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BCI for Sports

1. Golf (any sport) teaching robot
   1. An assistant system that reads cognitive states through a BCI and uses that to 1) predict the outcome of a certain sports task and 2) improve the outcome of that task
   2. Application: golf
      1. User has a neural interface reading EEG/EMG signals, video (eye-level), and previous shot/EEG/EMG/video data to predict the outcome of the current shot.
      2. Before the user takes a swing, the assistant stimulates the brain or muscles to assist the user’s swing to improve the outcome.
   3. Neural congruence: 5 (In the form of stimulation, could be perceived as touches)
   4. Distribution of Agency: 4 (Single player but also controlled by your ‘past self’ in the form of stimulation)
2. Sports experience BCI
   1. Immersive entertainment system that uses stimulation of sensory cortices to simulate the sports experience.
   2. Application: boxing
      1. Paired with a VR system where you *see* the boxing match in a first-person view, the impact of punches is delivered to the viewer’s somatosensory cortex
      2. Removing painful stimuli would be necessary to keep this an ethical system
   3. Neural congruence: 7 (direct stimulation simulating sensory experience of boxer)
   4. Distribution of agency: 2 (not controlled by the boxer, but the experience is controlled by the boxer’s experience
3. Training using imagined actions neural interface
   1. Simulated training interface using EMG (predictive signals) for pre-execution muscle activity
   2. Application: basketball
      1. User puts on electrodes on ‘key’ muscles
         1. Basketball: calves, thigh, shoulders, wrist/fingers, arm, etc.
      2. Detect planned movements via EMG decoder
      3. Visualization of outcome (shot) is displayed in VR or screen where the user uses that to train their shot
   3. Neural congruence: 2 (displayed as outcome in the sport — in basketball, the trajectory of the basketball)
   4. Distribution of agency: 4 no agency is compromised
4. Training via experiencing others
   1. EMG readings of a ‘coach’ is then sent to ‘players’ to experience. In sports, many coaches teach by describing certain sensations which are often difficult to understand. By stimulating players with the coaches movements, players could better understand mechanics.
   2. Application: basketball
      1. Coach wears EMG electrodes on ‘key’ muscles during a shot while players are hooked up to stimulators. The players experience the coach’s shot through stimulation of muscles to have a more immersive understanding of the shot mechanics
   3. Neural congruence: 6
   4. Distribution of agency: 3 (coach controls the stimulation but does not compromise the player’s agency)