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Design and evaluation of a tangible and haptic brain-computer interface for upper limb rehabilitation after stroke

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Introduction: The French ANR GRASP-IT project aims to recover upper limb control by improving the kinesthetic motor imagery (KMI) generation of post-stroke patients using a tangible and haptic interface [1] in a gamified Brain-Computer Interface (BCI) training environment (Fig. 1).

Material, Methods, and Results: This innovative KMI-based BCI integrates complementary interaction modalities such as tangible and haptic interactions. We designed and tested usability (including efficacy towards the stimulation of the motor cortex) and acceptability of this multimodal BCI.
The GRASP-IT project designed a gamified non-immersive virtual environment to support four hand motor imageries (grasp, pinch, realize, rotate) in 16 everyday situations.

Discussion: This multimodal solution is expected to provide a more meaningful, engaging and compelling stroke rehabilitation training program based on KMI production [2].

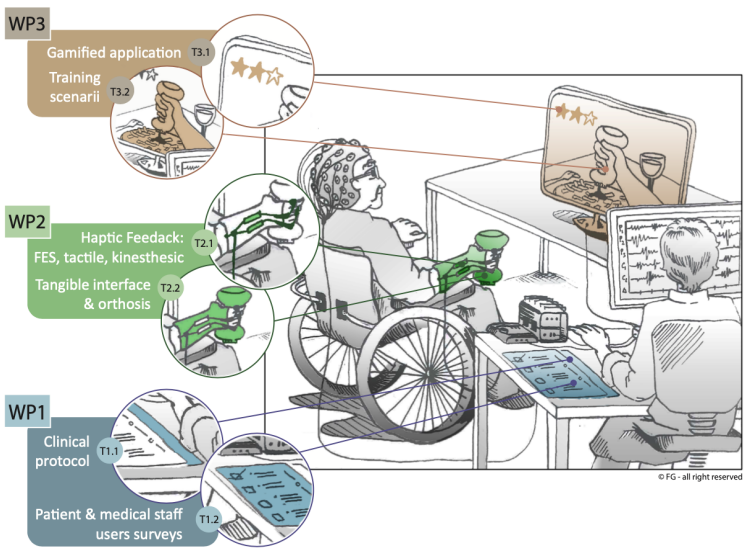

***Figure 1**. Scheme of the project structure*

Significance: The project will integrate and evaluate visual, tangible and haptic neurofeedbacks integrated in a 3D printable flexible orthosis in the gamified multimodal BCI in an ambitious clinical evaluation with 75 hemiplegic patients in 3 different rehabilitation centers in France.

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