Age-Related Differences in Transient and Sustained Cognitive Control:
Conflict Adaptation and Proportionality Effects in a Spatial Stroop Task

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INTRODUCTION

- **Conflict monitoring theory** posits that detection of conflict involving task-irrelevant information (e.g., Stroop or flanker interference) engages ***conflict adaptation*** (CA), a trial-to-trial preparation for future conflict (Botvinick et al., 2001).
- CA involves the dorsolateral PFC (Liu et al., 2004), an area susceptible to decline in older adulthood (Braver & Barch, 2002), suggesting potential age-related differences in CA.
- The present study assessed young and older adults' ability to engage in CA under two conditions of **sustained cognitive control** demands (*high* or *low* proportions of conflict trials).
- We computed Stroop ***interference effects*** (RT to incongruent trials - RT to incongruent trials), with the expectation that high conflict proportionality encourages sustained adaptation (i.e., smaller interference effects) compared with low conflict proportionality.
- We compared interference effects immediately following *conflict* and *non-conflict* trials. **Prior conflict** should engage transient adaptation (i.e., CA), reducing interference effects.
- Due to concerns that repetition priming across successive trials can bias estimation of CA (Mayr, Awh, & Laurey, 2003; Notebaert et al., 2006), we performed separate analyses of 2-trial sequences in which distractors/targets do or do not repeat.

Hypotheses: Older adults will demonstrate deficits in both (a) sustained cognitive control and (b) transient cognitive control (i.e., CA) relative to young adults.

Tasks

- Manual response spatial Stroop task was used with 3-color target patches and distractor words (Red, Green, Blue)
- **2 Trial Sequence Types:**
  - **Alternation Sequences:** neither target nor distractor repeats
  - **Repetition Sequences:** target and/or distractor repeats
- **Example Stimuli**: Overlapping vs. Separated Distractors
  - Overlapping: Incongruent = GREEN (GREEN) Congruent= RED (RED)
  - Separated: Incongruent = (GREEN) Congruent= (RED)

Analysis

Because age effects in Stroop tasks reflect, in part, general slowing (Verhaeghen, 2011), we used a z-score transform of RT data (Faust et al., 1999).

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Figure 1

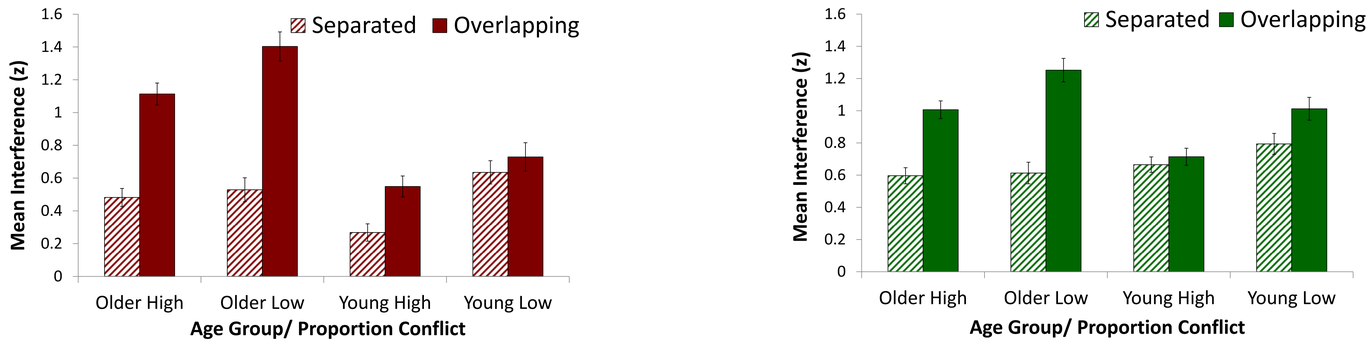
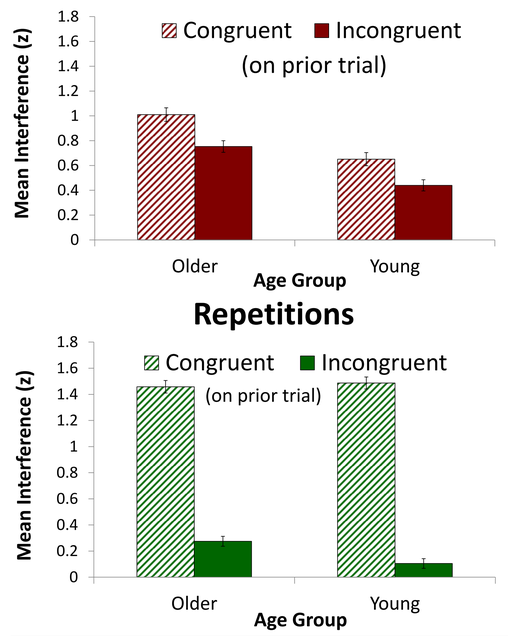


Figure 2



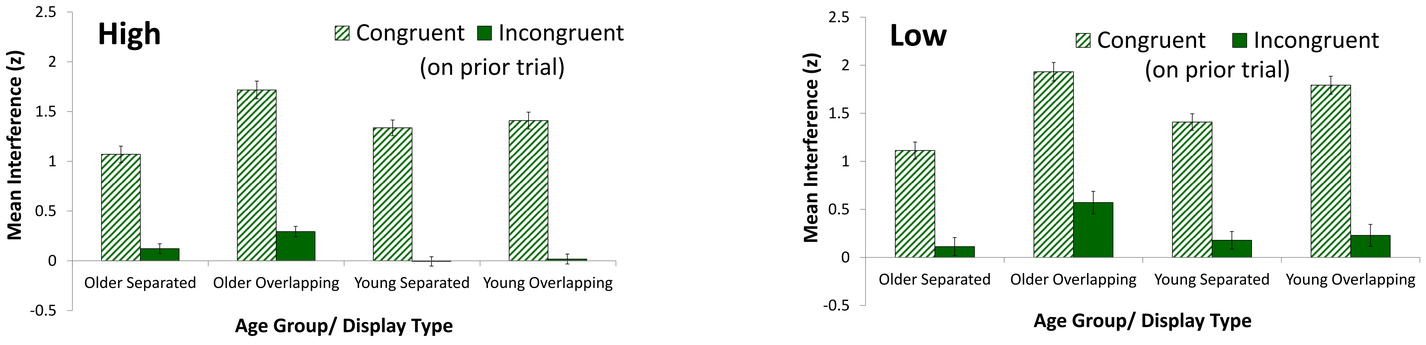
PARTICIPANTS

- **High Proportion Conflict** — **Old**: *n* = 64, *M* = 70.7 yrs; **Young**: *n* = 68, *M* = 19.5 yrs
- **Low Proportion Conflict** — **Old**: *n* = 36, *M* = 69.2 yrs; **Young**: *n* = 37, *M* = 20.1 yrs

RESULTS

- Age x Proportion Conflict x Display interaction significant for **alternations**, $p = .01$, but not **repetitions**, $p = .72$ (see **Figure 1**)
- Age x Prior Type interaction significant for **repetitions**, $p = .02$, but not for **alternations**, $p = .59$ (see **Figure 2**)
- For **repetitions**, we observed an Age x Display x Prior Type interaction for high proportionality, $p = .01$, but not for low proportionality, $p = .92$ (see **Figure 3**)

Figure 3 – Repetitions Only



DISCUSSION

- There were age-related deficits in both **sustained** (Figures 1 & 3) and **transient** cognitive control (Figures 2 & 3).
- There was an age-related increase in the effect of varying distractor location (separated, overlapping) that was modulated by **sustained control** (i.e., proportion conflict trials) for alternation sequences only (Figure 1).
- By contrast, there was an age-related decline in **transient control** for repetition sequences only (Figure 2).
- There was an age-related change in the **interaction of sustained and transient control** in the repetition sequences of the high-proportion conflict condition (Figure 3).
- The present study documents **age-related changes in adaptive cognitive control** of Stroop interference in a dynamically changing environment (after controlling for age-related slowing).