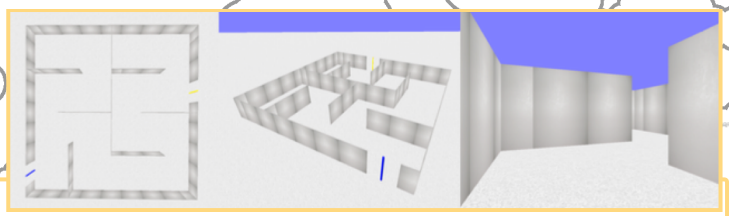
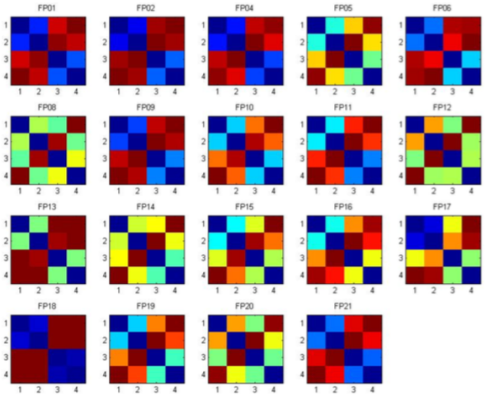
Navigation Proficiency Assessment (NPA)



In this experiment, I developed a game-like assessment of navigation ability in which people completed mazes of increasing size until they were unable to solve them without getting lost. Results indicated that there were two groups of subjects separable by navigation ability which was moderately correlated, but not explained by gender differences, and showed limited correlation with experience playing video games. This inspired a follow-up study looking at the differential effects of informative visual cues on each group of subjects: advanced navigators and basic navigators. **(Key Competencies: Python programming, assessment design, test reliability and validity)**

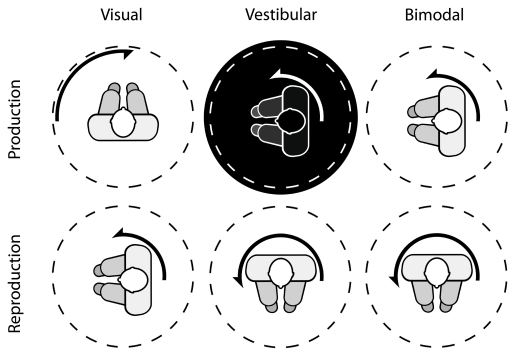
Neural correlates of navigation ability



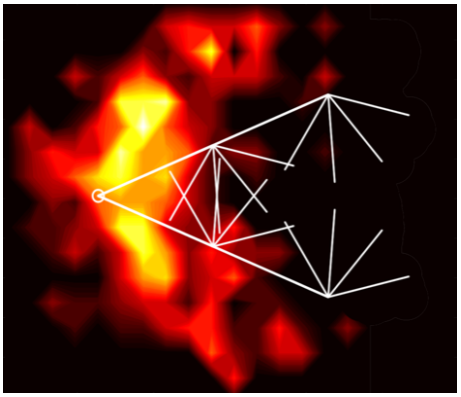
The NPA was used to identify two groups of subjects: advanced and basic navigators. The subjects' brain activity was recorded under 3 conditions and the similarity between activity in 7 anatomically defined regions were correlated across conditions. The dissimilarity matrices (DSMs) showed that, in most brain areas, activity was driven heavily by the visual input, regardless of navigation task. However, in the superior and inferior partial cortexes the effects of navigation strategy was widely variable. This was unfortunately not aligned with categories of basic and advanced navigators. **(Key Competencies: MRI imaging, experimental design, quantitative statistics)**

Multi-sensory integration during turning

We explored how humans use visual and vestibular information to update their representation of space while turning. The experiments themselves used a cleverly-designed rotating chair enclosed in a separately rotating drum in order to control which sensory information is available to the subjects. Using a Bayesian model of human cognition to predict subjects' behavior, we discovered that: 1) individuals may not use all available information when turning, but generally speaking most subjects do and 2) sensory experiences of turning are not stored as separate sensory experiences, but instead as a holistic experience. **(Key Competencies: Bayesian modeling, model comparison, MATLAB programming)**



Our mind's spatial frame-of-reference



We employed Bayesian models again to predict how people would walk back to their starting location after walking along two outgoing paths separated by one angle. Based on people's systematic errors and how well our 3 models predicted participant's behavior, we determined that our participants were navigating using an egocentric frame-of-reference. In other words they maintained estimates of the distance home and the angle required to turn home. Although this may seem intuitive, this represents an unlikely finding in a decade-long debate. **(Key Competencies: motion tracking, data visualization, data pre-processing)**