

Virtual and augmented reality in a biomedical context

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The institut Pascal is a joint interdisciplinary research and training unit, that is subdivised into five research groups. The main location of the institute is in Clermont-Ferrand (France) but we are a subgroup of four associate professor and one full professor based in the *IUT du Puy-en-Velay* teaching facility in Le Puy-en-Velay (France) and from the *Image guided therapies* axis of the institute. Our common research field is the image processing especially applied in a biomedical context, but each of us has specific competences in image processing, signal processing, features extraction, computer graphics and discrete geometry.

We have started two years ago to investigate the potential of virtual reality to address biomedical imaging problems such as segmentation, visualization and analysis as we have shown in [1, 2]. A first work has been to simulate an operating room in a CAVE environment (cf. Fig 1). The CAVE design is especially used here to enhance the immersive experience and interaction with the simulated environment. More recently, we have developed a simple tool using Unity (game engine) to load medical images and visualize it in a VR headset (HTC Vive) and operate a simple segmentation of those data. This work [2] presents a proof of concept, for the fast development of medical imaging applications using a game engine with advanced graphical possibilities.

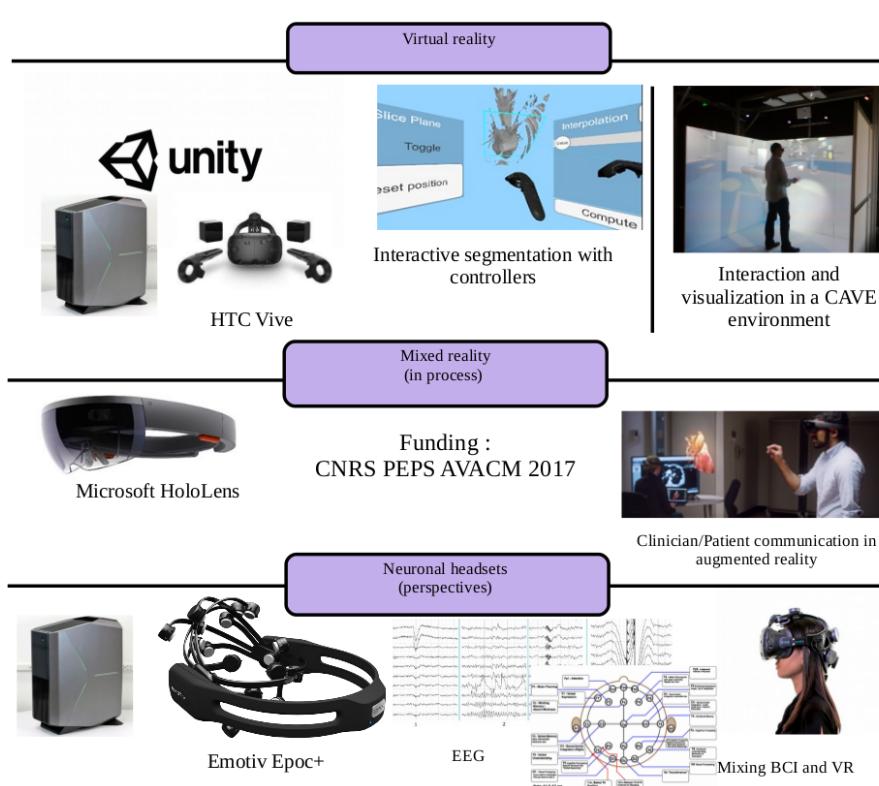


Figure 1: Our research outline on VR/AR and perspectives.

In 2017, by the means of a *PEPS CNRS*, we are focusing on a specific mixed reality headset (Microsoft Hololens) and its potential contribution with regard to different biomedical contexts. We will especially investigate its potential in the medical education context and an augmented operating room. This two studies will also provide different feedbacks on the user experience and the usability of this device in different applicatives contexts. Finally, a possible perspective that we will explore is the simultaneous use of brain-computer interface and this kind of mixed reality devices. This last idea is particularly interesting when the user can't use his hands to control the device (*e.g.* physician in a medical surgery).

References

- [1] Rositi, H. and Lohou, C., Utilisation d'un moteur de développement de jeux vidéo pour le développement d'une application basique d'imagerie médicale, RITS, 2017.
- [2] Rositi, H., Grand-Brochier, M., Courbon, J., Vacavant, A. and Lohou, C., Prototypage rapide d'applications d'imagerie médicale exploitant un casque de réalité virtuelle, RITS, 2017.