

# The Effect of Team Familiarity in Collaborative Learning Tasks: An AR+EEG Exploratory Study

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## OBJECTIVE

### The Goal of This Study

Investigating the influence of **team familiarity** on **group decision-making process** and its consequent **task performance**.

The **electroencephalography** (EEG) signal is captured to further identify participants' decision-making processes.



### Research Motivation

Collaborative tasks that rely on technology can hardly be separated from our everyday life.

Studies show collaborating with acquaintances can contribute to better outcomes than nominal groups, where participants believe their strategies are **more effective when co-working with an acquaintance**.

## METHODOLOGY

### 1 Experimental Designs

The experimental design allows us to explore how team familiarity influences collaborative behaviors and decision-making process.

Participants have to collaboratively navigate a helicopter to **avoid obstacles, visit destinations and collect award flags** as many as possible.

Participants will **discuss** with each other to **develop strategies** to complete the tasks.

16 pairs of users will be recruited.

- Half of the participants know each other prior to this study
- the other half of participants will be paired with strangers



Screenshot of Collaborative AR Task  
Courtesy of CSI Lab @ ASU



Snapshot of Collaboration in One User Study  
Courtesy of CSI Lab @ ASU

### 2 Research Methods

#### Familiarity Measures

Team familiarity and task efficiency will be studied. Familiarity will be measured by a pretest that contains questions about participants' **collaborative experience and how long they have known each other**.

#### Performance Measures

The numbers of **flags successfully collected** will be the measurement of task efficiency.

The AR system log and its associated behavioral data will be collected, which allows us to study the connections between participants' **actual behaviors and their brain activities**.

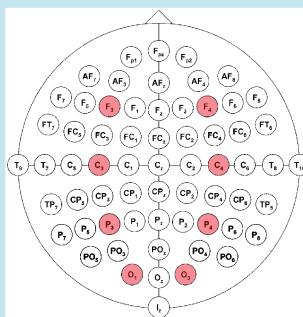
#### Brain Activity Measures

This study synchronizes the participants' operations with their EEG signals, which link the variation of EEG signals to **specific cognitive events**.

Low Beta (12.5-16 Hz)	Quiet, Focused, Introverted, Concentration
Medium Beta (16.5-20 Hz)	Increases in Energy, Anxiety, and Performance
High Beta (20.5-28 Hz)	Significant Stress, Anxiety, Paranoia, High Energy, and High Arousal
Low Gamma (30-50 Hz)	Cognitive Functioning, Learning, Memory, and Information Processing

Brain waves and the activities they are involved in

By analyzing the frequency and amplitude of the waves, different **brain activities patterns** can be modeled, such as learning or problem-solving.



EEG signals will be acquired via **eight spiked dry electrodes\*** based on the self-designed amplifiers.

\*left frontal (F3), right frontal (F4), left central (C3), right central (C4), left parietal (P3), right parietal (P4), left occipital (O1), and right occipital (O3).

DATA COLLECTED	APPLICANCE
Task Performance	Main measurement
Interaction Time Completion Ratio Communicative Behaviors	Operations $\Leftrightarrow$ Behaviors with brain activities
EEG Signals	Study the process of collaborative decision-making