Measuring Curiosity in Virtual Reality Classrooms
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Introduction:
- Traditional college lectures are not engaging.
- Explore the role of curiosity as a tool to optimize learning.
- Previous studies have used neuroimaging techniques, such as Electroencephalogram (EEG) to measure curiosity induction in lab settings.
- Curiosity is difficult to study in real-world due to situational factors.

Research Question:
- Can we identify the EEG fluctuations associated with curiosity to improve classroom engagement?
- Can we successfully merge VR and EEG to allow for more accurate testing of the effect of curiosity on learning?

Virtual Reality Environment:
- Used a virtual medium-sized college lecture hall in which participants were exposed to trivia (Figure 1).
- Participants rated their curiosity and satisfaction by interacting with cubes placed on desk in front of them.
- Implemented a timed collision event to collect event markers (Figure 2).

Methods:

Wired EEG in Lab:
- Developed trivia paradigm modeled after Gruber et al., 2014 (Figure 1, 2).
- Collected highly accurate EEG measurements using a 64-channel electrode cap on 10-20 EEG system (Figure 4).
- Participants progressed to Q&A phase after selecting low (1-3) and high (4-6) curiosity for 50 questions each (Figure 1).
- Participants were instructed to think about the answer during 4-second anticipation phase (Figure 2).
- Participants completed a free-recall memory test in an Excel spreadsheet after removing the cap.

Muse 2 Headband in VR:
- Implemented a modified trivia paradigm (figure 3).
- Participants were exposed to 60 questions to reduce risks associated with prolonged VR exposure.
- Utilized wireless Muse 2 headband to allow participants to move their head freely in VR (Figure 5).
- Synchronized EEG data stream and event marker stream using Lab Streaming Layer (LSL) to accurately correlate brain activity with VR events.
- Data was recorded using Lab Recorder, and processed in MATLAB with the EEGLAB toolbox.

Results:
- Participants had higher recall for questions that induced high curiosity (Figure 1).
- Participants showed higher EEG theta (3-7 Hz) power frequencies during the anticipation phase (Figure 2).
- Successful communication between the VR and EEG streams (Figure 3).

Discussion & Future Work:
- Positive correlation between curiosity and memory.
- Changes in theta frequency power represent a potential curiosity EEG indicator.
- Integration of EEG and VR technology offers an unprecedented paradigm for testing methods that will optimize learning outcomes in educational settings.

References:

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