

# Game Description Document: Egocentric Exploration Task (MRI Edition)

## 1. Overview

**Title:** Egocentric Exploration Task (MRI Edition)

**Purpose:** To investigate egocentric spatial perception by having participants navigate a virtual arena and learn the location of a target item based on auditory cues. The task is designed to run inside an MRI scanner, ensuring compatibility with the scanner's constraints while capturing data on navigational decisions and associated neural activity.

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## 2. Objective

Participants are required to explore a virtual, round arena using an MRI-compatible input device. During navigation, auditory cues indicate the location of a target item. The participant's goal is to learn and later recall the target's position. The exploration phase aims to simulate real-world navigation from a first-person, egocentric perspective.

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## 3. Gameplay Mechanics

### 3.1 Navigation Phase

- **Environment:**
  - A virtual, dark, round arena is rendered on an MRI-compatible display (e.g., goggles or rear-projection screen).
  - The arena is designed as a smooth circular plane that provides consistent spatial references.
- **Movement Controls:**
  - **Forward/Backward Movement:** Controlled by the up and down arrow keys (or MRI-compatible buttons/joystick inputs).
  - **Rotation:** Controlled by the left and right arrow keys, allowing the participant to change orientation as they navigate.
- **Auditory Cues:**
  - Specific locations within the arena are associated with distinct auditory cues delivered through MRI-compatible headphones.
  - Each cue corresponds to a target item whose position the participant must learn.
- **Task Instructions:**
  - Participants are instructed to navigate the arena and pay attention to the auditory cues.

- They must actively memorize the target's position relative to their current viewpoint.
- Movement continues until the participant presses the "Enter" key, which signals the end of the exploration phase.

### **3.2 Transition to Annotation Phase**

- Upon pressing "Enter," the exploration task stops, and the participant is transitioned to an annotation phase (which may occur immediately or after a brief pause).
  - In the annotation phase, participants are presented with a 2D representation (map) of the arena where they must indicate the location of the target.
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## **4. Technical Considerations**

### **4.1 MRI Compatibility**

- **Immobility:**
  - The participant remains in a supine position in the scanner.
  - Movement is simulated via input devices (joystick or button box) that are designed for minimal physical disturbance.
- **Input Devices:**
  - All control devices (joystick or MRI-safe button boxes) are MRI-compatible to prevent interference with the scanner's magnetic field.
- **Display System:**
  - Visual stimuli are presented through an MRI-compatible display (either a rear-projection system or specialized goggles), ensuring clear visibility while lying down.

### **4.2 Synchronization**

- **Timing and Synchronization:**
    - The task is synchronized with the MRI scanner's trigger signals to ensure that all navigational events and auditory cue presentations are precisely aligned with neural imaging data.
    - Data logging includes timestamps for movement updates, auditory cue presentation, and the transition to the annotation phase.
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## **5. Experimental Procedure**

### **5.1 Pre-Scanning Training**

- Participants undergo a brief practice session outside the MRI scanner to become familiar with the navigation controls and task objectives.
- The training includes a simplified version of the exploration task to reduce learning effects during the actual scanning session.

## 5.2 Scanning Session

- **Exploration Phase:**
    - The participant begins in the virtual arena and uses the MRI-compatible controls to navigate.
    - Auditory cues are presented at pre-determined locations. The participant's task is to explore the environment and learn the target's location based on these cues.
    - Movement data (position, orientation) are recorded continuously.
  - **Transition:**
    - Upon completing the exploration phase by pressing "Enter," the task transitions to the annotation phase.
    - This transition may coincide with a break in image acquisition or occur during a separate functional run.
  - **Annotation Phase (Post-Exploration):**
    - A 2D map of the arena is displayed.
    - The participant uses an MRI-compatible input device (e.g., a button box or a trackball) to annotate the target location on the map.
    - The annotated data is logged for later analysis.
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## 6. Data Collection & Analysis

- **Behavioral Data:**
    - Continuous logging of navigation data (x, y coordinates, orientation) during the exploration phase.
    - Timestamped records of auditory cue presentations and the key press events.
  - **Annotation Data:**
    - The 2D coordinates on the map where the participant indicates the target's location.
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