



Editorial comment

Working memory, optimism and pain: An elusive link



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In this issue of the *Scandinavian Journal of Pain*, Boselie and coworkers [1] report on evoked pain, positive reflection on self-image, and how manipulation of these two factors could influence participants' performance on a working memory test. It is well documented that pain has a negative influence on working memory, but little is known about how we can counteract this effect. Boselie and coworkers present data from two experimental studies in their article. The first study had a hypothesis about evoked pain having a residual effect on working memory, and that optimism could influence this effect. However, problems with demonstrating a residual effect from cold pressor pain on working memory made the hypothesis difficult to test. The second study looked at the influence optimistic self-reflection had on working memory performance during heat induced pain. The results did, however, not support the hypothesis of a protective effect of induced optimism on pain-related task performance decrements.

1. Pain reduces working memory performance

Reduced working memory performance when experiencing pain is a reliable and reproducible effect, especially for persistent pain [2]. There are several recent reviews on the subject suggesting different pathways for why this happens. One possible pathway is that pain demands cognitive resources and therefore limits working memory due to interference in cortical networks [3]. Prefrontal cortex, anterior cinguli, insula and other structures are involved in both pain processing and higher cognitive functions such as working memory [4]. Inputs have to be prioritized in order to select and maintain a subordinate goal, an effect that should be transferable to evoked pain. Indeed, several studies suggest this is the case [5]. Manipulation of optimism has been shown to lower pain intensity by reducing catastrophizing, and has been shown to increase performance on a test of working memory, the *n*-back task [6]. The *n*-back task makes the participant recall whether the current letter or number is identical to one presented two, three or *n* stimuli ago (hence *n*-back task).

2. The *n*-back task for working memory – influenced by a manipulation of optimism

This task involves multiple cognitive factors. It requires us to encode the incoming stimuli, monitor, maintain, and update the presented stimulus. It also requires us to match the presented stimulus to the one that occurred *N* positions back in the sequence. Decision, selection, inhibition, and interference resolution processes are also involved when performing this task, making it a suitable test for working memory. However, looking at the evidence from a cognitive science perspective, the manipulation of optimism seems to be linked to emotional processing in particular [7]. And it may be that the decreased working memory performance in pain is tied particularly to pain catastrophizing or emotional contingent processing [5].

3. No effect of pain on cognitive performance, no effect of optimism on reduced cognitive performance, and the importance of publishing studies with negative findings

The first study by Boselie and coworkers report that pain induction did not affect a subsequent cognitive task performance, while their second study report that optimism did not improve task performance that had been impaired during concurrent heat pain stimulation [1]. Their findings are highly interesting in the context of working memory and evoked pain. Optimism is a prime target for intervention as it has proven to be quick to influence and is tied to increased cognitive performance. The fact that the current study report lack of a protective effects of optimism is helpful when designing new experiments, and when delineating the causal relationships between pain, optimism and working memory. Manipulation of working memory is a field that has been fuelled by high hopes, indeed even optimism, and results like those reported by Boselie and coworkers are instrumental in moving the field forward. As an example, this is the first time a 2-back task is used in studying residual effects of pain on working memory [1]. Unfortunately researchers in general too often rely on positive results when seeking to get their work published [8]. Positive-outcome bias in publishing is now a serious concern in most academic disciplines [9], with one of the consequences clearly demonstrated in the recent reproducibility project [10]. The study by Boselie and coworkers with a solid methodology thus provides an important contribution to the further understanding and research in this

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particular field. Publishing well-done negative out-come studies is a tradition of the *Scandinavian Journal of Pain* [11].

4. A place for studies with *emotional n-back* task?

Finally, one alternative interpretation of the findings is that the 2-back task, where letters are presented one-by-one on a computer screen and participants have to recall what stimulus was presented two steps back, is not really suitable for investigating optimism and pain related working memory deficits [1]. It could be that the relationship is mediated by catastrophizing or other aspects of anxiety, making the chosen test neither lengthy nor relevant enough. In future studies, this relationship could be studied by applying an emotional *n-back* task. In this task, emotional words relevant to pain catastrophizing could be better when testing effects of increased optimism. In conclusion we commend the authors on a rigorously performed study and for reporting a null-finding with such attention to detail.

Conflict of interest

None declared.

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