

Background

Attentional control involves:

- The early discrimination of targets from non-targets¹
- The suppression of lure items in working memory (context-based interference resolution)²
- The withholding of prepotent response tendencies (response-based interference resolution)²

Separate studies have indicated that neural responses associated with target discrimination¹ and interference resolution^{3,4} are attenuated in older adults accompanied by decreases in behavioural performance.

Purpose

In order to determine which aspects of attentional control are most affected in older adults, we investigated changes in the magnitude and time-course of neural response to both targetness discrimination and interference resolution.

Method

Participants

16 Young Adults	18 Older Adults
10 Female	12 Female
Mean Age 20 (sd 1.9)	Mean Age 74 (sd 7.9)

Sternberg Design²

Stimuli: b, c, d, f, g, h, j, k, l, m, n, p, q, r, s, t, v, w, x, z

Duration: 45 minutes to complete

360 trials with 2000 ms ITI

Presented in 6 randomized blocks

Target Set	ISI	Probe	Response
1500 ms	2000 ms	1500 ms	
q v s k		S	“Positive”

Task Manipulations

Target Set	Probe	Condition Type
Trial n-2 p c r m	X	
Trial n-1 r b k h	H	
Trial n q v s k	if S	> Positive Response
	if F	> Baseline
	if B	> Familiar
	if R	> Highly Familiar
	if H	> Response Conflict

Electrophysiological Recordings

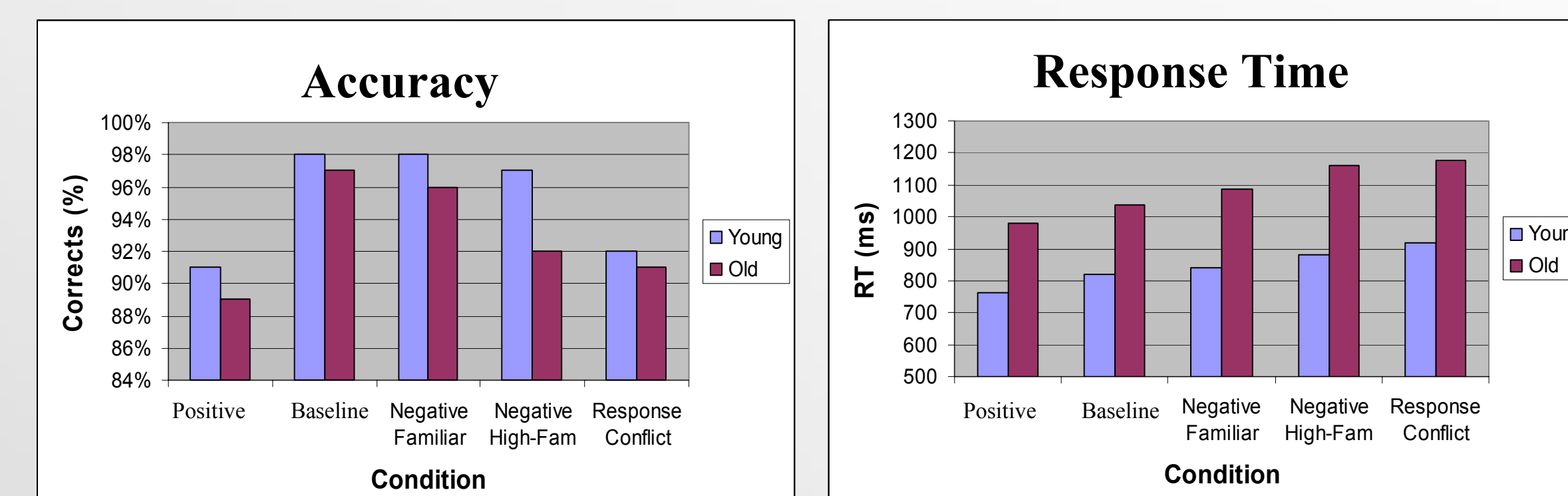
- Recorded using a 256-Channel EGI System at 500 Hz with a vertex reference and impedances < 50 kΩ
- Data were filtered offline at 1 to 30 Hz
- Converted to an average reference
- Blinks corrected with MATLAB regression module

Statistical Analysis

Repeated measures ANOVAs were performed on midline sites for the P200, P3a & P3b, and a cluster of 18 sites around Afz for the N450. Greenhouse-Geisser corrections were made for violations of sphericity

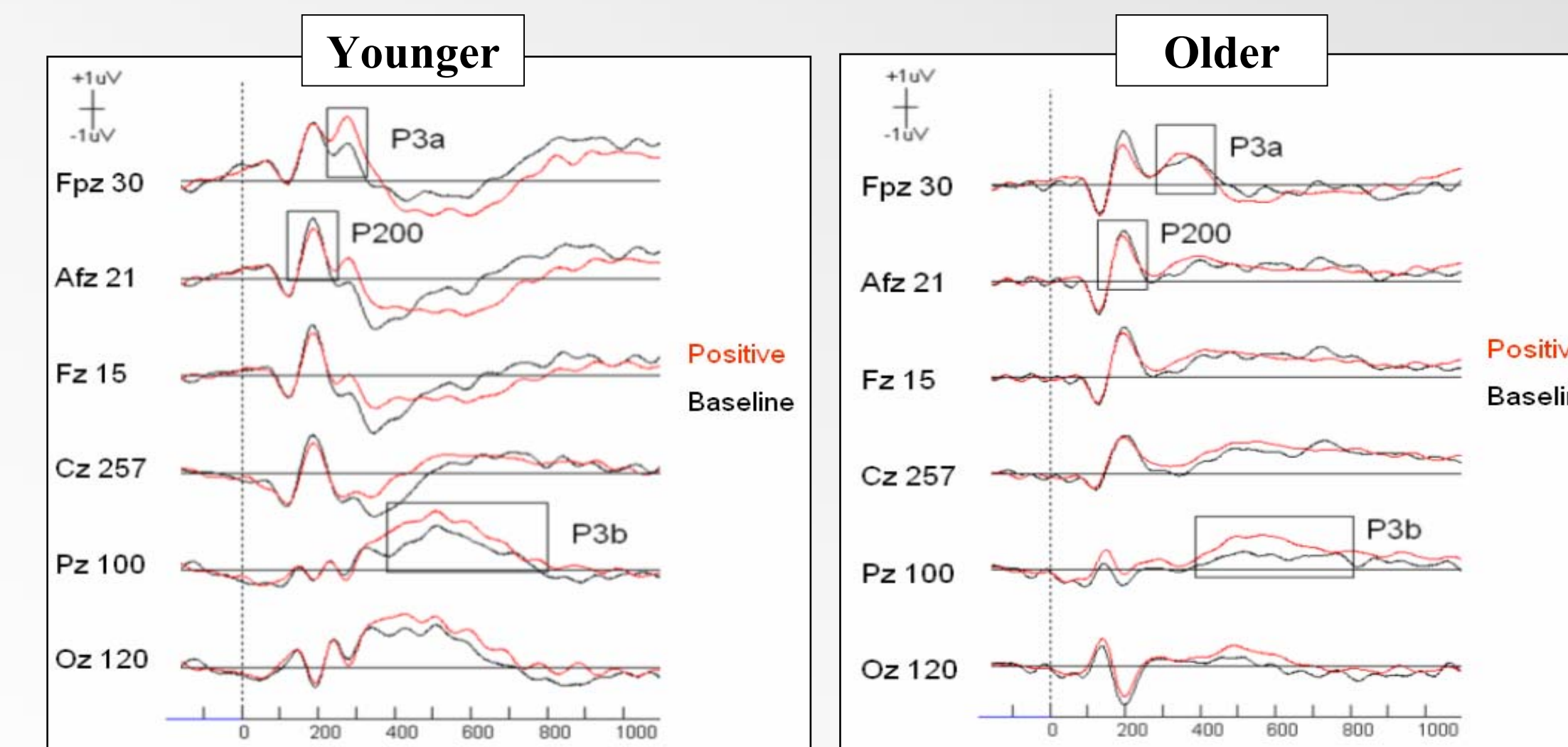
Results

Behavioural Results



Effect	p-value	Effect	p-value
Targetness Effect	p < .001	Targetness Effect	p < .001
Age Effect	p = .052	Age Effect	p < .001
T x A	p = .31	T x A	p = .47

ERP Response to Targetness

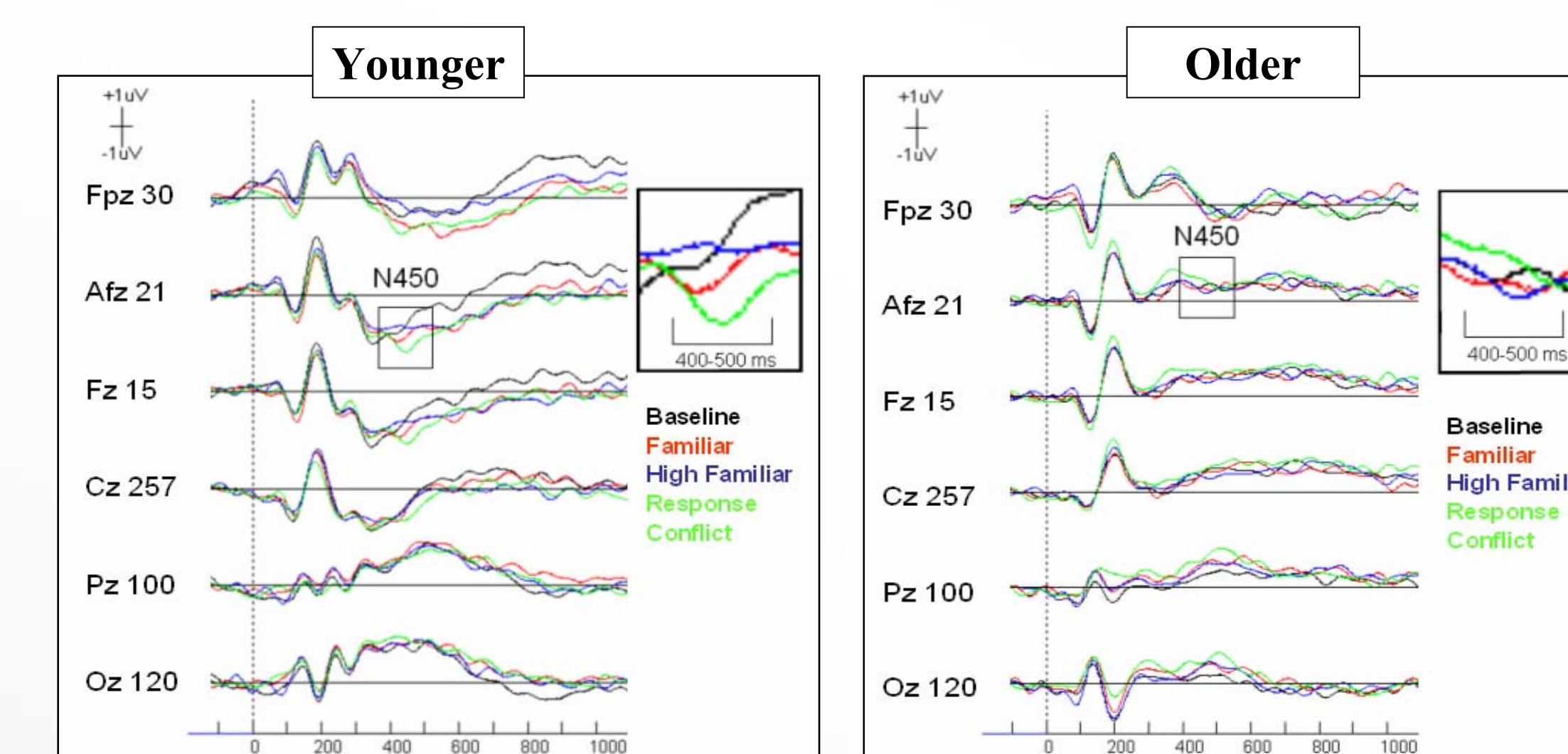


P200 Age x Target Condition p = .31
Targetness p = .36 Age p = .69

P3a *Age x Target Condition p < .05
Younger Targ. p < .01 Older Targ. p = .12

P3b *Age x Target Condition p < .01
Younger Targ. p < .01 Older Targ. p = .17

ERP Response to Conflict

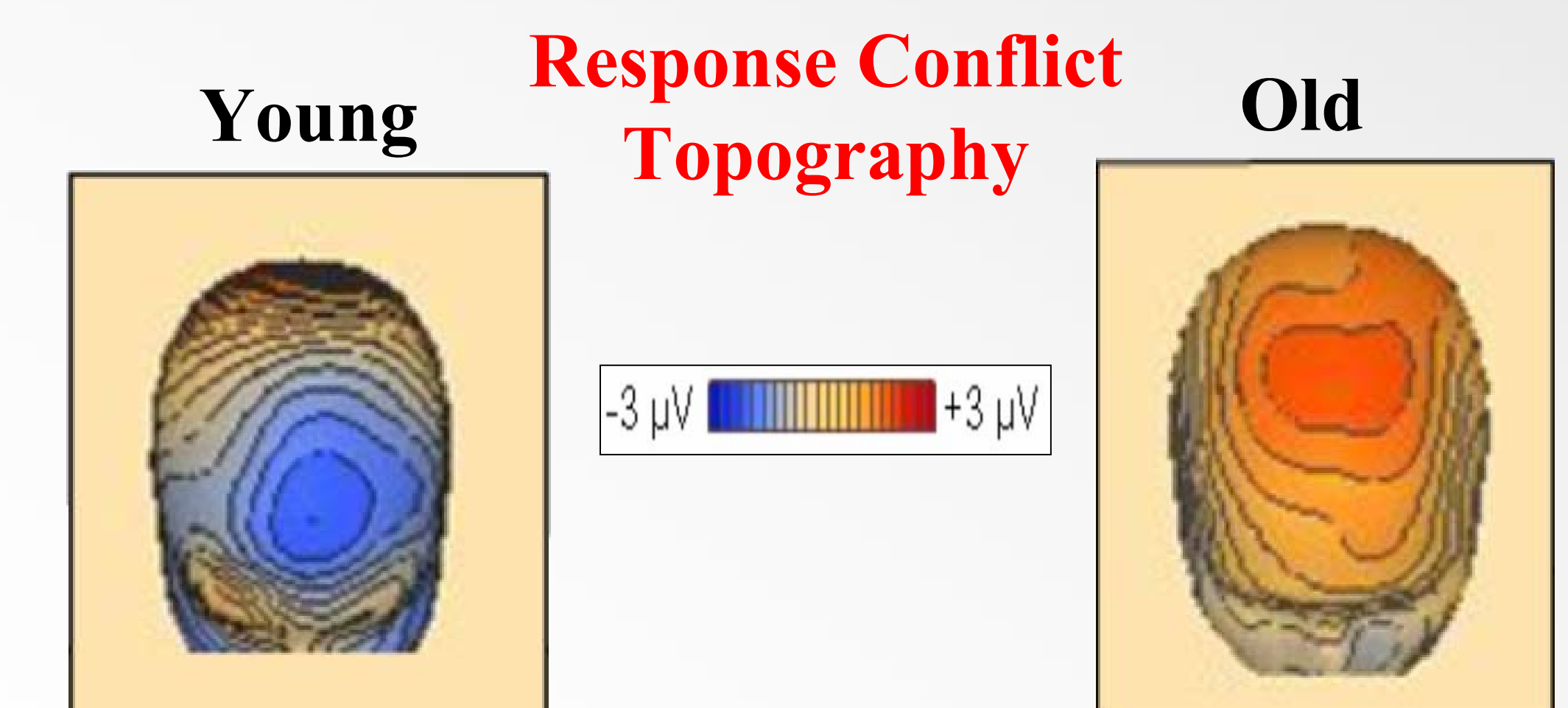


N450 *Age x Conflict Condition p < .05
Younger Conflict p < .02 Older Conflict p = .76

Baseline vs Familiar & Response Conflict

Summary

- The lack of strong interaction effects in accuracy and response time data indicate that both groups were similarly affected by the condition manipulations
- The P3a & P3b data support the notion that younger adults are more efficient at allocating attentional resources to target stimuli and ignoring distracters in comparison to older adults
- The N450 did appear to be related to the type of conflict in context-based and response-based interference conditions.
- Age differences in the N450 support the notion that conflict resolution processes are compromised in older adults. However, nearly equal performance among the age groups suggest that older adults may compensate by recruiting additional/separate brain regions⁵. This may be seen as a diffuse positivity.



References:

- 1 Dywan, J., Segalowitz, S. J. & Arsenault, A. (2002). Electrophysiological Response During Source Memory Decisions in Older and Younger Adults. *Brain & Cognition*, 49(3), 322-340.
- 2 Nelson, K., Reuter-Lorenz, P. A., Sylvester, C.Y. C., Jonides, J. & Smith, E. (2003). Dissociable Neural Mechanisms Underlying Response-Based and Familiarity-Based Conflict in Working Memory. *PNAS*, 100, 11171-11175.
- 3 Jonides, J., Marshuetz, C., Smith, E., Reuter-Lorenz, P. A., Koeppel, R. A. & Hartley, A. (2000). Age Differences in Behaviour and PET Activation Reveal Differences in Interference Resolution in Verbal Working Memory. *Journal of Cognitive Neuroscience*, 12, 188-196.
- 4 West, R. J. (2004b). The Effects of Aging on Controlled Attention and Conflict Processing in the Stroop Task. *Journal of Cognitive Neuroscience*, 16, 103-113.
- 5 Cabeza, R., Daselaar, S. M., Dolcos, F., Prince, E. S., Budde, M. & Nyberg, L. (2004). Task-independent and task-specific age effects on brain activity during working memory, visual attention and episodic retrieval. *Cerebral Cortex*, 14, 364-375.

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