Figure 1. Rahnev Lab.
From left to right, Farshad Rafiei, Jiwon Yeon, Dobromir Rahnev, Nadia Haddara, Medha Shekhar.

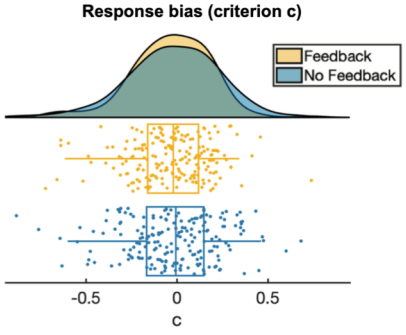

Figure 2. Does feedback help people improve their task performance?
In a behavioral study, Nadia found that feedback had no effect on perceptual or metacognitive sensitivity but that it significantly reduced both perceptual and metacognitive bias (less extreme criterion values – see tails of the distribution).

Summary:
How does the human brain utilize outside sensory signal to make perceptual decisions? How confident are we in our perceptual decision and why does the level of confidence in our decision change? In Rahnev Lab, we study how humans make perceptual decisions and judge confidence levels using sensory signals, as well as, what brain regions are involved in these processes. We use various methods for our research, such as behavioral responses, functional magnetic resonance imaging (fMRI), transcranial magnetic stimulation (TMS), TMS-fMRI, and computational modeling. The behavioral response is the most powerful tool to observe how humans react to presented stimuli. We frequently use this method to see how people perceive and respond to stimuli (Figure 2). fMRI and TMS are used when we want to look into the brain regions that are responsible for specific cognitive functions. While fMRI shows what brain regions are activated in a specific experimental condition (Figure 3), TMS disrupts a particular brain region temporally to determine what happens if the area does not function normally (Figure 4). We are also working on developing a concurrent TMS-fMRI setup so that we can observe brain activation while simultaneously stimulating specific regions of the brain that are responsible for different functions (Figure 5). Some of our work includes computational modeling of behavioral and neural responses, by which we estimate how the brain would react to new stimuli in order to understand how the brain functions systematically.

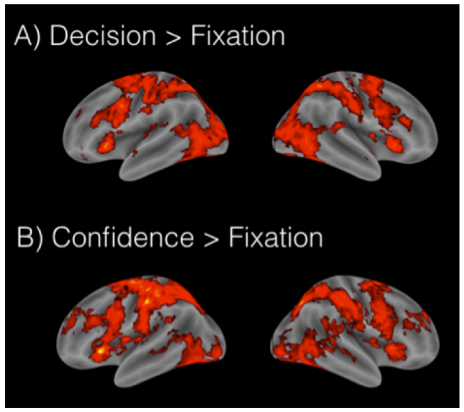

Figure 3. Brain regions involved in computing perceptual decision and confidence judgment. Jiwon observed largely overlapping brain regions that are responsible for the two processes. Moreover, a few unique regions are activated for confidence computation.

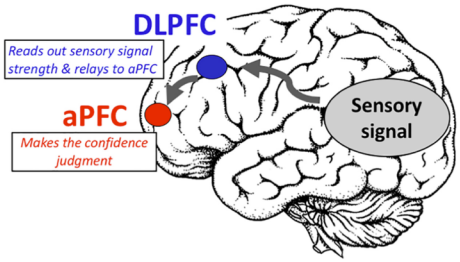

Figure 4. Hypothetical neural mechanism of confidence computation.
Medha found evidence that DLPFC reads out the strength of the sensory signal and relays it to aPFC in confidence computation by stimulating each region with TMS.

Figure 5. TMS-fMRI setting.
Farshad (lying down) and his collaborators, Martjin Wokke (Right; SUNY) and Martin Safrin (Left; UCLA). Farshad's project aims to deliver TMS while scanning MRI images.

Rahnev Lab