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# A virtual classroom to help children with attention deficit to regulate their attention



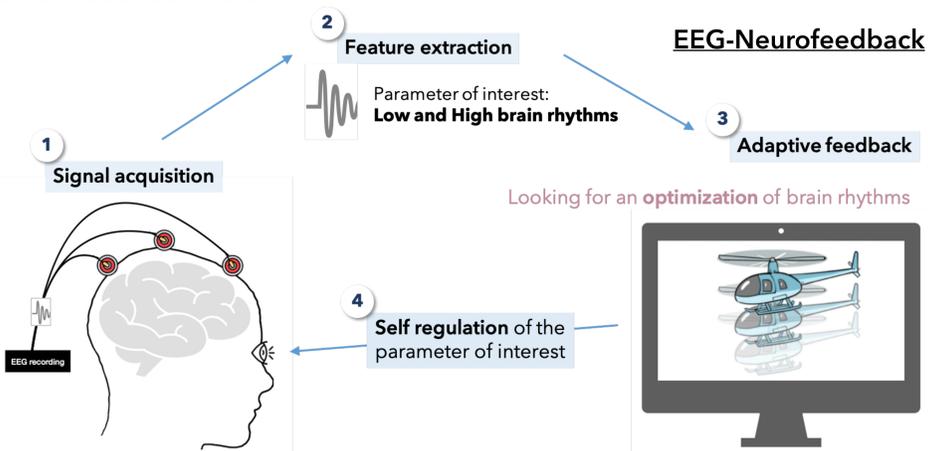
## OBJECTIVES

Attention Deficit Hyperactivity Disorder (ADHD) is a common neurodevelopmental disorder affecting 5% of school age children. The invalidating consequences for children suffering from ADHD compromise their quality of life with school underperformance or social exclusion. Drug treatments exist but have many side effects.

The aim of the project is to propose an alternative to medication in order to train the children to self-regulate their attention in a playful environment.

## METHODS

We developed a **virtual classroom** in an immersive virtual reality cave in which the children is seated in a real desk. Their level of attention is monitored in real-time using electroencephalography (EEG) and a feedback is displayed onto the school board.



The children were asked to regulate their attention by trying to fly a helicopter. The level of distraction fluctuates depending on their level of attention in order to train them progressively.



## PRELIMINARY RESULTS

- 6 neurotypical children performed 8 EEG-neurofeedback (EEG-NFB) sessions into the virtual classroom environment. They also performed **neuropsychological tests** and **functional MRI** before and after this intervention to evaluate the benefits of the training.
- All the children remained **highly motivated and enjoyed** participating in the 8 sessions until the end of the training.



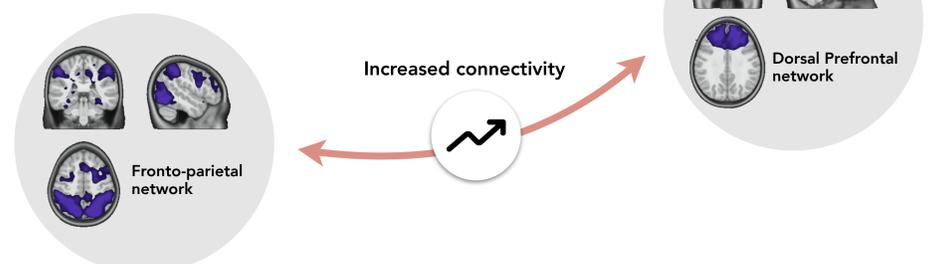
### Neuropsychological tests

► Most of children showed faster reaction times without accuracy trade-off. This result underlines a **stronger attentional focus** in the exercise performed and a **higher cognitive control**.

### Functional MRI

#### Connectivity at rest

Strength to which activity between a pair of brain regions correlates over time



► Connectivity strength between **Fronto-parietal** and **Dorsal Prefrontal** networks significantly increased after the EEG-NFB training. These findings echo the behavioral results and suggest a **greater signal transmission between brain areas involved in attentional control**.

## PERSPECTIVES

- To make the EEG-NFB treatment more accessible, we envision transposing our **virtual classroom to the child's home or in pediatric consultation** thanks to a combined Virtual Reality - EEG helmet.
- This highly adaptable environment can also be reused to treat other pathologies (autism, emotional disorders, etc.).



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