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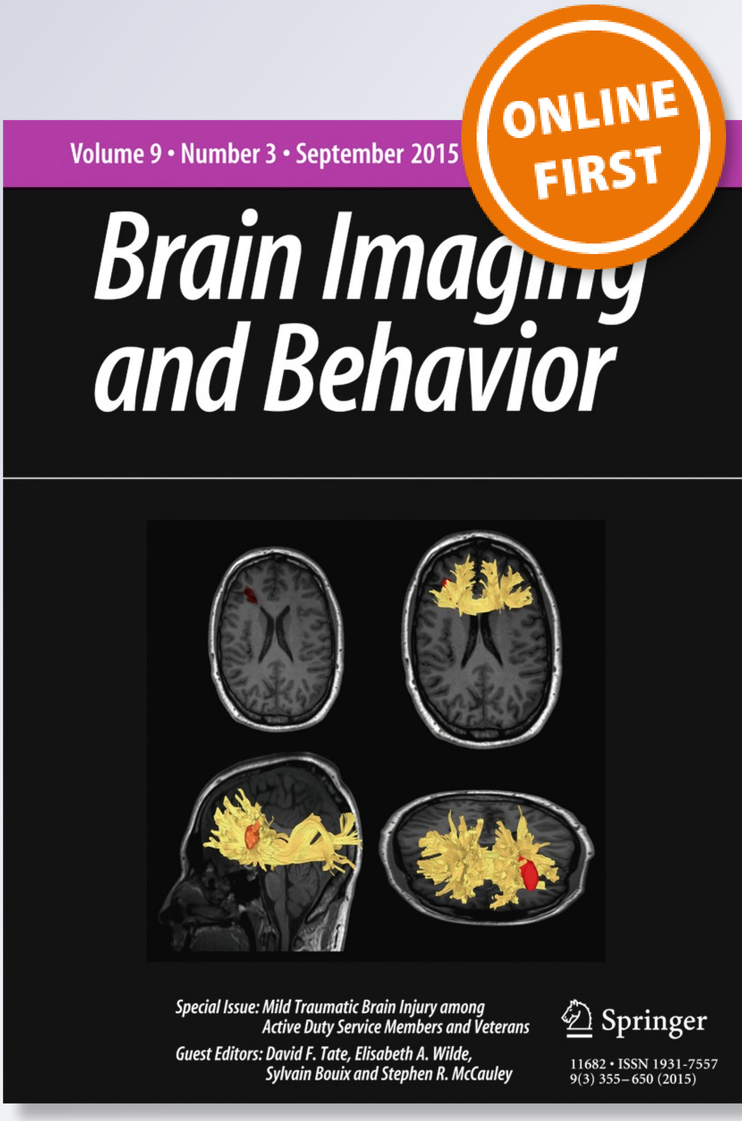

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LETTER TO THE EDITOR

Sensory source for stroop effects in persons after TBI: support from fNIRS-based investigation

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To the Editor,

We recently read the interesting and informative paper "fNIRS-based investigation of performance on a Stroop task after TBI" (Plenger et al. 2015). The authors were careful not to interpret the behavioral data as supporting a deficit in selective-attention in TBI, but rather that the "TBI group had significantly more difficulty performing the incongruent task." We would like to further suggest that the compelling and novel imaging data provided in that study provides support for a sensory source for the increase in Stroop interference after TBI (Ben-David and Schneider 2009, 2010; Ben-David et al. 2011, 2014).

The color word Stroop test is the most commonly used tool to assess selective-attention in TBI. The classic Stroop test includes at least two tasks: (1) Naming the font color of a stimulus unrelated to color (dot color naming condition in Plenger et al. 2015; baseline condition); and (2) Naming the font color of a color-word, where the semantic content is mismatched with the print color – e.g., the word RED printed in blue (incongruent condition in Plenger et al. 2015). The latency difference between the two tasks is referred to as the Stroop Interference (SI). Generally, larger SIs are found for TBI patients than for healthy controls. This TBI-related increase in SI is typically taken to reflect a decrease in selective-attention after TBI. In a recent meta-analysis (Ben-David et al. 2011), we suggested that TBI-related changes in sensory processing, specifically color-vision, could explain (at least in part) this increase in SI after TBI. In our analysis, we found a TBI-related increase in baseline color-naming latencies that was significantly larger (by around 30 %) than a TBI-related increase in reading latencies (reading a word printed black on white). This imbalanced slowdown for color-naming after TBI was correlated with the TBI-related increase in SI. Indeed, Melara and Algom (2003) have suggested that the SI could be the outcome of faster access to the representation of the (semantic) word code than to the representation of the font-color code. In other words, we proposed that increased difficulty in color-vision processing after TBI could be the source for inflated SI, beyond any changes in selective attention. We note that the greater difficulty in color naming after TBI is not reflected in the behavioral data of Plenger et al. This may be a result of using error rates as the dependent variable, which may not be sensitive enough for gauging these small-scale differences in baseline color-naming.

The fNIRS data collected by Plenger and colleagues may present some support for this sensory theory. For controls, there were additional loci of brain activity when

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performing the incongruent task over the simple color-naming task (specifically, additional activation in the bilateral pre-frontal cortex). However, for TBI patients, the same areas that showed activation in the incongruent task, were activated in the baseline color-naming task. The authors maintained "it is not yet known why patients demonstrated greater activity in the frontal lobes for the color naming task than controls." We wish to consider the option that this additional activity in the frontal lobes for TBI patients may reflect the increased difficulty they have in the simple task of color naming (regardless of the semantic content of the stimuli). In this context, the fNIRS data supports the latency data collected in our meta-analysis, revealing the additional difficulty for people with TBI in color naming.

In sum, the fNIRS data can provide further support for the possible sensory source for the increase in SI after TBI. Consequently, we suggest that when applying the Stroop test with TBI patients, one must control for changes in color-vision processing, or consider a selective-attention test that does not involve colored stimuli (e.g., Attention Network Test; Fan et al. 2002).

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