



# Resolving Interference One Component At A Time:

## Dissociation Between N2 and N450 in a Modified Continuous Performance Task

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### Background

The limited-capacity nature of attention makes it vital to withstand and overcome the interference caused by distracting perceptual inputs and inappropriate response tendencies. Psychophysiological research has identified two event-related potentials generated by frontal cortices that relate to the implementation of this cognitive control:

- The N2 is a fronto-central negativity (peaking between 200-350 ms) observed in tasks requiring strategic monitoring.<sup>1</sup>
- The N450 is a fronto-central negativity (peaking between 350-500 ms) observed during incongruent Stroop trials,<sup>2</sup> and proactive interference trials during memory tasks.<sup>3</sup>

### Present Study

We created a continuous performance task<sup>4</sup> using Stroop stimuli that required participants to discriminate frequent congruent colour-words from three different types of infrequent stimuli each requiring the evaluation of different context contingencies:

- incongruent colour-words (feature contingency)
- a predefined congruent colour-word (memory contingency)
- consecutive congruent colour-words (repetition contingency)

**Research Question: What are the cortical responses associated with the implementation of cognitive control across the various task contingencies (i.e., do they elicit N2 or N450 responses?)**

### Methods

#### Participants

- 15 healthy young adults (12 female; Mean age 20.9 yrs, sd = 2.0)
- Screened for medical, psychiatric, and neurological conditions

#### Procedure

- Participants completed 3 versions of a forced-choice continuous performance task that used colour-word Stroop stimuli (see Tasks)
- **Stroop:** Press "Accept" for congruents; "Reject" for incongruents.
- **Repeat:** As for Stroop but also "Reject" repeated congruents
- **Memory:** As for Stroop but also "Reject" predefined congruents

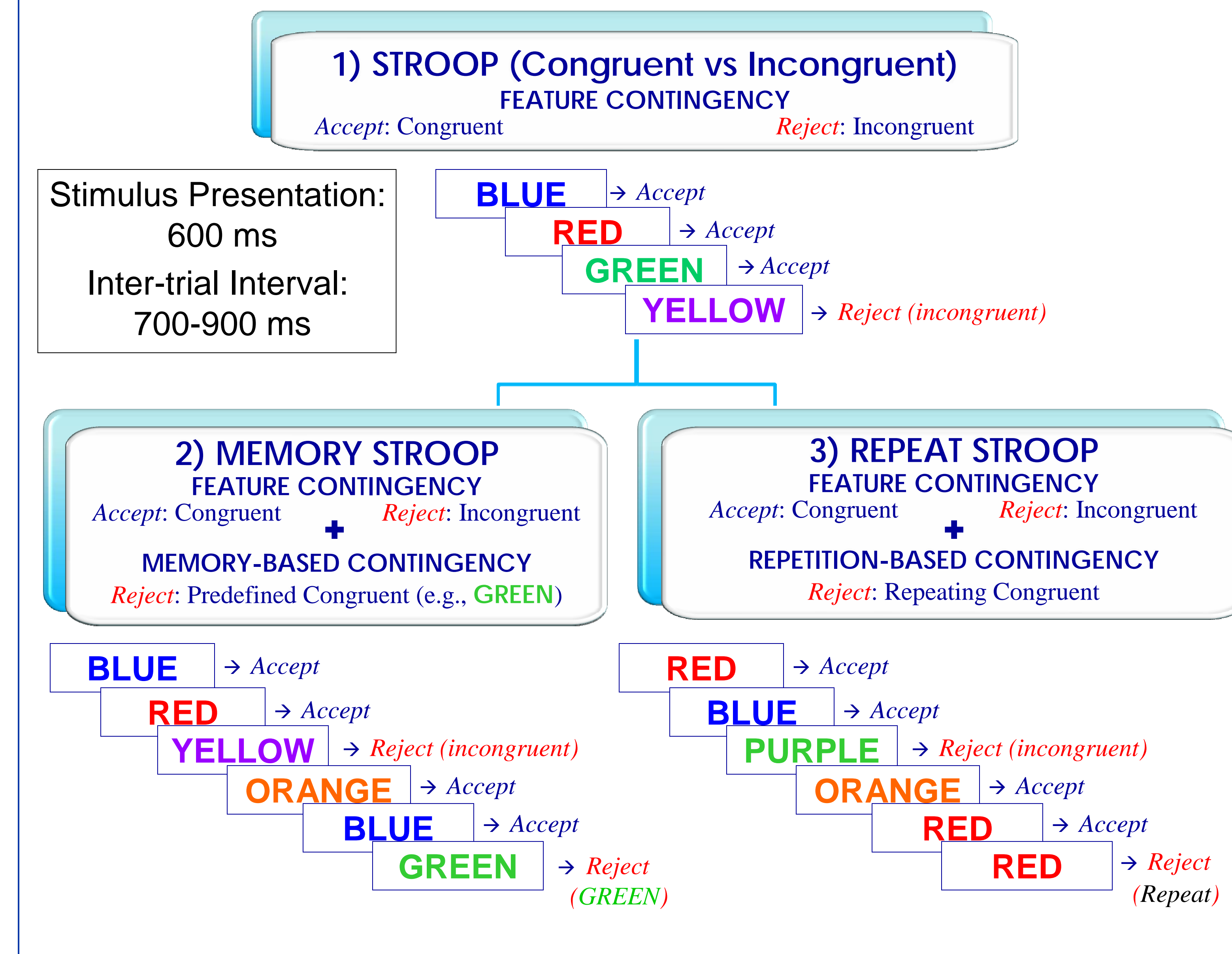
Each of the 3 versions had 450 trials (50 practice + 400 test) and were counterbalanced across participants

- 80% of trials required an "accept" response & 20% a "reject" response

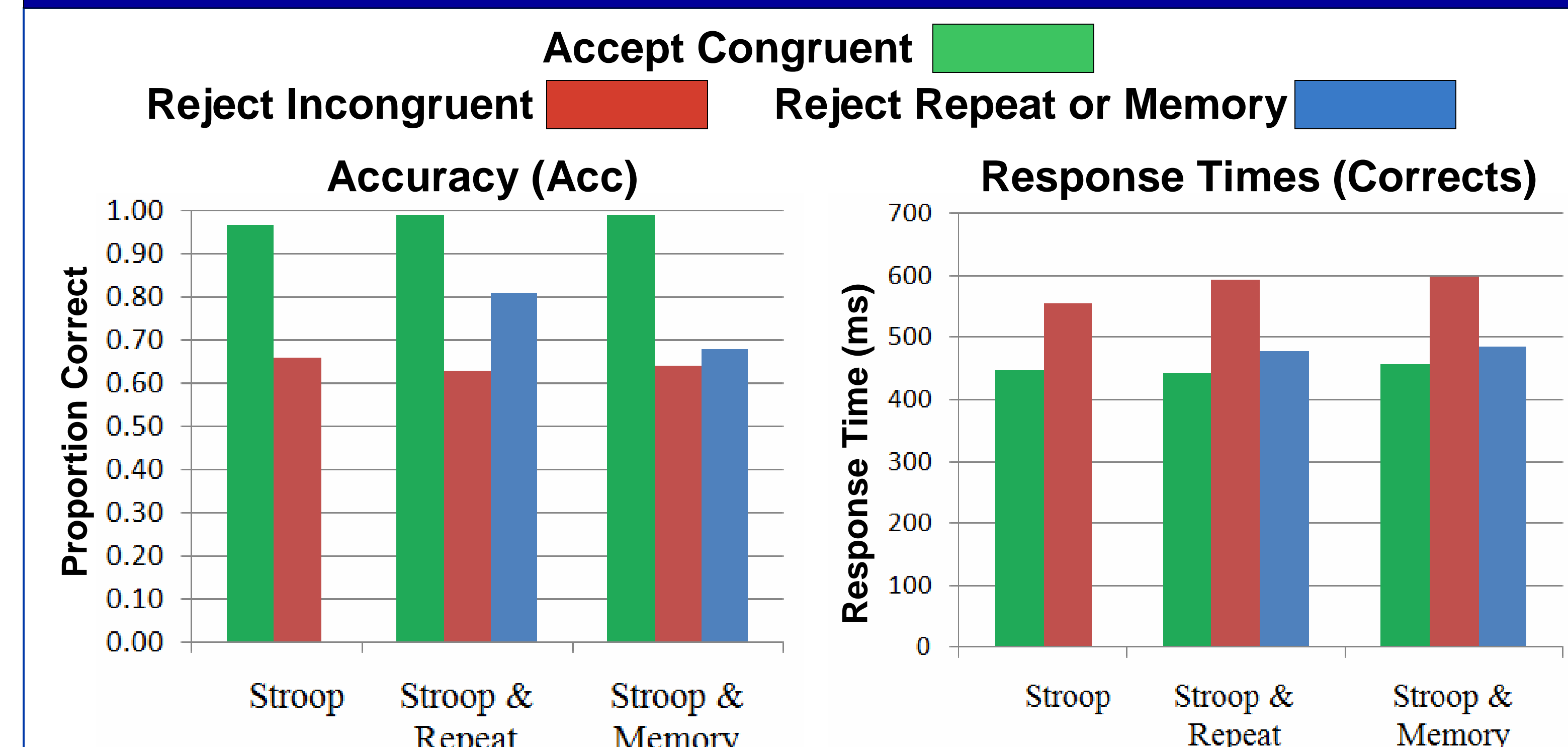
#### EEG Recordings

- 128 Channel Biosemi Cap
- Bipolar eye-regression
- Correct trials only
- 30 Hz low-Pass Filter
- ERPs presented with average reference

### Tasks



### Behavioural Results



#### 2 Condition (Congruent vs Incongruent) x 3 Tasks ANOVAs:

Acc: Condition Effect  $F(1, 14) = 171.82, p < .001$   
 Cong Acc > Incong Acc

RT: Cond x Task Int.,  $F(2, 28) = 15.96, p < .001$   
 Stroop Effect increase by adding Repeat/Memory

#### 3 Condition (Congruent vs Incongruent vs Special) x 2 Tasks ANOVAs:

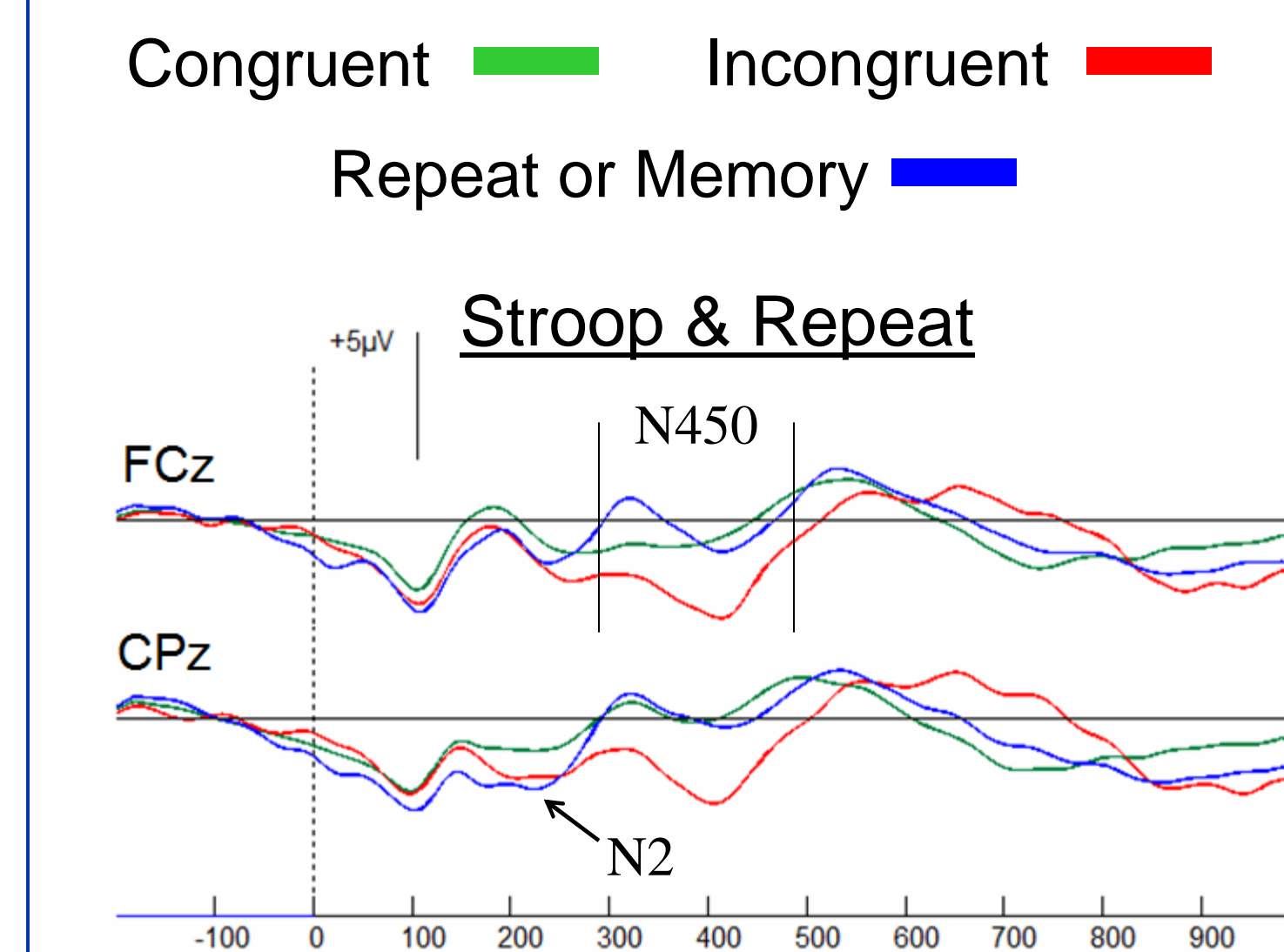
Acc: Cond x Task Int.,  $F(2, 28) = 7.30, p < .01$   
 Repeat > Incong Acc; Memory=Incong Acc

RT: Condition Effect,  $F(2,28)=215.63, p < .001$   
 Incong RT > Repeat or Memory RT > Cong RT

### ERP Results

**ERP Measures**

- The N2 was measured as the average area at site CPz from 200-300 ms after stimulus presentation
- The N450 was measured as the average amplitude at site FCz from 300-500 ms after stimulus presentation



**Congruents vs Incongruent = N450 Effect**  
 -Larger N450s for incongruents than congruents in all three tasks,  $F(1,14) = 37.69, p < .001$

**Congruents vs Repeat/Memory = N2 Effect**  
 -Larger N2s were found for both Repeat trials ( $p < .05$ ) and Memory trials ( $p < .01$ ) vs. congruents.  
 -Incongruent trials during the Repeat task showed a trend that was not significant ( $p = .12$ ).

### Discussion

- Behavioural data indicate that it is more difficult to identify incongruent colour-words than to identify the repetition of congruents (Repeat Condition) or a single predefined congruent (Memory Condition)
- Type of task contingency was an important determinant of cortical response to interference (N2 vs N450)
- This distinction likely reflects temporally dissociable cognitive control processes:
  - To-be-rejected items that are easily identified (Repeat or Memory lures) elicit an early N2 response, which may reflect a fast-acting, frontally mediated monitoring function that relies on up-regulation of attention<sup>1</sup>
  - To-be-rejected items that require attending to low-salience stimulus features (font colour vs word identity) elicit an N450, recently suggested to reflect a combination of response control and interference resolution<sup>5</sup>
- Together, these data show that different stimulus contingencies, even when existing within the same task, place distinct demands on behaviour and require dissociable forms of cognitive control

### References

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