The effect of a concurrent executive working memory task on pain and placebo

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Does executive working memory play a role in placebo?

- Previous research has shown that both distraction¹ and placebo² reduce pain.
- Previous research has argued that executive processes may play a role in placebo analgesia³.
- However, recent neuroimaging work by Wager and colleagues (in press) has challenged this claim.
- To test these competing hypotheses, we designed a novel paradigm that combined transient thermal pain, performance of a difficult, 3-back, working memory task, and a placebo drug treatment.
- An interaction between the task and placebo conditions would provide evidence for the involvement of executive processes in placebo analgesia⁴.

Design

- 33 participants completed 3 separate sessions

Session 1: Temperature & task calibration

Sessions 2 & 3: Counteraligned placebo and control sessions

Placebo

<table>
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<tr>
<th>Run 1</th>
<th>Run 2</th>
<th>Run 3</th>
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<tr>
<td>Control</td>
<td>placebo</td>
<td>Control</td>
<td>placebo</td>
<td>Control</td>
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Control

Pain trials: 16 per run

1. Raw pain ratings by condition

![Graph showing raw pain ratings by condition](image)

- Data for run 1 excluded
- Apparent mean differences with large variance between participants
- Suggests participants used scale differently

2. Normalized ratings by condition

![Graph showing normalized ratings by condition](image)

- Ratings normalized within participant (runs 2-5)
- Main effects of placebo, \( F(1, 128) = 31.40, p < .001 \)
- and task, \( F(1, 128) = 72.76, p < .001 \)
- but no interaction between the two, \( F(1, 128) = .05, p = .833 \)
- Results are nearly identical when session order, \( F(1, 127) = 36.25, p < .001 \)
- is included as a covariate

3. Raw pain ratings by run

![Graph showing raw pain ratings by run](image)

- Lower pain ratings for placebo manipulation run (run 1) correspond to lower temperature used

4. Normalized pain ratings by run

![Graph showing normalized pain ratings by run](image)

- Greater pain reported on 1st experimental run (run 2) during both placebo and control sessions

5. Performance by condition

![Graph showing performance by condition](image)

- Placebo does not affect task performance, \( F(1, 64) = .01, p = .946 \)

Summary and conclusion

- Both task and placebo reduced pain.
- No interaction existed between task and placebo.
- The placebo-induced reduction in pain did not lead to improved task performance.
- Taken together, these results suggests that the cognitive processes that support placebo analgesia may be independent from those supporting executive function.

References