PROJECT XAI

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Problem Definition

While AI allows for newer and more efficient methods of accomplishing tasks, the impact of this collaboration is still not fully understood. Our team designed an interface for researchers in the Neuromotor Control and Learning (NMCL) to customize and perform experiments with human-robot interactions that involve AI explanations (XAI), which could give insight into the impact of this cognitive load and how systems can be better designed to optimize collaboration.

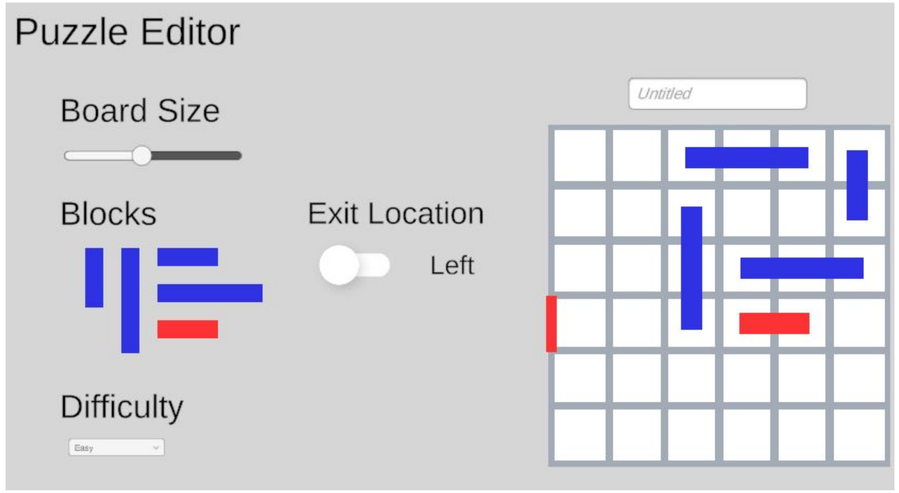
Applications

- Lab wants to optimize trust and cognitive load with the use of robot explanations during collaboration

Major Goals

- Integrate AI explanations into the existing research infrastructure.
- Give researchers options to design experiments to closely study the cognitive impact of XAI collaboration.

Cognitive Load in Collaborative Puzzle Solving



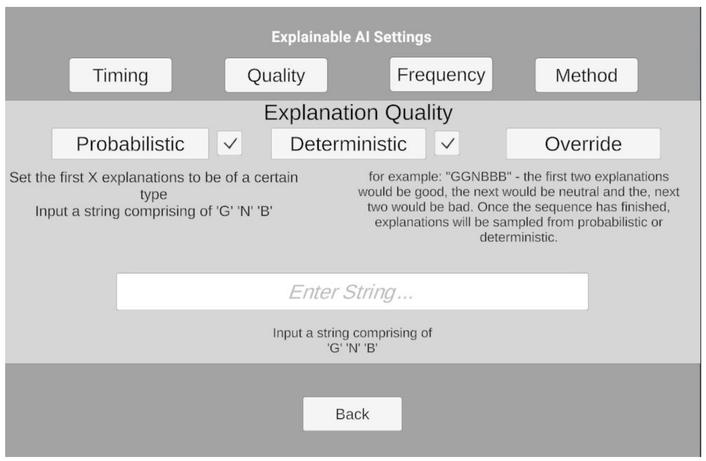
Electroencephalography (EEG)

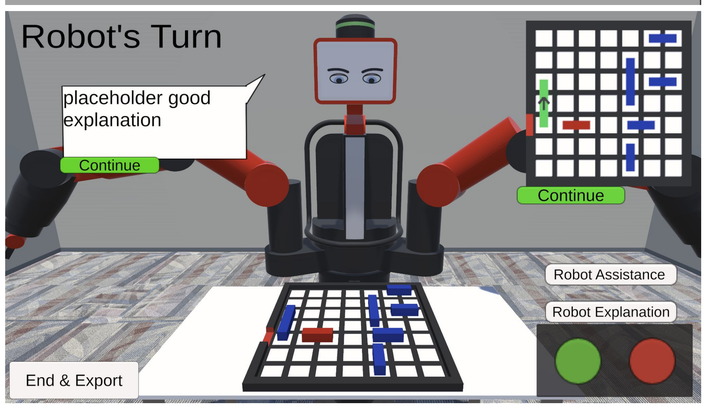
- EEG measures brain activity
- Puzzle solving invokes observable load on brain activity measurements, which can be studied during use of the program
- Robot involvement/explanations in puzzles causes shifts in cognitive load

Rush Hour Logic Game

- Goal of the game is to get the red “car” through the gate
- User and robot take turns moving blue “car” obstacles
- Puzzles range from simple to complex

Final Design





Parameter Customization

- Researchers can tweak robot behavior and explanations to study the resulting changes in cognitive load

Quality of Explanations

- Varying accuracy/complexity of explanations (good, neutral, bad)
- Can be sampled randomly in a probabilistic manner, or set in a determined order

Timing & Frequency

- Explanations can be set to occur before, during, and after moves
- Explanations can be set to occur every move, or spaced out

Types of Explanations

- Graphs, text pop-ups, and audio prompts can be used to convey explanations

On-Demand Robot Actions

- User may request a robot explanation or active assistance

Future Applications

The conclusions obtained from this research gives insight into how human-robot collaborations could be designed more optimally.

AI Driving Assistance

- Finding optimal method/amount of AI involvement with driving and directions
- Reducing cognitive load while still involving the driver to ensure road safety

Airplane AI Copilot

- Reducing cognitive load of the pilot while still maintaining safe control of the aircraft

Robot/Doctor Collaborative Surgery

- Providing helpful explanations without overbearing surgeon cognitive load, which could lead to critical mistakes