PCI Registered Reports #808

One and only SNARC? Spatial-Numerical Associations are not fully flexible and depend on both relative and absolute magnitude

Stage-2 Submission, Version 3

Dear Rob,

Thank you for reviewing version 3 of our Stage-2 Registered Report so quickly! As always, your feedback was very helpful. We have revised Figure 5 and the Abstract accordingly and highlighted all related changes.

Best wishes,
Lilly (on behalf of all authors)

I have now had a chance to examine the revisions made to this paper, and I think they are generally fine. It is very good also that you spotted the error in the Bayesian analysis, which myself and the reviewer had missed (and also reassuring that it has not affected the pattern of outcomes).

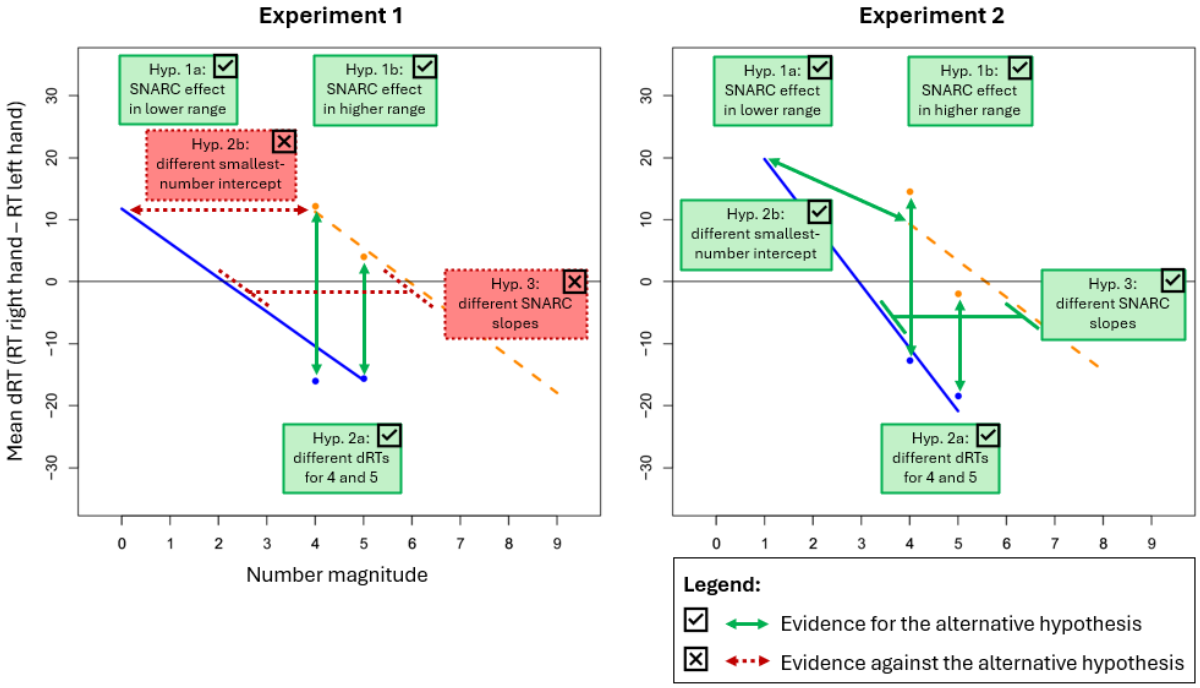
I do not think there is a need for further external review, and I am more-or-less ready to recommend this Stage 2 report formally. However, there are two points that I think you should attend to, one of which relates to material newly added at this revision.

Thank you, we have revised the two points in our manuscript and we are looking forward to getting your formal recommendation.

1. Figure 5 is helpful, but I think it may be potentially confusing that you have reversed the statement of the hypothesis in (red coloured) cases where there was evidence against the hypothesis. This makes it look (to me) like there was evidence against the reversed statement. I think you would be better to keep the statement of the alternative hypothesis consistent, with the colour of the box (and the tick or cross) symbol indicating whether there was evidence for or against that statement. This in my opinion would be clearer, but you might want to check with some other colleagues what they find most intuitive.

Also, is there a cross missing from the H3 box in Figure 5a? Also for the statement of H3, I think it would be clearer to write "Different SNARC slope" rather than "Different SNARC strength", and even better if you could adjust the end of the arrows (maybe to short lines running parallel to a portion of the fit lines) to graphically indicate that it is slopes (not points) that are being compared.

Thanks for your helpful feedback regarding our new Figure 5! We have adapted it according to your comments (i.e., changed reversed statements to prediction statements, added missing cross for H3, changed “SNARC strength” to “SNARC slopes”, and changed arrows for H3). We put the following improved version into our manuscript:



2. In the abstract you state, "In two highly powered Registered Report online experiments (https://doi.org/10.17605/OSF.IO/AE2C8, IPA by PCI: 12/03/2023), we observed and here report such a dependency on absolute magnitude (in addition to the replication of effects of relative magnitude)."

There are a few issues with this statement.

i) It is misleading to imply "In two experiments we observed a dependency on absolute magnitude". You did not observe such a dependence in Experiment 1, only in Experiment 2. There are good reasons for this, so perhaps you could report your outcomes with more nuance?

> You are right, we have revised the Abstract accordingly and now report the results with more nuance:
> "Experiment 1 (N = 200) replicated relative-magnitude dependency using the same stimuli as Fias et al. and Dehaene et al. However, Experiment 2 (N = 300) additionally demonstrated absolute-magnitude dependency, while considering recent advances in SNARC research (mainly by improving the stimulus sets and using 1 – 5 excluding 3 and 4 – 8 excluding 6)."

ii) It doesn't seem quite right to state that your experiments were "highly powered", because the concept of statistical power does not apply directly in Bayesian statistics. It would be correct to say that the experiments were designed to provide strong evidence for or against relative and absolute magnitude dependency, or some other form of words to this effect.

> Thanks for noting this. Power is indeed frequentist terminology, and we only ran simulations to determine the maximum sample size for the SBF+maxN approach. In the revised version, we state that we ran "Bayesian analyses with optional recruitment

stopping at moderate evidence for (BF_{10} above 3) or against (BF_{10} below 1/3) each hypothesis".

iii) You don't need to insert the doi to the Stage 1 report in your Abstract.

We have deleted the doi from the abstract.

Finally since I am returning this manuscript to you for final minor revisions, I am taking the opportunity to share my draft of the recommendation text for this Stage 2 report. This is the text that will appear on PCI RR site when the report is formally recommended. If you think I have misrepresented anything about your experiment in this draft, then please let me know.

Thanks for sharing your drafted recommendation for our stage-2 RR with us. We think that it perfectly summarizes our study aim and findings!

Best wishes,

Rob

A Registered Report demonstration that the SNARC effect depends on absolute as well as relative number magnitude

The Spatial-Numerical Association of Response Codes (SNARC) effect refers to the fact that smaller numbers receive faster responses with the left hand, and larger numbers with the right hand (Dehaene et al., 1993). This robust finding implies that numbers are associated with space, being represented on a mental number line that progresses from left to right. The SNARC effect is held to depend on relative number magnitude, with the mental number line dynamically adjusting to the numerical range used in a given context. This characterisation is based on significant effects of relative number magnitude, with no significant influence of absolute number magnitude. However, a failure to reject the null hypothesisis not firm evidence for the absence of an effect. In this Registered Report, Roth and colleagues (2023) report two large sample online experiments, with a Bayesian statistical approach to confirm—or refute—an effect of absolute number magnitude in modulating the classic SNARC effect (smallest effect size of interest, d = 0.15).

Experiment 1 closely followed Dahaene's (1993) original methods, and found strong evidence for an influence of relative magnitude, and moderate-to-strong evidence against an influence absolute magnitude. However, Experiment 2 was designed to exclude some potential confounds in the original method, and this second experiment found strong evidence for both relative and absolute magnitude effects, of comparable effect sizes (in the range of d = .24 to .42). This registered study demonstrates that the SNARC effect is not 'fully flexible', in the sense of depending only on relative magnitude; it is also shaped by absolute number magnitude.

This Stage 2 manuscript was evaluated over one round of in-depth review, by the recommender and one external reviewer. Following appropriate minor revisions, the recommender judged that the manuscript met the Stage 2 criteria for recommendation.