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The Photometry of GCS Lighting Used as an Environmental Chromatic Cue for Self-Regulation of Negative Emotions

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INTRODUCTION

While piloting an unmanned aircraft, the visual modality is one of the most important and demanding (Sivak, 1996). This may be true for foveal vision, but peripheral vision could offer a new way to communicate information without cognitive overloading when operating a ground control station (GCS). Light exercises broad effects besides vision (Vandewalle *et al.*, 2010), including hormone secretion, body temperature, sleep, alertness, cognition, and emotion regulation. The finding that melanopsin is a photopigment highly sensitive to blue wavelengths and that night shift workers have shown deficient in melanopsin receptors (Roecklein *et al.*, 2009) has been linked to mood disorders and has encouraged the use of blue light as a therapeutical instrument. This study proposes that applying an integrative interaction design that uses colour-coded lights to deliver peripheral information to individuals using blue light as a chromatic cue could promote relaxation and reduce physiological reactions associated with negative emotions with implications for emotional health and cognitive performance. Therefore, the aim of this study was to test the effects of blue light in reducing negative emotions. The findings have implications for the design of the photometry of GCS lighting and in particular the use of blue light in confined darkened GCS cabins for unmanned aircraft.

METHOD

The protocol consisted of reducing anger levels in participants who were exposed to blue light and had knowledge that the blue light was a trigger for relaxation. Thirty healthy volunteers (age: M = 23.4 years, SD = 3.6 years) agreed to take part in a car driving simulator task. Anger was manipulated during the drive by means of time pressure, financial penalties and traffic jams. Three equal experimental groups were formed: the first group was primed to the relaxation effects of blue light (BL1), the second group was exposed to blue light without priming (BL2) and the third group was not exposed to any ambient blue light (control group). Light was presented at three stages: prior to the task for 5 mins and during anger induction due to simulated traffic jams. Psychological state of anger was measured using STAXI (Spielberg, 1999) and psychophysiological measures included systolic blood pressure (SBP).

RESULTS

The analysis showed a significant effect for Group with respect to the feelings of anger sub-scale $F(2,27) = 4.82$, $p < .05$, $\eta^2 = .26$). Post-hoc tests indicated stronger feelings of anger in the control group compared to the BL1 group only $p < .05$; Fig. 1. The analysis of SBP revealed a significant main effect for group ($F(2,23) = 5.04$, $p < .05$, $\eta^2 = .31$). Post-hoc tests revealed a significant increase of SBP for the Control group compared to both blue light groups (BL1, BL2).

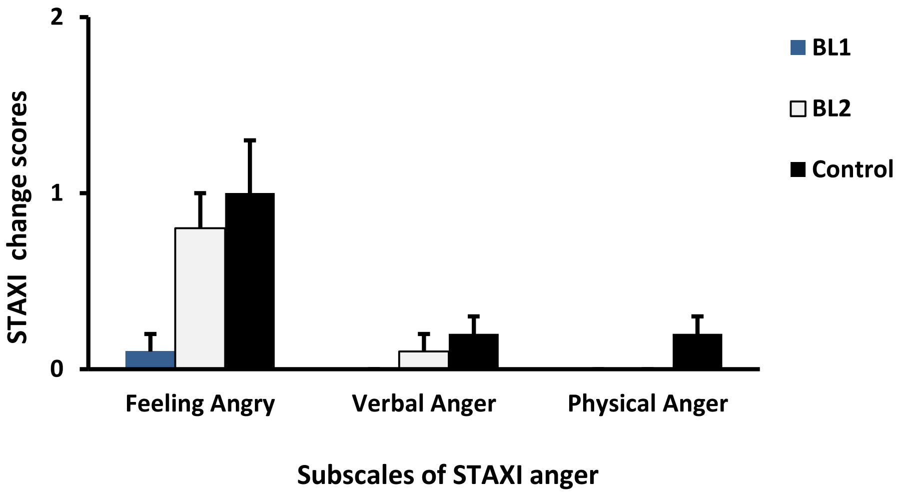

Fig. 1: Subjective anger during exposure to blue light

Discussion & Conclusion

There was a decrease in subjective feelings of anger in the BL1 condition relative to the control condition. Systolic BP was also significantly reduced in the BL1 condition compared to the control condition, thus indicating a non-visual effect of blue light on physiological reactions (Vandewalle *et al.*, 2010). Blue light when accompanied by conscious appraisal of its relevance as an external cue for relaxation reduced feelings of anger in the absence of other stimuli and reduced SBP within an anger inducing scenario. Future work could be proposed to incorporate SBP measures into GCS biofeedback platforms for self-regulation of negative emotions during the piloting of unmanned aircraft.

References

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