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POST-DOCTORATE PROPOSAL

Title : "Impact of cognitive fatigue on monitoring processes: applications on drone supervision"

Reference : **PDOC-DTIS-2021-04**
(to be recalled in all correspondence)

Start of contract: 01/10/2021	**Application deadline:** 31/08/2021

Duration: 18 months

Keywords

Cognitive fatigue ; supervision ; monitoring ; Cognitive control ; Decision making

Profile and skills required

We are seeking a European candidate who will have obtained his/her PhD before the start of the postdoctoral contract and with no more than 2 years of postdoctoral experience.

Required skills are good programming in Matlab and/or Python and a keen interest in cognitive neuroscience. Previous experience with electromyography, eye-tracking and/or electroencephalography is appreciated.

Presentation of the post-doctoral project, context and objective

Protracted cognitive effort can reduce performance by increasing a state labelled "cognitive fatigue" (e.g. Lorist et al., 2000), especially to tasks requiring few active responses, such as monitoring operations (Kamzanova et al., 2014, 2020 ; Lim et al., 2010). Unmanned Aircraft Systems such as drones can function in an autonomous way. Nonetheless, they need to be supervised for the duration of the operation, and manual control may be needed under dangerous or unpredicted circumstances. The flexibility necessary to switch from monitoring to manual control of operations requires optimal cognitive control functions that are known to be affected by cognitive fatigue (Salomone et al., 2021). Moreover, decision making is a pivotal skill necessary to distinguish between conditions requiring or not human intervention. Multiple hours-long operations require the parallel supervision of several drones, which can negatively impact attention, cognitive control and decision making (Krejtz et al., 2020; Lorist et al., 2000. Clayton et al., 2015). The duration of the required effort (*time on task* - ToT) is a key factor influencing both subjective and objective cognitive fatigue. For example, studies on car driving performances clearly indicate that a progressive decrease of driving performances occurs as time elapses (Kee et al., 2010; Phipps-Nelson et al., 2011). However, cognitive fatigue and its subjective feeling are not directly related (Deluca, 2005), making the latter not a suitable predictor of performance impairment. Moreover, ToT interacts with other factors, such as motivation and circadian rhythms, to affect vigilance, rendering the investigation of cognitive fatigue based on ToT alone quite difficult (van der Linden, 2011).

In this study, we aim to explore the non-specific neurophysiological markers of cognitive fatigue and to test the impact of ToT on the individual evolution of such markers, while controlling for vigilance effects, during the execution of an ecological drone-monitoring task. Particularly, we propose to use electroencephalography (EEG), which is a non-invasive neuroimaging technique successfully used to detect neurophysiological markers of cognitive fatigue (Barwick et al., 2012; Craig et al., 2012; Wascher et al., 2014; Linnhoff et al., 2021) and to explore the evolution of these physiological markers over time. The results of these studies will greatly improve our knowledge on the effects of cognitive fatigue on different cognitive functions and will provide ready-to-use both metrics and methods to test operators' susceptibility to cognitive fatigue.

External collaborations

ENAC, ISAE

Host laboratory at ONERA

Department : Traitement de l'information et Systèmes

Location (ONERA centre): Salon de Provence

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