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Which sensations should you imagine?

François Le Jeune
Inria, Univ Rennes, IRISA, CNRS
F35000 Rennes, France

Léa Driessens
Inria, Univ Rennes, IRISA, CNRS
F35000 Rennes, France

Emile Savalle
Inria, Univ Rennes, IRISA, CNRS
F35000 Rennes, France

Léa Pillette
Univ Rennes, Inria, CNRS, IRISA
F35000 Rennes, France

During motor imagery-based brain computer interfaces (MI-BCI) training, users are most often instructed to perform kinesthetic motor imagery, i.e., imagine the sensations related to a movement [1]. However, there is a great variety of sensations associated with motor imagery that can either be interoceptive or exteroceptive [2]. Interoceptive sensations related to movement arise from within the body, such as muscle contraction, whereas exteroceptive sensations are sensed through the skin, such as touch or vibration. Among those different sensations, we do not know which to advise MI-BCI users to imagine [3].

Thus, our experiment aims at studying the influence of imagining sensations on neurophysiological activity and user experience. It will consist in a two hours session during which participants (thirty expected) will be equipped with an electroencephalographic headset while performing five MI tasks: interoceptive, exteroceptive and both, with either a unique or multiple exteroceptive sensations, i.e., pressure and vibration (Fig. 1). After all MI conditions, participants will be asked to fill a user-experience questionnaire [4]. The kinesthetic and visual imagery abilities of participants will also be considered in our analyses [5].

Based on previous results, we expect that imagining both exteroceptive and interoceptive sensations leads to a stronger desynchronization over the sensorimotor cortex [6] than imagining interoceptive sensations only [7, 8], in turn stronger than imagining exteroceptive sensations only. Imagining several exteroceptive sensations should also enable a stronger desynchronization than imagining only one [9]. We also expect a correlation between participants' kinesthetic and visual imagery abilities, their neurophysiological results [10, 11] and their preferences.

Our results should provide useful insights on which instructions to give to participants during MI-BCI user training and potentially how to adapt them to the participants' profile.

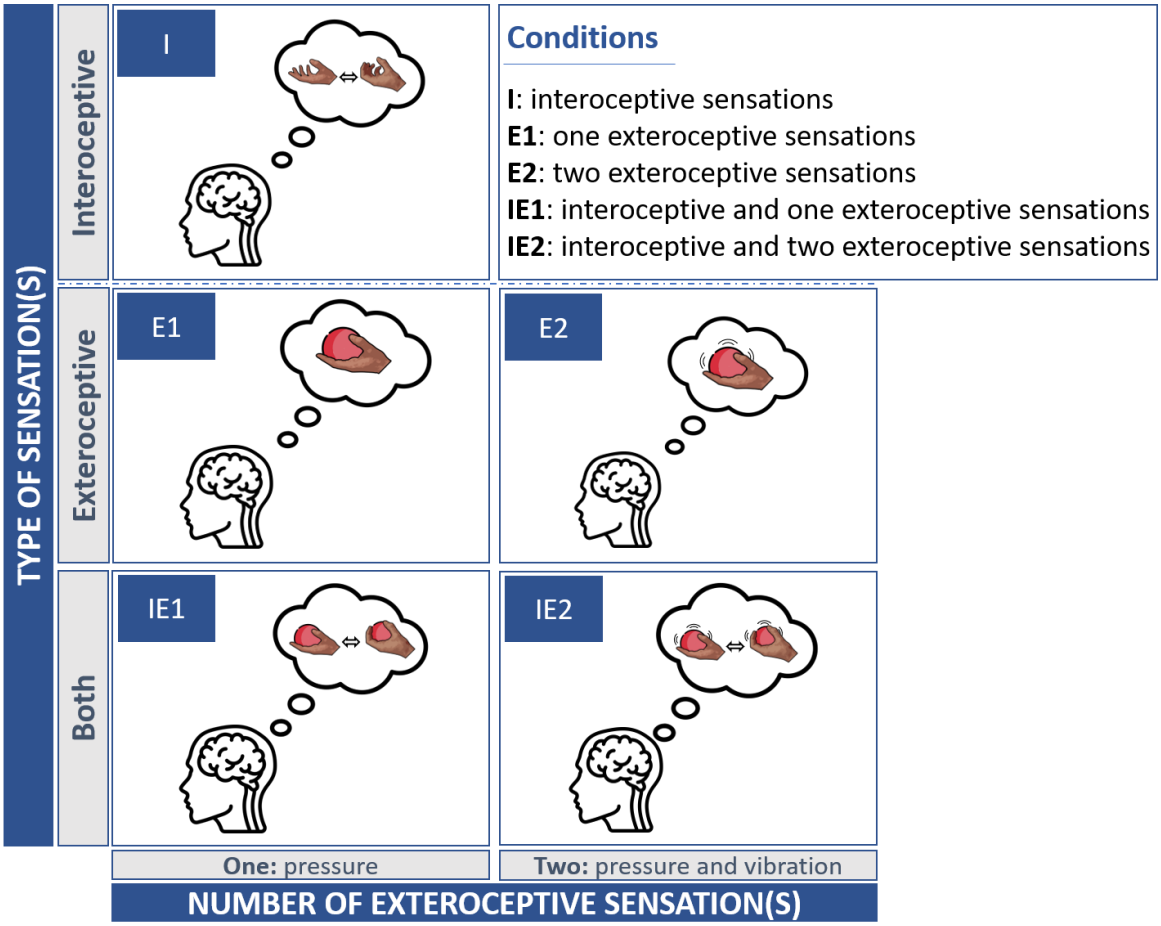

Figure 1: Experimental conditions according to the type of sensation(s) and the number of exteroceptive sensation(s) to imagine.

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