

Introduction

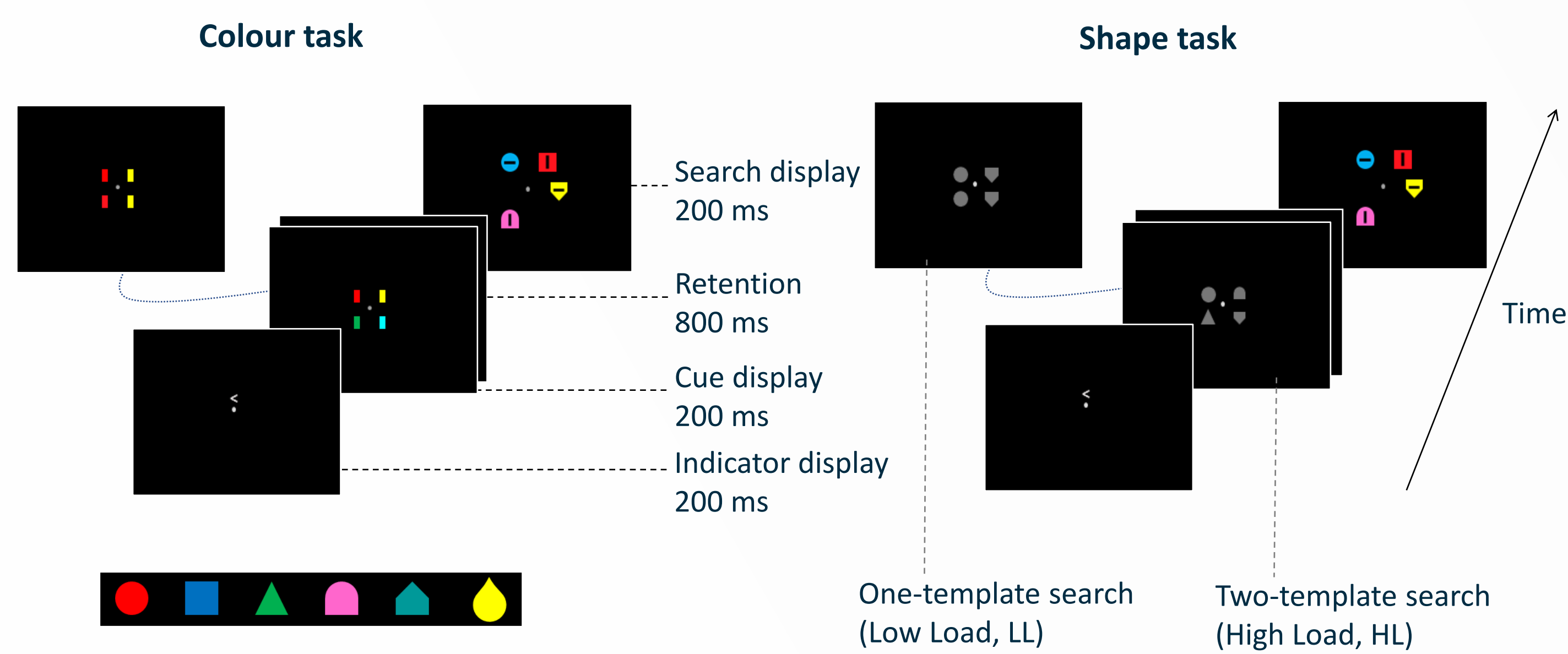
Attentional selection is guided by search templates – representations of target-defining features in working memory [1]. Recent studies, using colour-defined search templates, have observed that **multiple attentional templates can be activated simultaneously to guide attention in parallel** [2-3].

It is unclear whether template co-activation is also true for feature dimensions suggested to have lesser guiding qualities, such as shape [4]. Also, visual search in the real world often involves combinations of multiple feature dimensions, such as colour and shape.

Q1: Can multiple shape templates be activated simultaneously to guide attention, as effectively as colour templates?

Q2: Can multiple conjunction templates be activated simultaneously to guide attention, and are such conjunctive templates feature- or object-based?

Experiment 1



12 participants (♀ 8 ♂ 4)

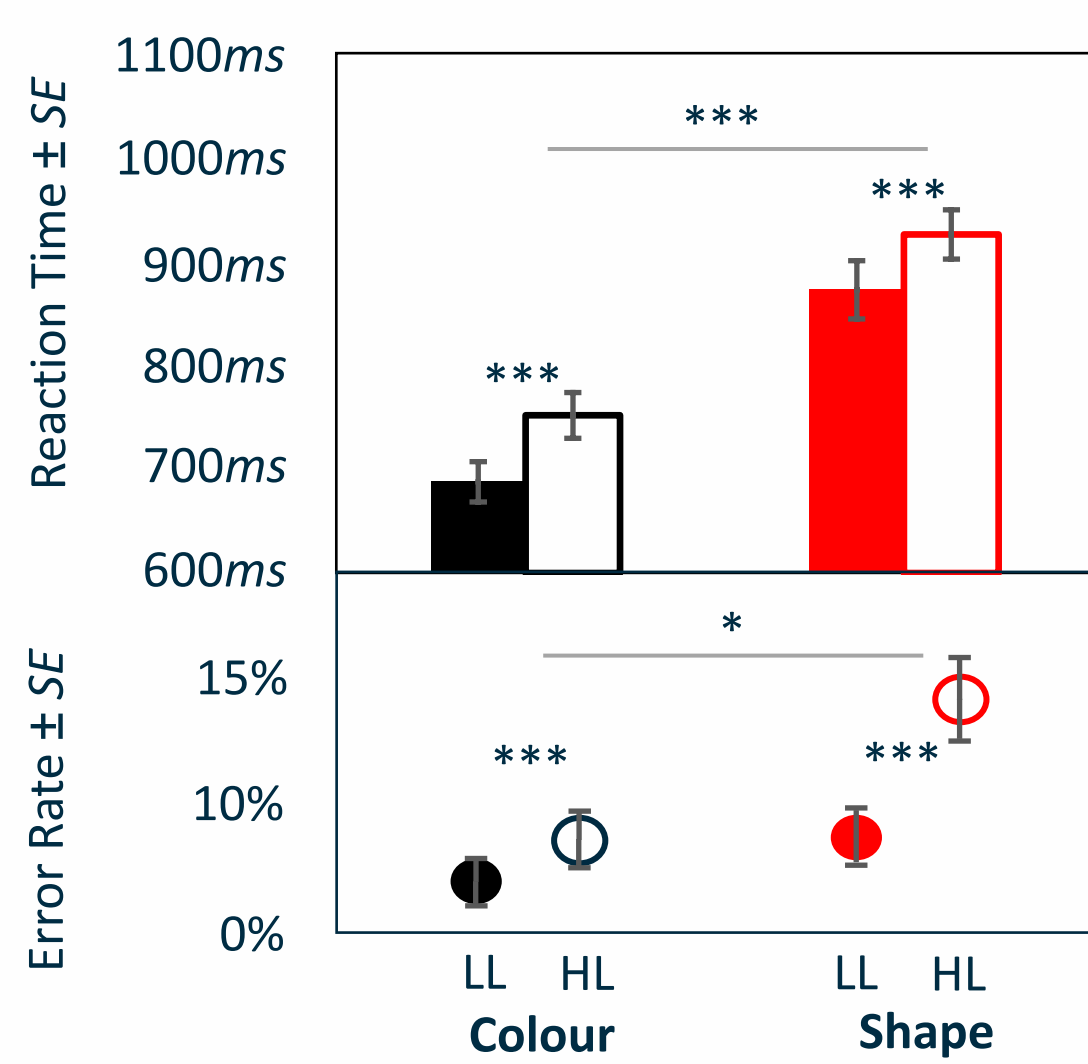
Task: report the orientation (horizontal or vertical) of the line inside the target

Indicator array: indicates the relevant cue side;

Cue array: defines the upcoming target colour(s);

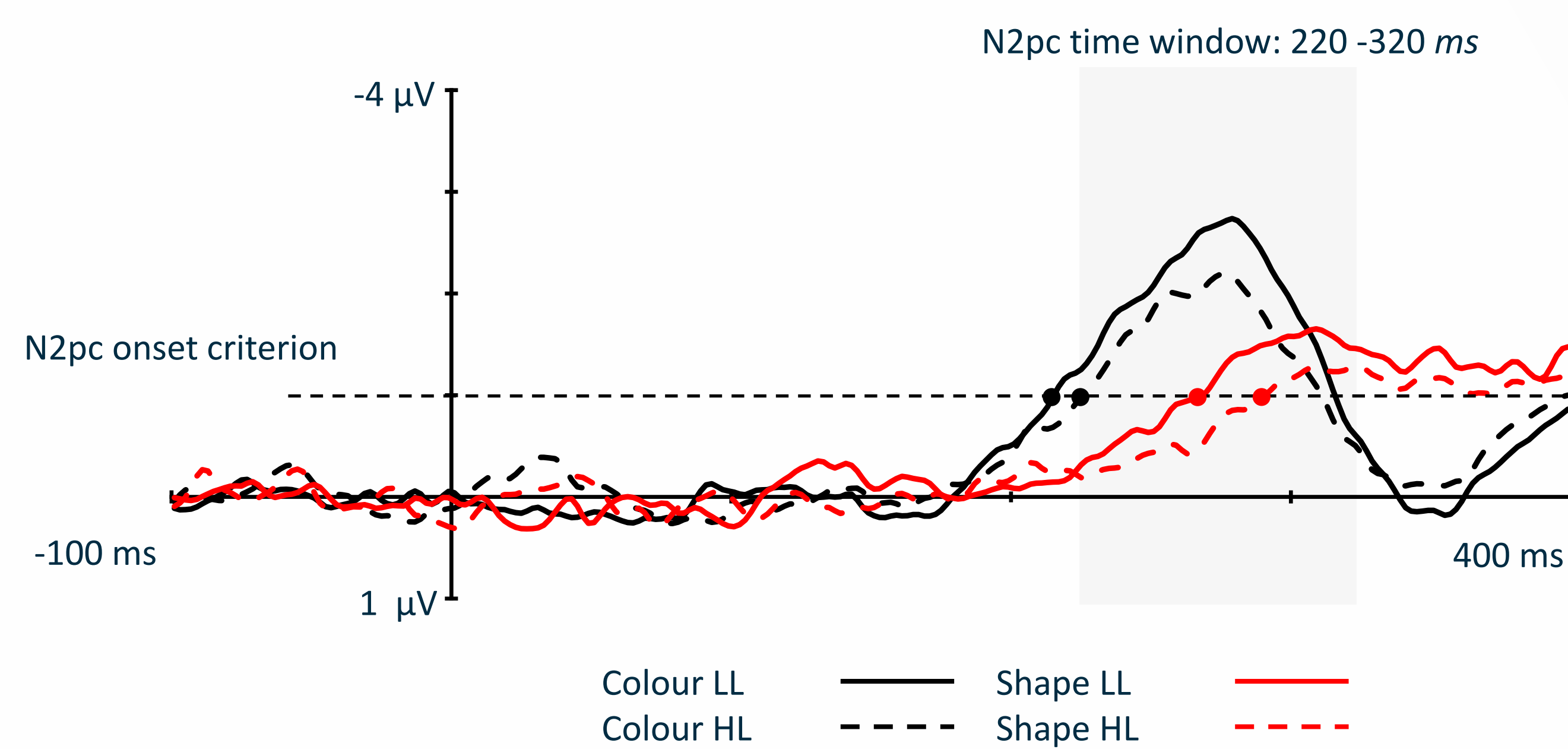
Search array: hosts the target in (one of the) cued target colour(s) among three nontargets.

Behavioural results



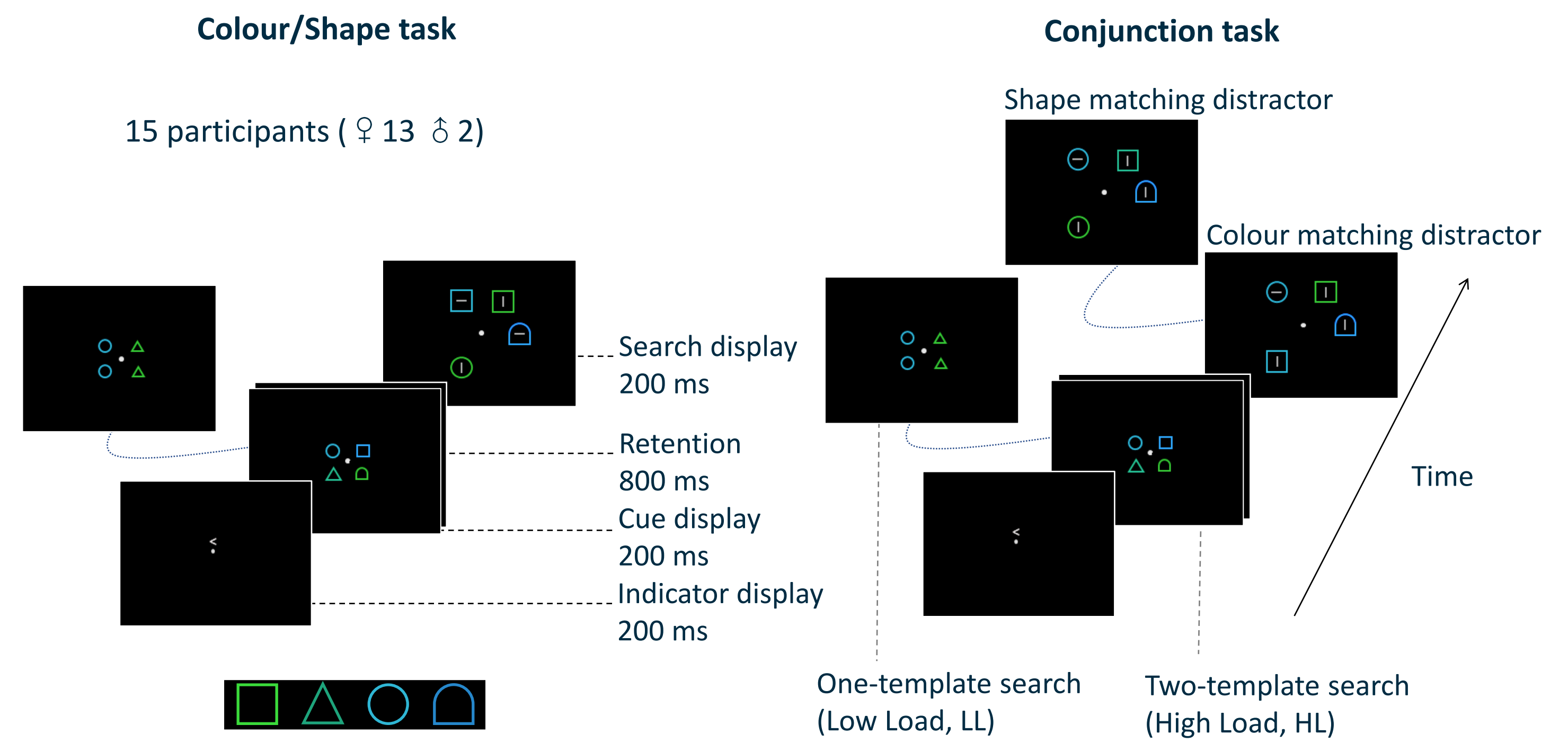
- Longer RTs and higher error rates (ERs) in the high-load (839ms, 9%) than low-load conditions (780ms, 5%), and in the Shape (899ms, 10%) than in the Colour task (720ms, 5%).
- However, relative load costs (HL – LL) on RTs and ERs were comparable in the Colour (+64ms, +3%) and Shape tasks (+53ms, +5%).

N2pc (contralateral – ipsilateral ERPs)



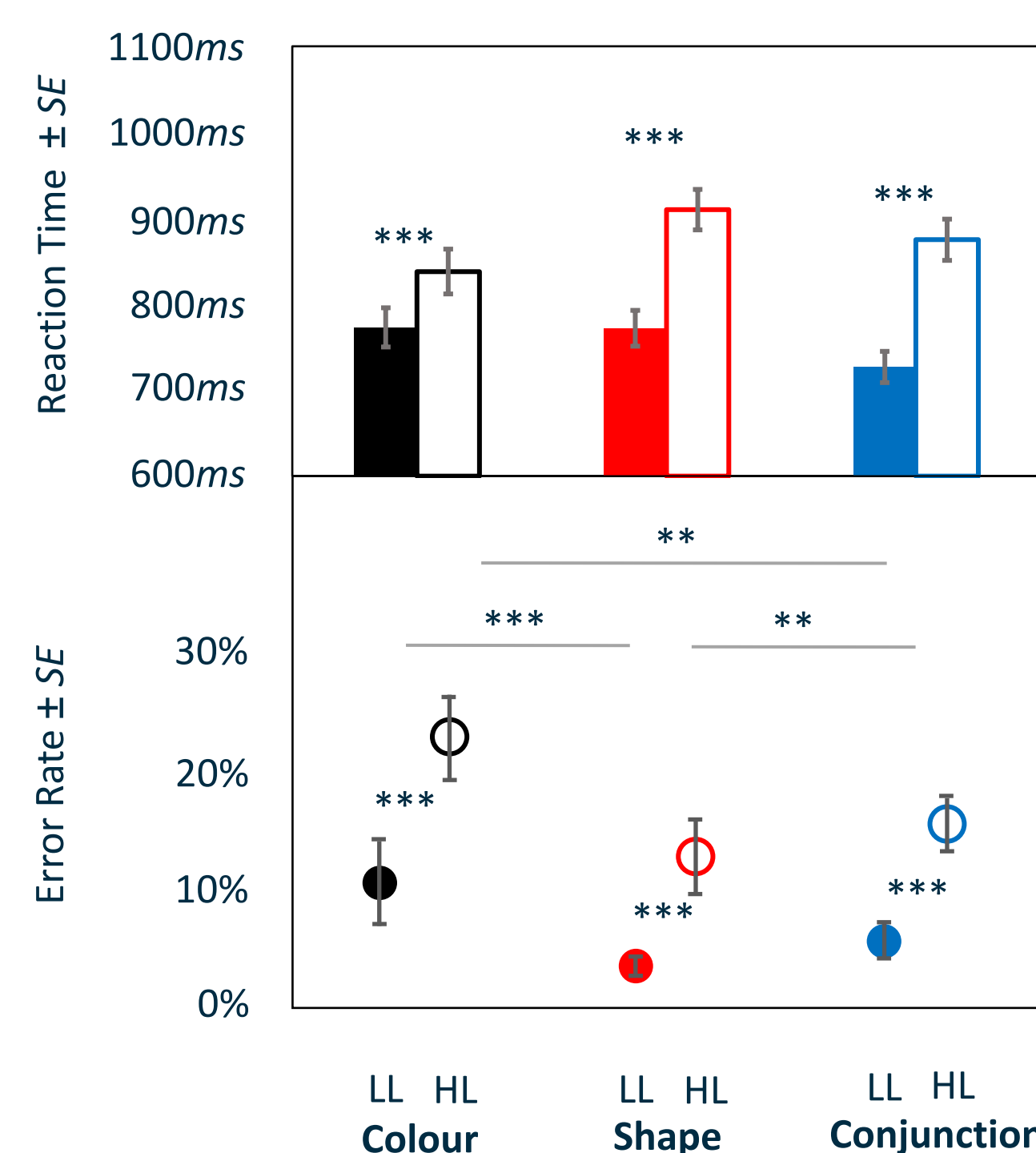
- Smaller and delayed N2pcs in the high-load (-1.1µV; 257ms) than low-load conditions (-1.5µV; 240ms), and in the Shape (-0.9µV; 278ms) than Colour tasks (-1.8µV; 219ms).
- Relative load costs (HL – LL) on N2pc mean amplitudes and latencies were comparable in the Shape (-0.3µV; +24ms) and Colour tasks (-0.4µV; +11ms).

Experiment 2



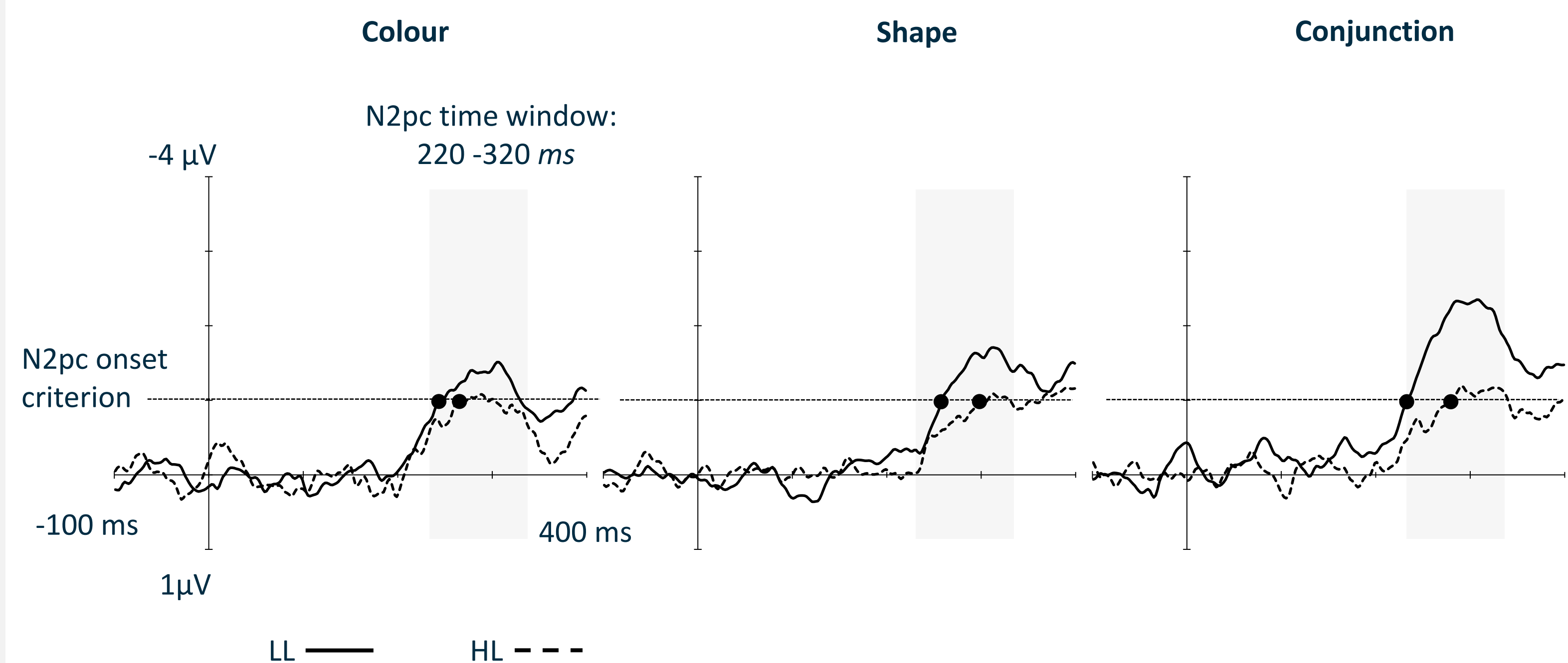
15 participants (♀ 13 ♂ 2)

Behavioural results



- Longer RTs and higher ERs in the high-load (875ms, 17%) than low-load conditions (758ms, 6%).
- RTs were not significantly different across the three tasks (Colour: 806ms, Shape: 842ms, Conjunction: 801ms). ERs were highest in the Colour (16%), then the Conjunction (10%), and then the Shape task (7%).
- Relative load costs (HL – LL) on RTs were comparable in Shape (+138ms) and Conjunction tasks (+149ms), and were lower in the Colour task (+65ms). ER load costs are not significantly different in the three tasks (Colour: +11%, Shape: +9%, Conjunction: +11%).

N2pc (contralateral – ipsilateral ERPs)



- Smaller and delayed N2pcs in the high-load (-0.77µV; 281ms) than low-load conditions (-1.36µV; 245ms). N2pc mean amplitudes were comparable in the Colour (-0.99µV) and Shape tasks (-0.87µV), but were increased in the Conjunction task (-1.32µV). No significant differences in N2pc onset latencies were found among the three tasks.
- Relative load costs (HL – LL) on N2pc mean amplitudes were comparable in the Colour (-0.33µV) and Shape task (-0.46µV), but higher in the Conjunction task (-0.97µV). Relative load costs on N2pc latencies were not significantly different among the Colour (+24ms), Shape (+40ms), and Conjunction tasks (+45ms).

Conclusion

- N2pc components measured in the colour task mirrored previous findings. They were slightly delayed and attenuated in high- versus low-load trials, reflecting the mutual inhibition of two simultaneously activated colour templates.
- The same N2pc pattern was found in the shape search. The relative load costs (latency and amplitude differences in high- minus low-load trials) were comparable between the colour and shape tasks. This suggests that multiple shape templates, just like colour templates, can be activated in parallel if multiple shapes are task relevant.
- In the conjunction search, N2pc amplitudes were attenuated in the high load relative to the low load condition by approximately 50%, suggesting that only a single conjunctive template could be activated at a time. The results also suggest that attentional templates in conjunction search hold separate features rather than a combined object representation.

