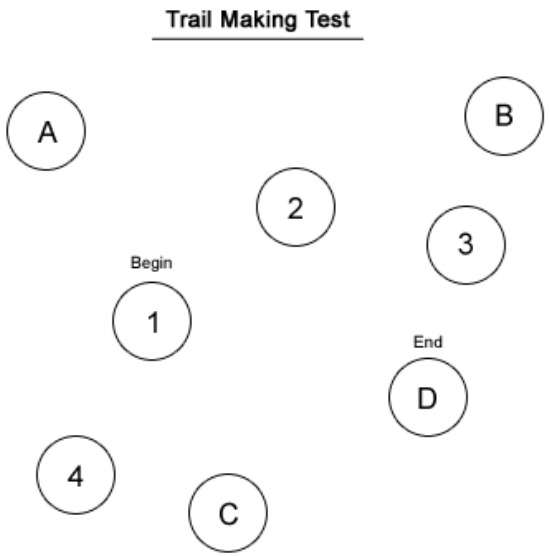
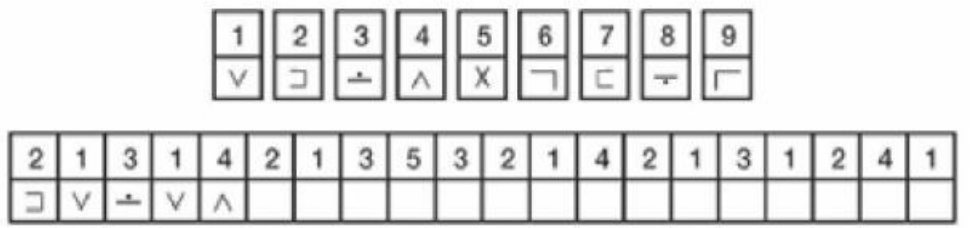
Process-specific involvement in gait?

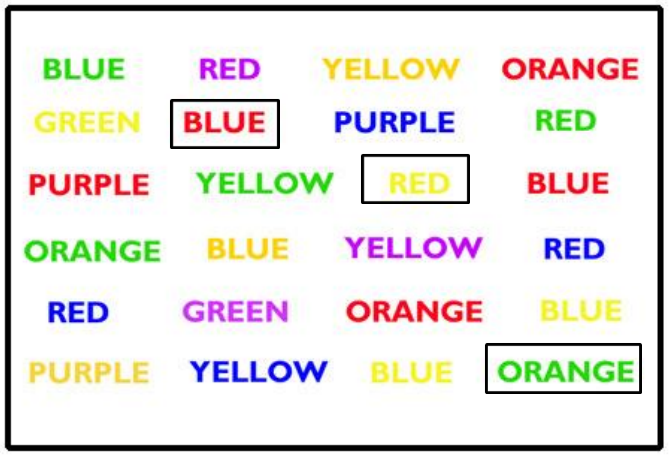
- **Trails A vs. B:** switching



- **Digit symbol substitution**: processing speed, selective attention



- **Stroop interference**: response inhibition, selective attention (switching)



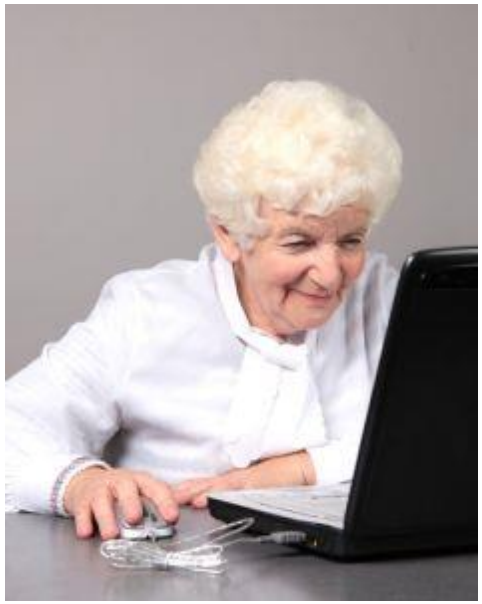
Assessment:
Cognitive considerations

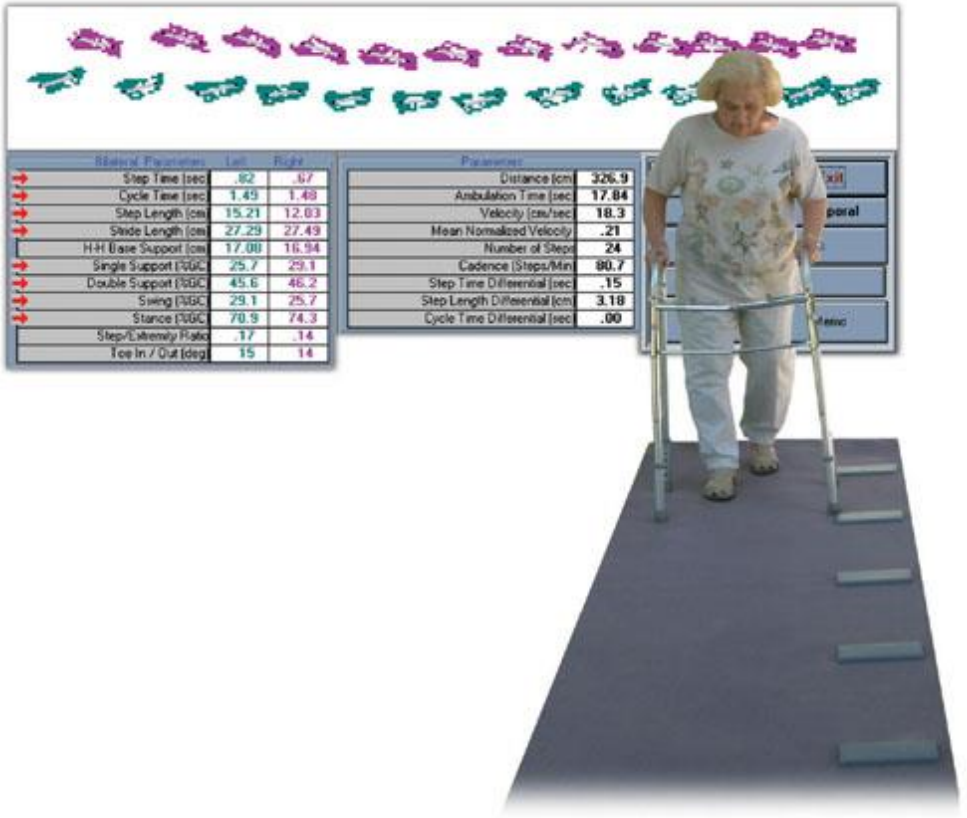
- Processing speed (WAIS Digit-Symbol Substitution)
- Executive functions
  - Switching (Trails B-A)
  - Updating (*n*-back)
  - Response inhibition (Stroop*: neutral, interference, switch)
- Additional measures
  - Working memory (digits backward, letter number sequencing)
  - Selective attention (NIH Toolbox Flanker task)
- For ease of administration, paper-and-pencil with stopwatch timing, translations available, check near visual acuity

Intervention

What cognitive measures are sensitive to cognitive remediation?

Cognitive Training Leads to Physical Gains





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doi:10.1093/gerona/glq127

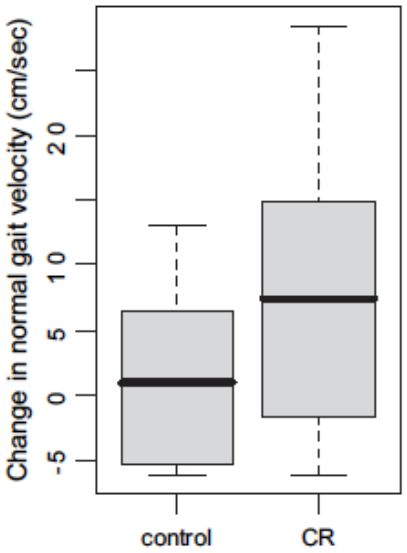
Advance Access published on July 19, 2010

Effect of Cognitive Remediation on Gait in Sedentary Seniors

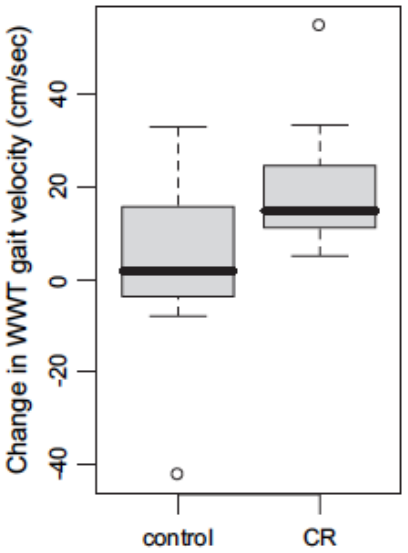
Joe Verghese,[1] Jeannette Mahoney,[1,2] Anne F. Ambrose,[3] Cuiling Wang,[4] and Roee Holtzer[1,2]

- Sedentary older adults randomly assigned to computerized brain training or wait-list control groups
- Multiple tasks to strengthen memory, attention, inhibition, speed, executive functions
- Training: 45 mins, 3 days/week x 8 weeks
- Training gains were observed for walking and walking-while-talking (increased speed)
- MMSE no change; processing speed (RT) improved (p = .03) in training group

Walking



Walking & Talking



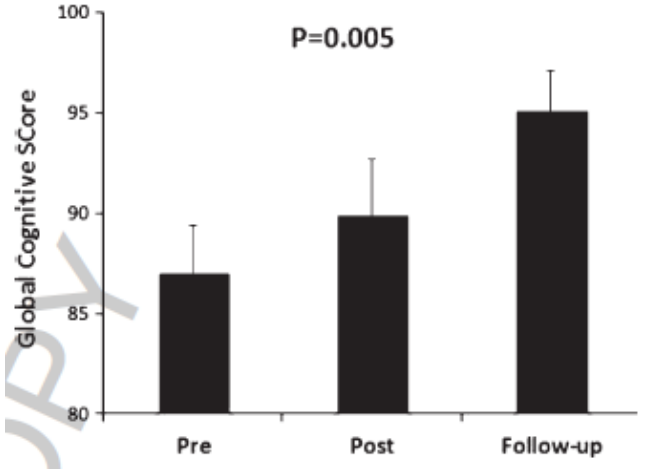
Journal of Parkinson's Disease 4 (2014) 37–44
DOI 10.3233/JPD-130321
IOS Press

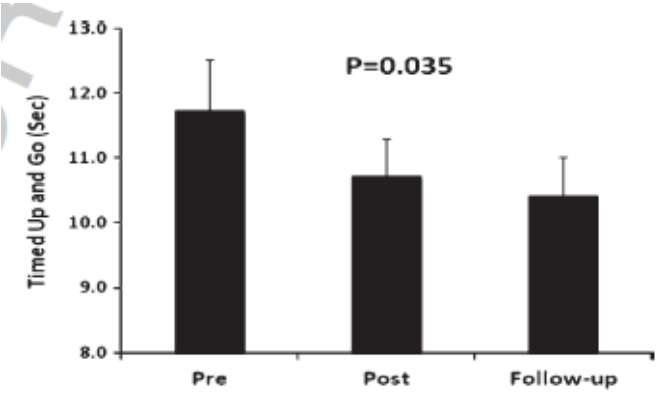
Research Report

Can Cognitive Remediation Improve Mobility in Patients with Parkinson's Disease? Findings from a 12 week Pilot Study

Uzi Milman[a,b], Hagit Atias[c], Aner Weiss[d], Anat Mirelman[d] and Jeffrey M. Hausdorff[d,e,f,*]

- 18 PD patients 50 – 80 yrs.; Hoehn & Yahr score I – II
- EF brain training at home, 30 mins, 3x / week for 12 weeks
- Follow up 4 months after post
- TUG time improved under full attention conditions
- Global cognition improved; specific EF tests showed trends towards improvement

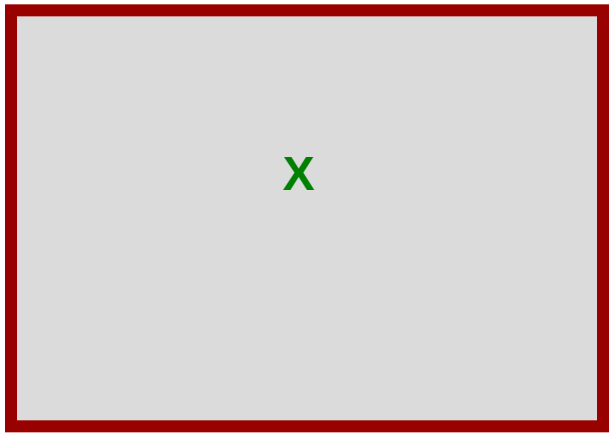




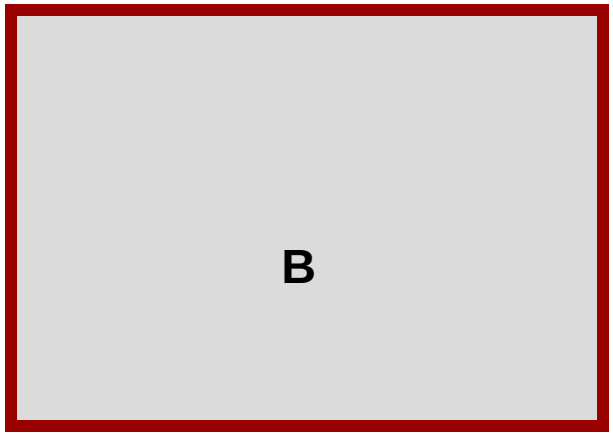
Attentional training method

(Bherer, Kramer, et al., 2005)

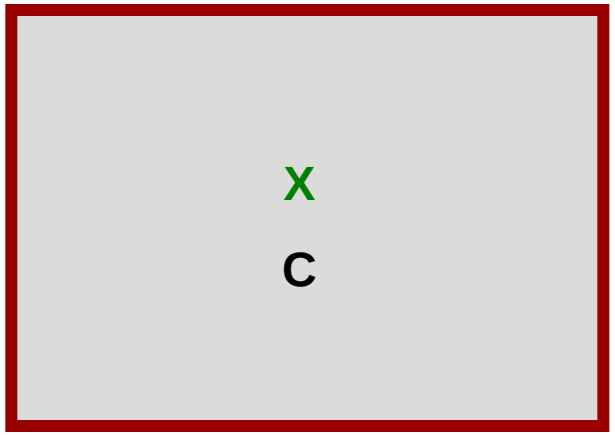
Task 1: green/yellow?



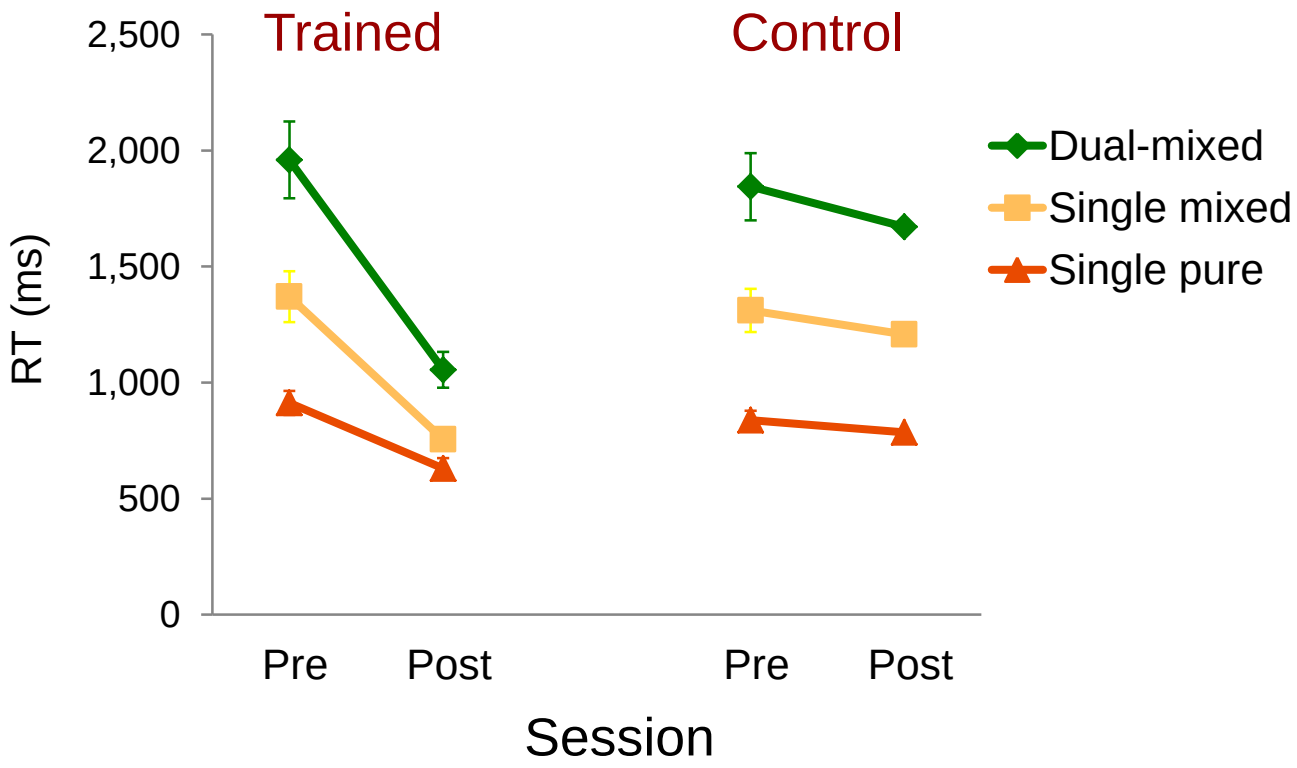
Task 2: B/C?



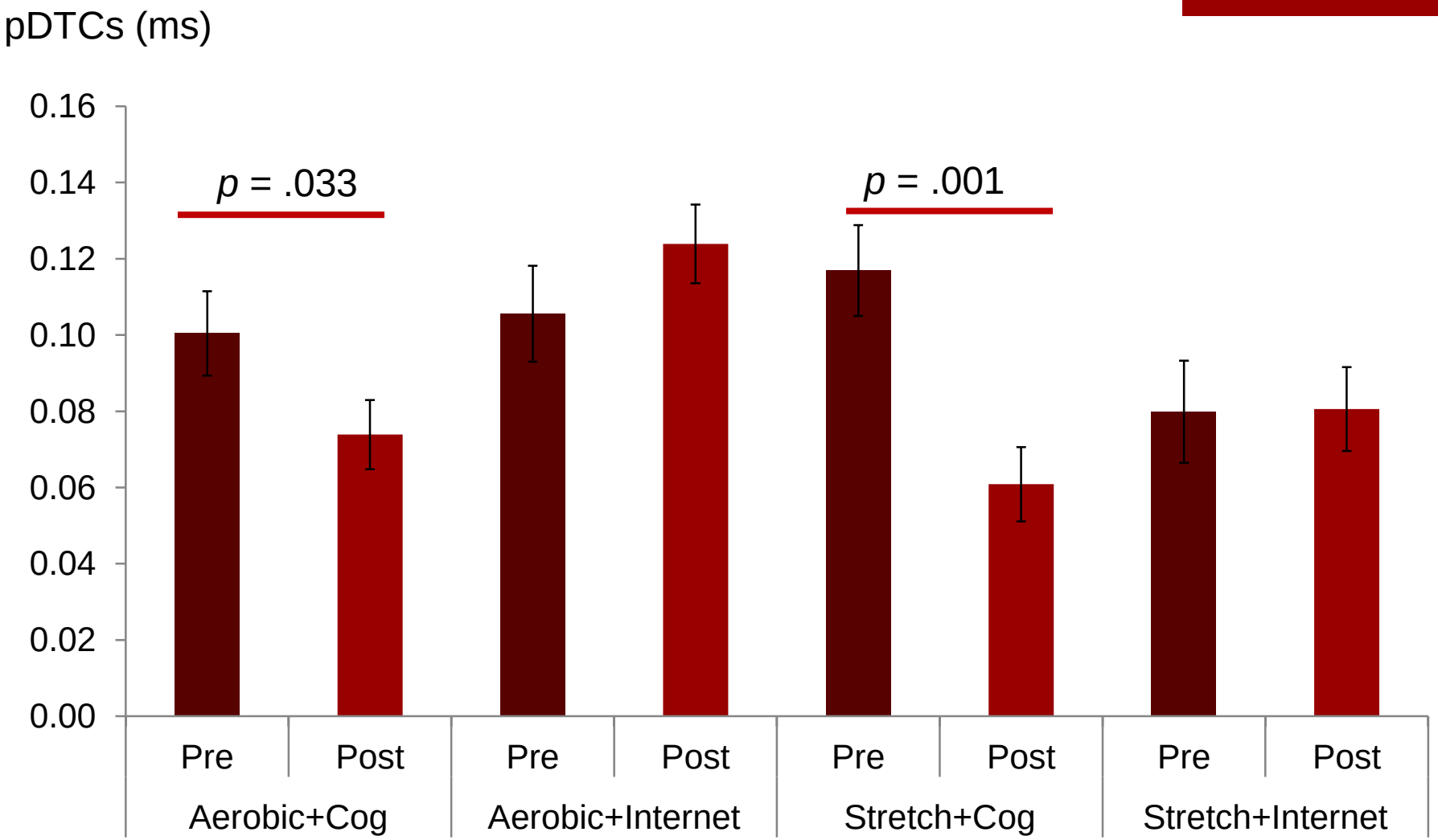
Dual-Task: 1+2



Improvements in cognitive performance for Trained vs. Control

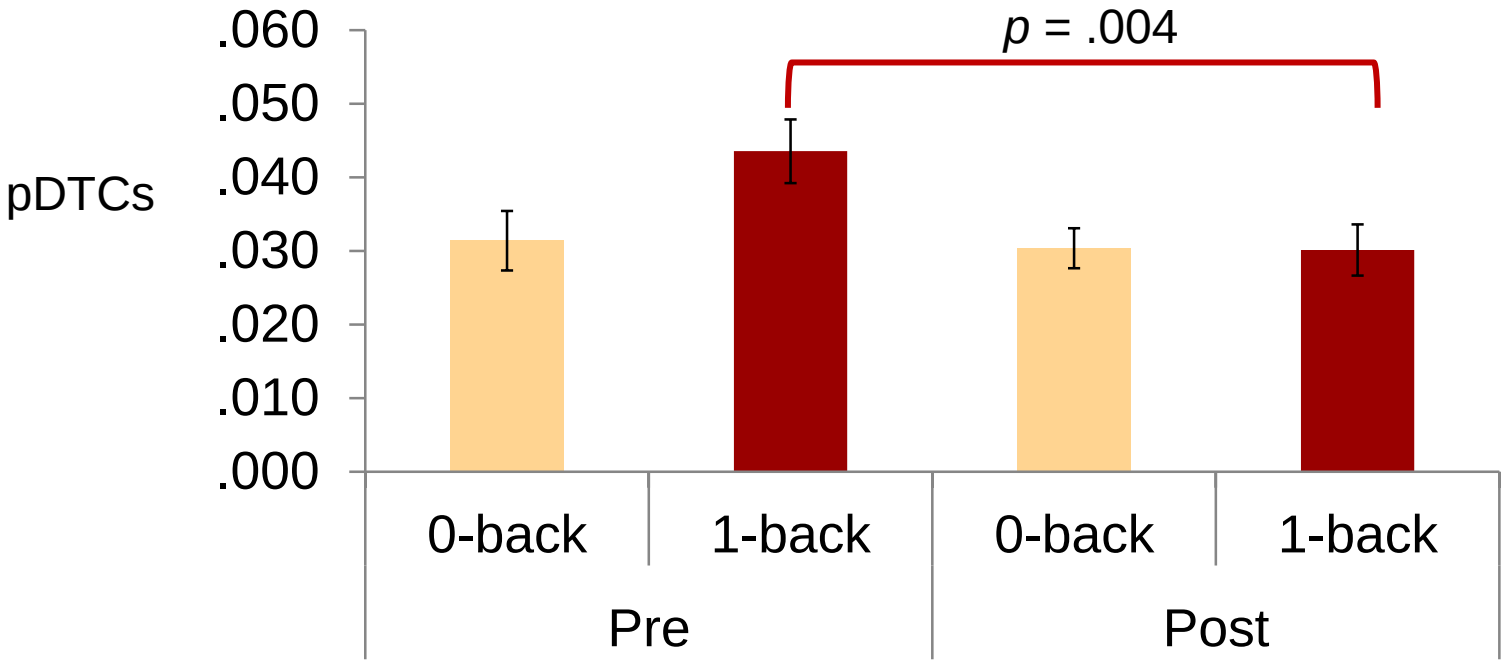


Cognitive training manipulation check



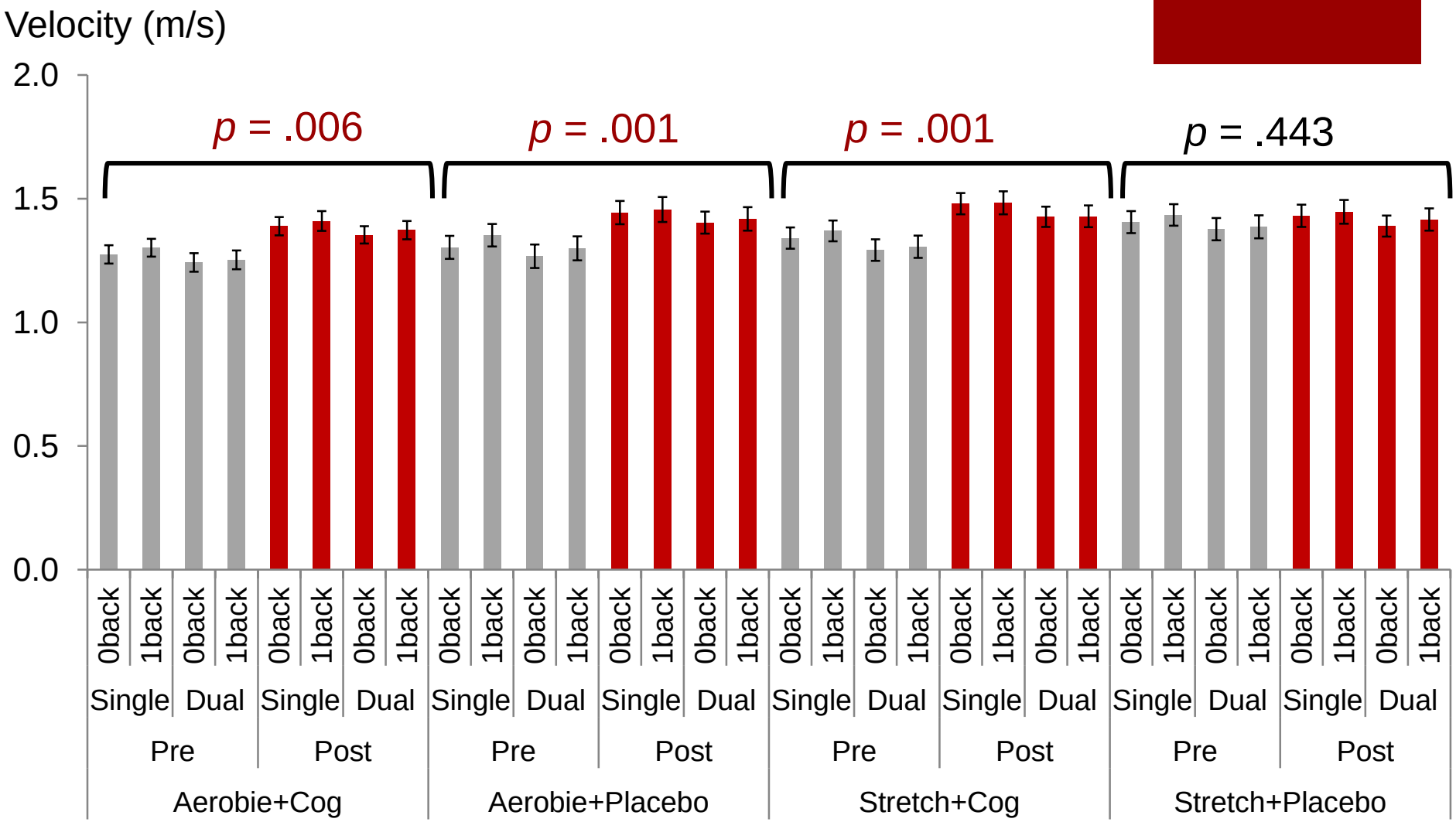
Results:
Dual-task costs in walking

- Gait velocity pDTC
  - Time (p = .032): Pre > Post
  - Difficulty (p = .022): 0back < 1back
  - Time x Difficulty (p = .016)

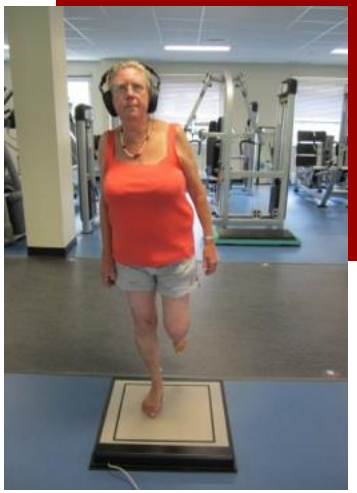


Results:

Treatment-specific gains



Results: Dual-task balance



- Reduced sample
  - Aerobic + Cognitive = 16; Aerobic + Internet = 12
  - Stretch + Cognitive = 17; Stretch + Internet = 12

MEASURE	PRE	POST	p-value
Peak ML (cm)	11.42 (.98)	9.49 (.92)	0.033*
SD ML (cm)	2.31 (.21)	1.79 (.20)	0.007*
RMS ML (cm^2)	24.66 (.90)	23.46 (.93)	0.166
Velocity ML (m/s)	4.47 (.34)	4.03 (.29)	0.119

Intervention:
Cognitive considerations

- Type of cognitive training protocol
  - Adaptive cognitive intervention with motivational feedback
  - Process-oriented training focusing on executive functions
- Cognitive outcome measures
  - In some studies, global cognitive measures improve with training but other studies show process-based improvements (speed, EF) and not global improvements (NB: sensitivity of MMSE vs. computerized assessment)
  - Near transfer is more common in older adults than far transfer

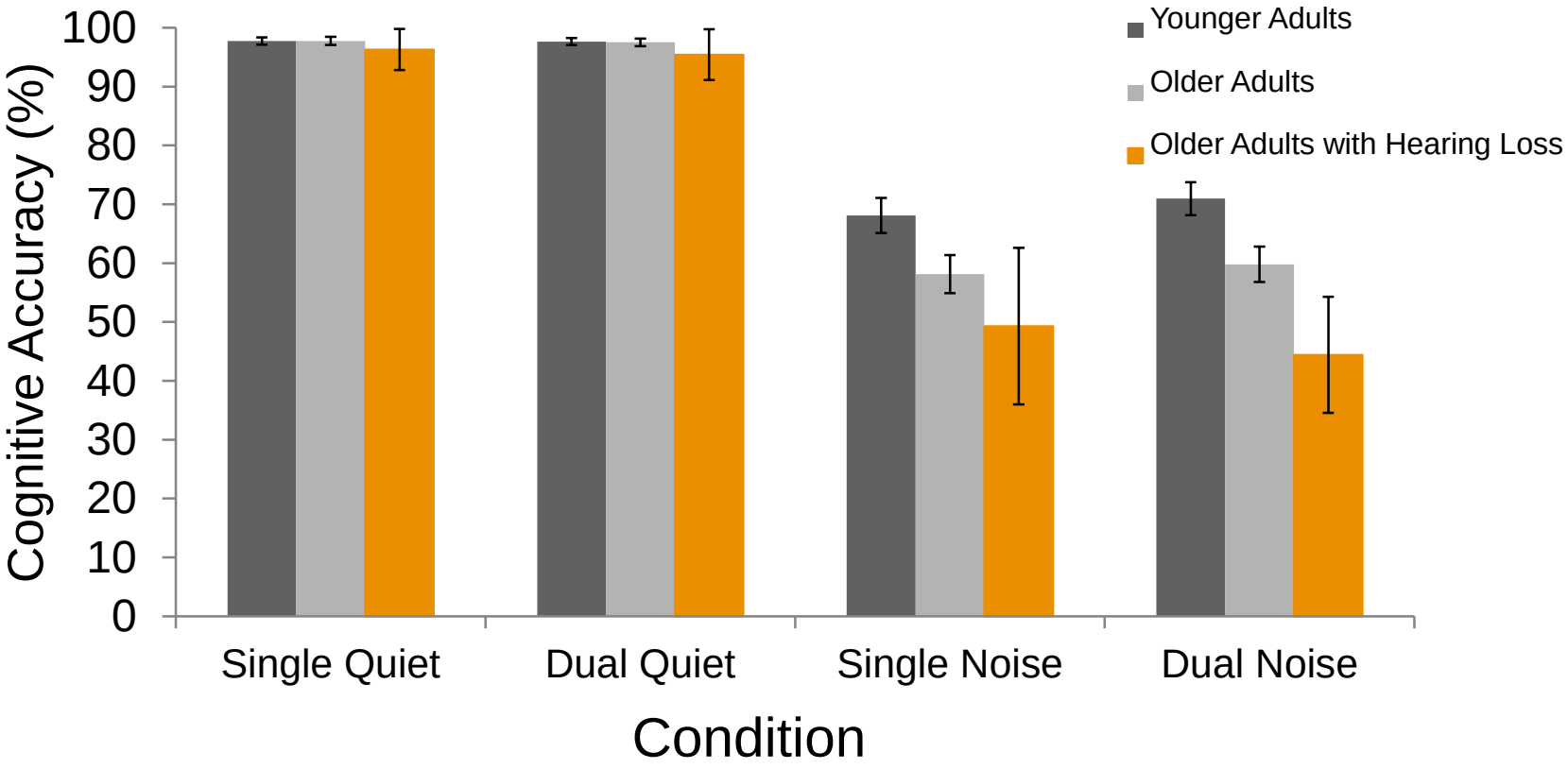
Additional Considerations

Moderators of cognitive capacity?

Hearing and mobility

- Of older Canadians reporting hearing difficulty, 65% also report mobility problems (Statistics Canada, 2006)
- 1.4 times greater likelihood of falling per 10 dB of hearing loss (Lin & Ferrucci, 2012)
- Over 3 years, hearing impaired seniors showed greater falls incidence and slower walking (Viljanen et al., 2009a,b)
- Cognitive compensation may underlie comorbid hearing and mobility decline

Standing balance with simulated and actual hearing loss



Bruce, Asare, Aponte, St. Onge, & Li, 2014)

Baer, L.H., Tabri, N., Blair, M., Bye, D., Li. K.Z.H., & Pushkar, D. (2013). Longitudinal associations of need for cognition, cognitive activity, and depressive symptomatology with cognitive function in recent retirees. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 68(5)*, 655–664, doi:10.1093/geronb/gbs112. Advance Access publication December 3, 2012

Longitudinal Associations of Need for Cognition, Cognitive Activity, and Depressive Symptomatology With Cognitive Function in Recent Retirees

Lawrence H. Baer, Nassim Tabri, Mervin Blair, Dorothea Bye, Karen Z. H. Li, and Dolores Pushkar

Centre for Research in Human Development and Department of Psychology, Concordia University, Montréal, Québec, Canada.

- *Need for Cognition*: Enjoyment of cognitively effortful activity (Cacioppo & Petty, 1982)
- 333 community-dwelling seniors, tested annually for 5 years
- Predictors of cognitive status (MoCA)
  - Variety of leisure activities (+)
  - Depressive symptomatology - CESD (-)
- Predictor of cognitive (MoCA) change / maintenance over 12 months
  - Need for Cognition (+)

Summary

- Choice of cognitive measures for assessment and training outcome should focus on different facets of EF and other cognitive abilities that may engage compensatory scaffolding
- Do not expect strong transfer to other cognitive abilities from cognitive training (cf. exercise training)
- Consider individual differences in motivation and sensory abilities

Thank you for your attention!