General public summary

A hallmark of cognition is the ability to monitor internal states. Monitor of internal states is typically studied in a paradigm where mental states are driven by simple perceptual stimuli. However, mental states can also be shaped internally without interference from external environment, such as our stream of thought. As stream of thought is difficult to measure experimentally, to investigate internally-driven processes in laboratory one can use time perception. Inherent feature of subjective time perception is its variability. Previous studies suggested that humans and animals my take into account their internal timing uncertainty, and thus an ability to monitor temporal error. However, only recently possibility to introspect about time errors was investigated in humans.

To illustrate the problem of error monitor of perceived time, imagine playing darts with closed eyes. You throw a dart. Of course, without vision you don't know where the dart landed. Could one nevertheless accurately guess the dart's position? In fact, current evidence suggest that one would be able to accurately estimate the dart's position. In collaboration with Dr. V. Doyère and Dr. V. van Wassenhove, I recently developed a modified version of that unusual game to enable us to investigate error monitoring in the lab. However, instead of spatial dimension we used perceived passage of time.

To assess the underlying brain mechanisms and understand how internally driven brain dynamics is monitored, we developed a novel behavioral task that can be used both in humans and rodents, in line with translational approach. The project aims to use causal methods in order to inhibit selective brain area's activity (with transcranial magnetic stimulation in humans, and infusion of GABA agonist in rats) to first identify brain networks crucial for temporal error monitoring. Second, neuronal activity will be recorded using electroencephalography in humans and local field potentials together with spiking activity in rats. Combination of causal methods with electrophysiological recordings in humans and rats will provide critical information to understand temporal error monitoring, thus bringing wider perspective of brain machinery allowing to monitor mental processes.