Peer Community In Registered Reports

Understanding oscillatory correlates of pain expectation

A recommendation by ***Gemma Learmonth*** *based on peer reviews by* ***Chris Chambers***, ***Markus Ploner*** *and* ***Zoltan Dienes*** *of the STAGE 2 REPORT:*

Chiara Leu, Esther Glineur, Giulia Liberati (2024) Cue-based modulation of pain stimulus expectation: do ongoing oscillations reflect changes in pain perception? A Registered Report. OSF, ver. 2, peer-reviewed and recommended by Peer Community in Registered Reports. https://doi.org/10.17605/OSF.IO/9UD7X

Submitted: 25 January 2024, Recommended: 10 April 2024

Cite this recommendation as:
Learmonth , G. (2024) Understanding oscillatory correlates of pain expectation. *Peer Community in Registered Reports*, 100675. 10.24072/pci.rr.100675

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Recent studies using an EEG frequency tagging approach have reported modulations of alpha, beta and theta bands at the stimulation frequency during nociceptive/painful thermal stimulation compared to non-nociceptive/non-painful vibrotactile stimulation. Prior expectations of the intensity of upcoming painful stimuli are known to strongly modulate the subjective experience of those stimuli. Thus, modulating the expectation of pain should result in a change in the modulation of oscillations if these factors are indeed linked. In this study, Leu, Glineur and Liberati modulated expectations of pain (low or high intensity) in 40 participants prior to delivering thermal cutaneous stimulation (low, medium or high intensity). They recorded how intense participants expected the pain to be, and how intense they felt it to be, as well as EEG to assess oscillatory differences across the expectation and intensity conditions. The results confirmed that there was a strong effect of expectation on the perceived stimulus intensity. However, contrary to the hypotheses, this was not reflected in the cortical oscillations. Overall this indicates a possible dissociation between perceived pain and modulation of ongoing oscillations in the theta, alpha and beta bands. The Stage 2 manuscript was evaluated over one round of in-depth review. Based on detailed responses to the reviewers' comments, the recommender judged that the manuscript met the Stage 2 criteria and awarded a positive recommendation.
URL to the preregistered Stage 1 protocol: https://osf.io/y6fb8

Level of bias control achieved: Level 6. *No part of the data or evidence that was used to answer the research question was generated until after IPA.* **List of eligible PCI RR-friendly journals:**

- Advances in Cognitive Psychology

- F1000Research
- Brain and Neuroscience Advances
- Cortex
- Imaging Neuroscience
- In&Vertebrates
- NeuroImage: Reports
- Peer Community Journal
- PeerJ
- Psychology of Consciousness: Theory, Research and Practice
- Studia Psychologica
- Royal Society Open Science

References:

1. Leu, C., Glineur, E. & Liberati, G. (2023). Cue-based modulation of pain stimulus expectation: do ongoing oscillations reflect changes in pain perception? [Stage 2] Acceptance of Version 2 by Peer Community in Registered Reports. https://osf.io/awrge

Reviews

Evaluation round #1

DOI or URL of the preprint: https://osf.io/gfjsy
Version of the preprint: 1

Authors' reply, 28 March 2024

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Decision by Gemma Learmonth, posted 21 February 2024, validated 21 February 2024

Understanding oscillatory correlates of pain expectation

Dear authors,

Many thanks for submitting your Stage 2 report for review. Please find attached the 3 reviewer opinions of your Stage 2 report, which are generally favourable.

Reviewers 1 & 3 have made a few minor points that should be reflected in your re-submission.

Reviewer 2 makes a stronger point around the interpretation of your non-significant EEG results. After consideration, and re-review of your Stage 1 plan, I think the difference lies in the precise terminology that was accepted at Stage 1. You had stated in the pre-registration that "no definitive conclusions will be drawn from a non-significant result", and I think on balance that this does allow for some interpretation of the observed result compared to if the pre-registration had stated that no conclusions would be drawn at all. Whether

this should have, in hindsight, been tightened up at Stage 1 is an open question, but I do believe that your interpretations fit within the previously accepted plan.

Best wishes,
Gemma Learmonth

Reviewed by Markus Ploner, 20 February 2024

The stage 2 manuscript accurately follows the outlines of the stage 1 manuscript. The results have shown primarily negative findings, indicating a lack of a relationship between phase-locked responses and ongoing oscillations on the one hand and pain perception on the other hand. This conclusion is hampered by the limited sample size and failure to induce pain in most stimulation conditions.

The manuscript presents the results clearly and discusses the findings appropriately. Some clarifications and added details might further improve the manuscript:

1. P.6, first line. Remove “be”.
2. P. 6, third paragraph. Why were the stimulation temperatures changed compared to the temperatures specified at stage 1?
3. P. 6, third paragraph. Replace “will be” with “were”
4. P. 8, line 6. Remove “be”
5. P. 10, second paragraph. “the resulting amplitude was multiplied by the number of averaged chunks.” Multiplied or divided by the number of chunks?
6. P. 24, first paragraph. “neither the expectation of a similar stimulus nor the mismatch in perception for condition HM seemed to have an influence on the recorded amplitude.” This sentence was not clear to me. Please rephrase.
7. P. 25, last paragraph. “the smallest possible effect size that we would still be interested in.” What would be the smallest effect size the authors would be interested in? And what were the criteria for defining this effect size?
8. P. 26, first paragraph. The study’s main result is a negative finding that cannot be conclusively interpreted. This somehow disappointing outcome is mainly due to the limited sample size. The authors might discuss their sample size calculation and lessons learned for future studies more critically and openly.

Reviewed by Zoltan Dienes, 20 February 2024

The authors have conducted the analyses they said they would; though I now note that it slipped us all by, that the precise analyses were not absolutely nailed down beforehand; for example, exactly how post hoc tests would be performed appears not to be pre-registered. However, whatever extra flexibility snuck through, the key theoretical finding was non-significant. So nothing need be done about this point.

My main point is that the pre-registration declares no conclusion follows from nonsignficant results for the EEG. The way the authors deal with this is make conclusions but add a paragraph saying do not take them seriously. That is to write in contradictions. The correct thing to do is draw no conclusions in the first place - a point which applies to the abstract as well. The discussion and summary of results in the abstract need a major re-write therefore. I realise the authors may wonder what to write about. They could say "whatever the difference is between HM and LM it lies in this interval" and give a confidence interval, and declare no conclusion can be made yet as to whether or not there is a difference of scientific relevance.

Reviewed by Chris Chambers, 06 February 2024

I think the authors have done a great job with this Stage 2 submission. The study remained impressively close to the approved protocol; I found the reporting of results to be clear and the Discussion insightful in considering the implications and limitations of the research. Broadly, the manuscript in my view meets the Stage 2 criteria and I have only a few very minor comments for consideration. In a few places, the language implies evidence of absence from statistically non-significant results. e.g. (with my suggested modifications highlighted in **underlined bold**):

- p22 “The conditions of interest HM and LM did not differ **significantly** in their modulation at the frequency of interest”
- p26: “Despite a strong effect of the visual cues on stimulus perception, no **significant** differences were found in the modulation of ongoing oscillations at the frequency of interest between the conditions of interest (medium intensity stimulation preceded by either a cue for a high or a low stimulation intensity)."

I suggest checking carefully throughout for other instances and adjusting accordingly. pp25-26 “Frequently, the targeted effect size is the observed effect in previous literature; yet, this approach might lead to the rejection of a hypotheses only because the effect might have been smaller than in previous investigations and not because there was truly no effect”. I would suggest replacing "the rejection of a hypotheses" with "lack of support for a hypothesis" as I initially read "rejection" to imply rejection of the null (which would convey the opposite intended meaning). Q5 in the Stage 2 submission checklist asks: **5. Have all digital materials that are necessary and sufficient to reproduce all data acquisition procedures been made freely and publicly available? Such materials can include, but are not limited to, software code associated with data acquisition hardware, stimuli (e.g. images, videos), survey text, and digital or digitized questionnaires.** The authors answer YES and linked to the Harvard Dataverse repository at https://doi.org/10.7910/DVN/40ZRQR However as far as I can tell, this repository contains only *data*, not the digital study materials. Please either add the digital study materials to this repository (and add their mention in the README file), or alternatively add them to the study’s OSF repository (https://osf.io/9ud7x/) and add a mention of this repository to the Stage 2 manuscript (as it is not currently stated anywhere). Please also augment the README file in the Harvard repository to provide a complete list (inventory) of files with an accompanying description that defines the file content.