Detecting Focus States in Office Environment with Neurable EEG Headset

Alicia Howell-Munson[1,2]*, Walter T Piper[2], Theresa Guarrera[2], David Stanley[2], Davide Valeriani[2], Michelle Lim[2], Ramses E. Alcaide[2]

[1]Worcester Polytechnic Institute, Worcester, MA, USA; [2]Neurable Inc., Boston, MA, USA

*100 Institute Rd, Worcester, MA 01609, USA. E-mail: anhowellmunson@wpi.edu

Introduction: Workers switch between different states of focus throughout the day, such as deep focus, productive multitasking, and unproductive multitasking [1]. Recently, Neurable designed a machine learning algorithm to estimate a focus score metric from the normalized alpha band extracted from EEG signals [2]. We expanded this work to explore changes in alpha power, as shown by the focus score, with the intention of classifying when a distraction is work related, as it is in productive multitasking, such as looking between notes and work, and not related to work, as it is in unproductive multitasking, such as emails unrelated to the current task.

Material, Methods, and Results:
We developed an algorithm to predict the focus state a user is in using Neurable's headset [2]. We collected 114 hours of EEG data from 43 participants who were engaged in their daily work activities in an office environment. We labeled each dataset as deep focus (DF), productive multitasking (PMT), or unproductive multitasking (UMT) based upon user reflections. Participants recounted their work session, including times when they switched tasks or multitasked, and often acknowledged that drops in their focus score correlated to times when messages or emails were received. Our ground truth datasets were when the participant stayed within a single focus state (70 hours) to train a model that predicted the focus state (DF, PMT or UMT), and tested it on datasets where participants indicated they had switched focus states (24 hours), with 20 hours of data removed due to noise artifacts. Our model correctly identified when users switched focus states in 83% of the datasets (Fig. 1).

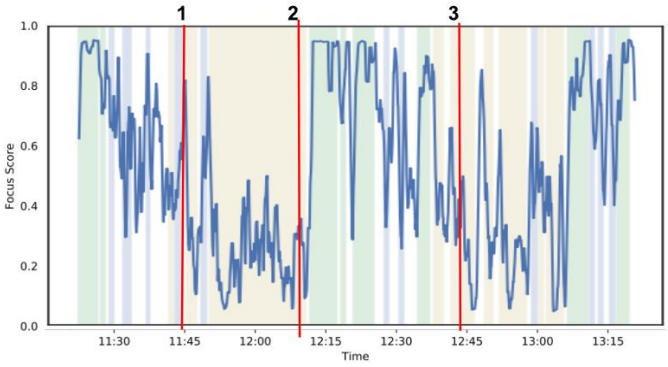

Figure 1. The user was in DF (green) and PMT (blue) while writing a grant, then would shift to UMT (yellow) as they started to respond to unrelated emails (Line 1). After finishing the unrelated work and sending a draft of the grant to a colleague, the user switched back to DF as they focused on only grant writing again (Line 2). Finally, they went back to UMT as more unrelated emails came through that they needed to respond to (Line 3).

Discussion: In this study, we showed that different states of focus can be accurately tracked with Neurable EEG headset and algorithms. This enables the development of EEG products that can help users track their attention and potentially limit factors that lead to unproductive multitasking.

Significance: We've shown the ability of a consumer grade BCI to detect changes in workers' focus state in an office environment. This takes a large step towards incorporating BCIs in daily work activities, similar to how movement and heart rate trackers have become integrated into daily life.

References

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