Dynamic Cognitive Control of Conflict from Task-irrelevant Information:
Evidence from Sequential Stroop and Flanker Tasks

UNCCHARLOTTE

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INTRODUCTION

- Mechanisms of cognitive control play an important role in the modulation of selective attention during inhibition of task-irrelevant information (Faust & Balota, 2007; Gernsbacher & Faust, 1991; Hasher, Zacks, & May, 1999).

- The Stroop color naming task (MacLeod, 1991) and the Eriksen flanker task (Eriksen & Eriksen, 1974) provide opportunities for study of the control of inhibitory processes in that both tasks require one to ignore potentially conflicting information (i.e., identity of a color name or flanker item).
  - Stroop stimuli: Conflict=GREEN, Congruent=GREEN.
  - Flanker stimuli: Conflict=HHEHH, Congruent=EEEEE.
  - **Interference Effect**= Conflict RT – Congruent RT.

- One idea is that cognitive control is initiated in a top-down manner upon detection of conflict (e.g., Botvinick, Braver, Barch, Carter, & Cohen, 2001)., and that *interference effects will be reduced following a conflict trial due to a resetting of selective attention* (Interference Modulation).

- However, interference modulation is also predicted by a bottom-up control view that stimulus-driven memory binding processes work in a bottom-up manner matching the preceding conflict stimulus with the following stimulus (e.g., Mayr, Awh, & Laurey, 2003).

- Notebaert et al. (2006) manipulated **RSI** (50 ms vs. 200 ms) and the amount of item repetition across successive trials.
  - **Easy Trial Sequence:** Target and/or distractor repeats.
  - **Difficult Trial Sequence:** Target and distractor change.

- They found bottom-up control for **easy repetition sequences** and top-down control for **difficult alternation sequences**.
  - **Bottom-Up:** Interference modulated at **short and long delays**.
  - **Top-Down:** Interference modulated at **long delay only**.

Present Study

1. Will the top-down/bottom-up pattern replicate?
2. Does the top-down/bottom-up pattern of cognitive control generalize to the Flanker task?
3. If not, will the top-down/bottom-up pattern emerge in the Flanker task when the to-be-ignored information (i.e., color names) is the same as in the Stroop task?
4. Will changing the control demands of the Stroop task (e.g., reducing proportion conflict trials) change the pattern of control?

METHOD

Stroop Task
- 3 colors & 3 color names (Red, Green, Blue), button-press response to indicate color, 50 ms or 200 ms (250 ms, Figure 5) RSI, blocked by RSI.

Flanker Task
- Letter Version: 3 letters used (T, H, E), target letter in center with 2 flakers on each side, button-press response to center letter, analog to Stroop task, 50 ms or 200 ms RSI, blocked by RSI.
- Color Name Version: Same as letter version, but with Stroop color names (Red, Green, Blue), presented in black font, single flanker word above and below target word.

RESULTS

Figure 1: Bottom-up control pattern for easy trial sequence, top-down for difficult trial sequence.

Figure 2: Bottom-up/top-down pattern replicated.

Figures 3 & 4: Failure of top-down pattern to emerge for difficult sequences in the Flanker task.

Figure 5: A unique control pattern emerges for difficult sequences in the Stroop task when the proportion of conflict trials is reduced.

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Figure 1: Notebaert et al. (2006) Pattern (67/33 Congruency)
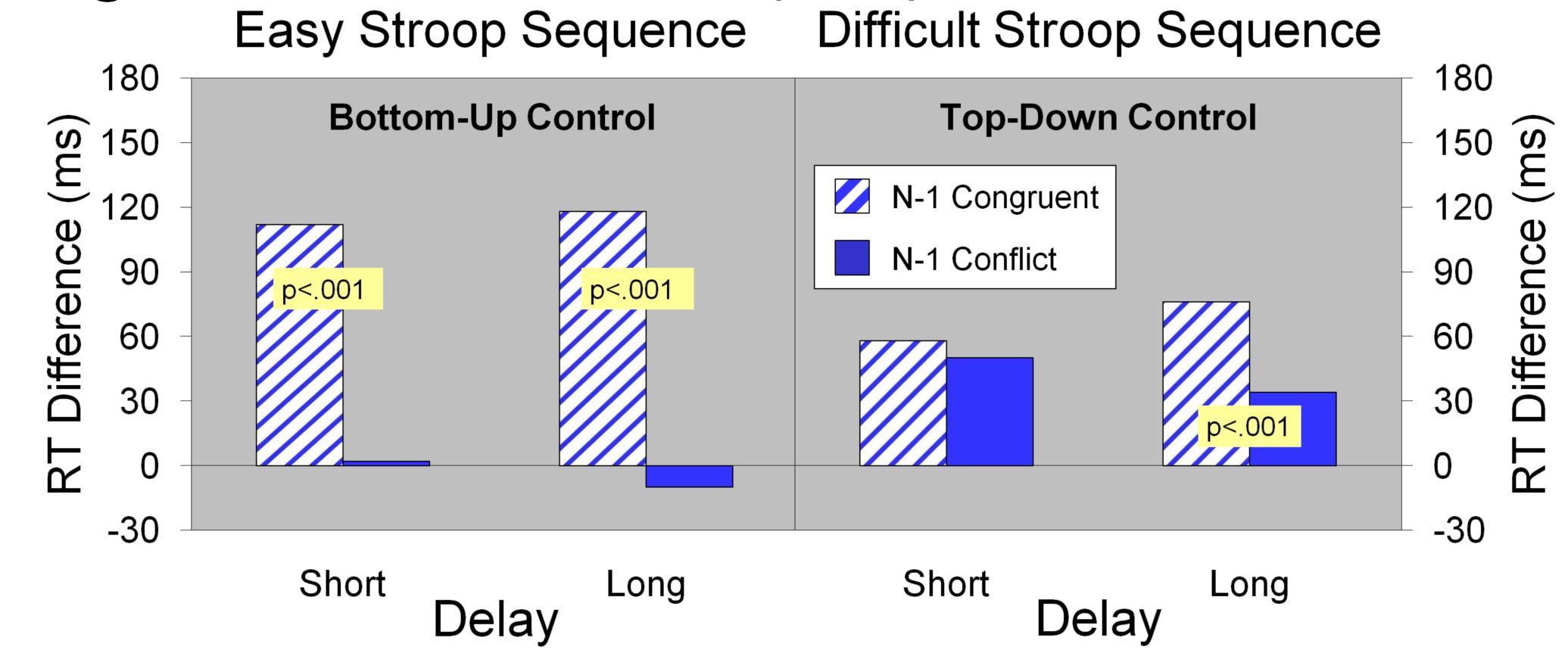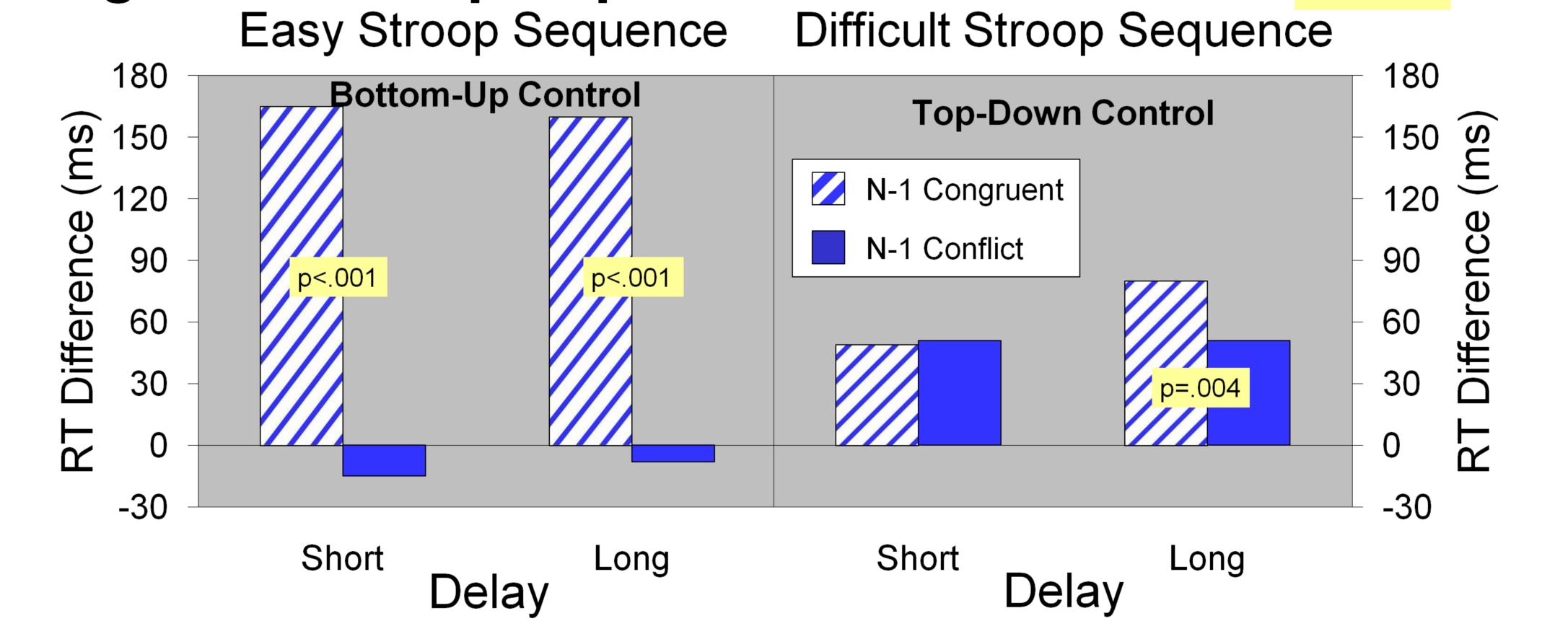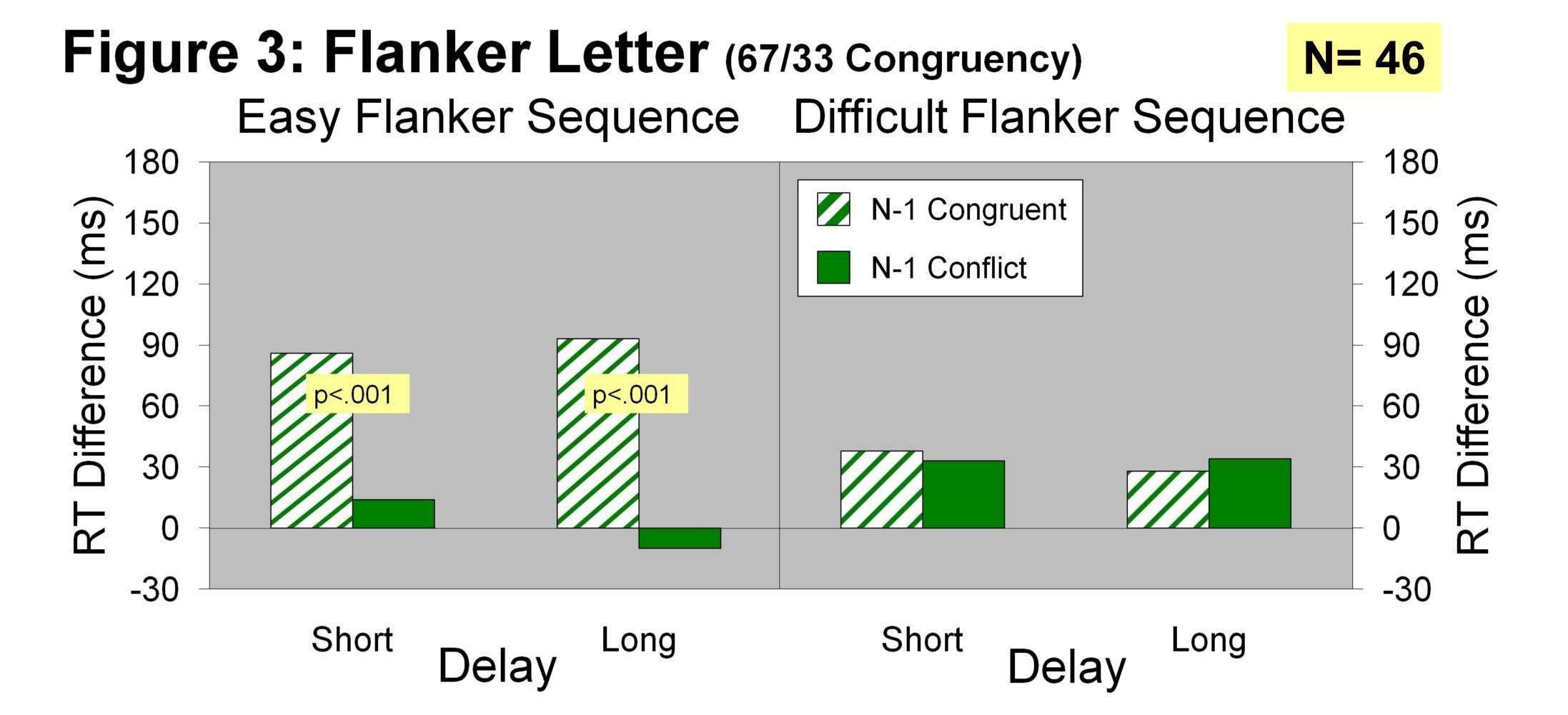
Figure 2: Stroop Replication (67/33 Congruency)   N= 55

Figure 3: Flanker Letter (67/33 Congruency)   N= 46

Figure 4: Flanker Color Name (67/33 Congruency)   N= 43

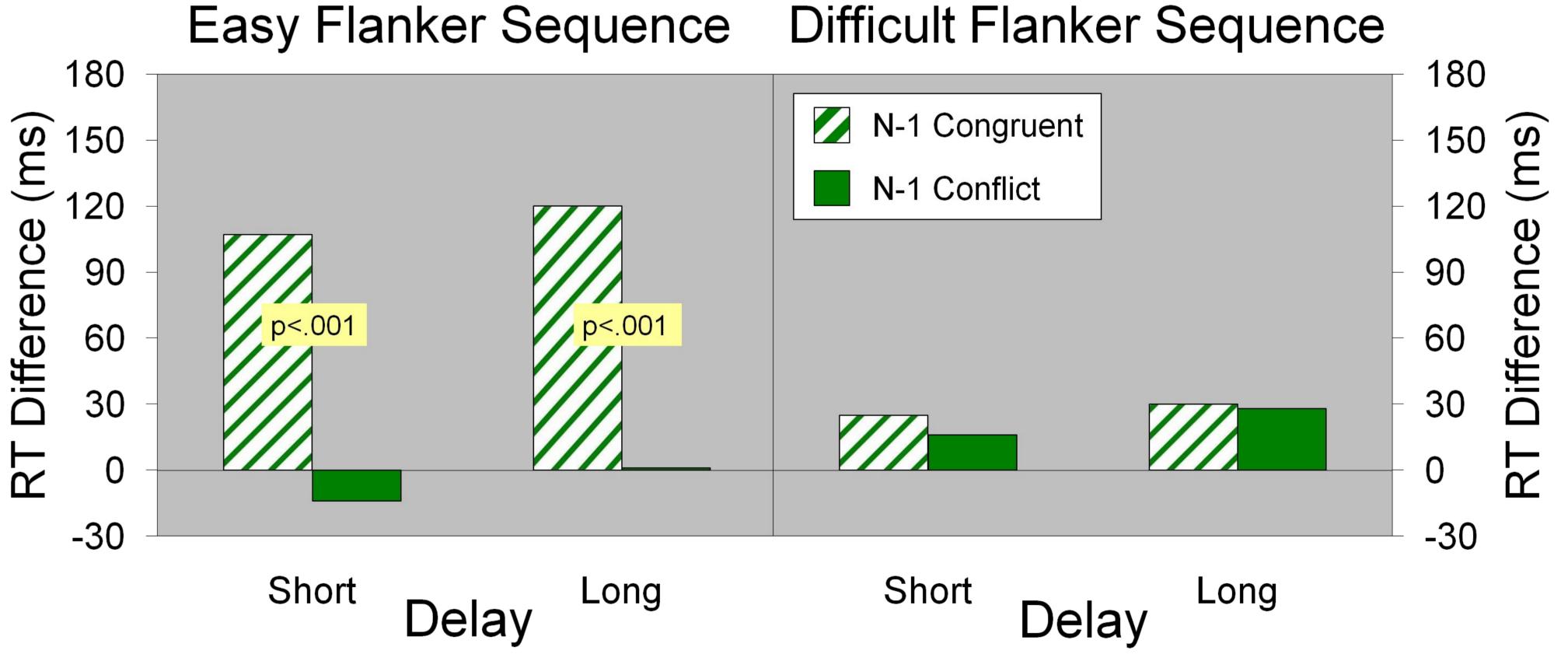### Figure 5: 50/50 Congruency Stroop   N= 53

DISCUSSION

1. The present results support both bottom-up & top-down accounts of control over to-be-ignored information in the Stroop & Flanker tasks.

2. A clear bottom-up control pattern for easy trial sequences was observed across all versions of both tasks.

3. The Notebaert et al. (2006) finding of top-down control of difficult sequences in a high proportion conflict version of the Stroop task was replicated.

4. But, the failure to find a top-down control pattern in the Flanker task, and the unique control pattern observed for the low proportion conflict trial version of the Stroop task, indicate that the emergence of top-down control is not universal and is sensitive to control demands and processing constraints of the task.

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