Obstacle Avoidance Application:

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Description of the Application design:

The application will consist of 6 main components, those being the cursor, start position, occluder bar, left and right obstacles and the target. The cursor will be what the user in the trial controls and what the application will be tracking. The occluder bar will hide the cursor briefly then trigger a change to the layout of the left and right obstacles to force the user to make a reaction to the change giving out scientist information that is important to his study. The user will start at the start position located at the bottom of the screen then advance upwards towards the target which will turn red once it is reached. When a user first loads up the trial they will be prompted to enter their participant ID before progressing to the trials, this ID will be used to correlate who this user is, so that the application can track and store data regarding how that participant did in their trials. After the ID is entered and verified they will move on to a description of the trials, and then into the actual trials from their where their speed and collisions will be tracked trial by trials to get valuable data for the scientist.

UI Domain and Description:

The UI Domain this application belongs to is in the realm of Interactive Research Interfaces. This application is an interactive interface in which participants will undergo a pre-determined number of trials where data regarding their time taken to complete the trial, number of collisions in the trials and age of the participant are all taken into account in order to conduct research on the impact of age on reaction time. For this reason we believe that the best UI Domain for this application will be in Interactive research interfaces.

List of heuristic usability principles for the design's UI domain:

Visibility of system status:

- The application should always inform the user about what is currently happening. Example for the application would be showing a clear "Trial Started" indicator when the participant begins a trial.

Match between system and real world:

- The application should use visuals and language that are familiar to the user. Such as a green "start area" and red collision feedback, or even a popup describing that a collision has occurred.

User control and feedback:

- Users should be able to restart a trial if the cursor is to go off-screen or they are to navigate to another tab by accident. Essentially users should be able to undo or exit unintended actions without a penalty.

Error Prevention:

- The design should minimize opportunities for mistakes, such as accidental collisions caused by unclear obstacle boundaries or ambiguous instructions.

Consistency and Predictability:

- Trial layouts, feedback mechanisms, and navigation should behave consistently so participants can focus on performance rather than interface mechanics.

Minimal Cognitive Load:

- Since the application measures reaction and motor performance, the interface should avoid unnecessary visual clutter or complex interactions that could interfere with the task.

Clear Feedback on Performance:

- Participants should receive immediate and unambiguous feedback when collisions occur or when a trial is successfully completed.

Potential Usability Problems

1. **The participant ID entry screen lacks validation feedback.**
   If an invalid ID is entered, the user may not understand why they cannot proceed. This violates *Visibility of System Status*.
2. **No clear indication of when a trial officially begins.**
   Participants may start moving prematurely or hesitate, affecting timing data. This violates *Visibility of System Status*.
3. **Collision feedback may be ambiguous.**
   If freezing or flashing is subtle, users may not realize they collided. This violates *Clear Feedback on Performance*.

Usability Concerns Illustrated Through a Short Story

During a trial, Jane enters her participant ID and prepares to begin, but the interface provides no clear indication that the trial has officially started. Unsure whether timing has begun, she hesitates before moving the cursor, unintentionally inflating her recorded reaction time. As she navigates toward the target, the cursor briefly disappears behind the occluder and the obstacle layout changes; moments later she clips an obstacle, but the collision feedback is subtle and she is uncertain whether an error occurred. Shortly after, Jane accidentally clicks outside the browser window and returns to find the cursor misplaced, yet the application offers no option to restart the trial. Forced to continue, she completes the task knowing her performance data is no longer accurate. This combination of unclear system status, ambiguous feedback, and lack of recovery mechanisms results in corrupted data and participant frustration, demonstrating how these usability issues critically undermine both user experience and research validity.