ID: 661

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Title:
Decoding the neuroscience behind truth evaluation: a multimodal investigation of human-ai interaction dynamics through EEG, eye movements, and facial metrics

Primary Area:
Experimental

Is the first author a Psi Chi member? :
Yes

Is the first author an undergraduate student (or recently graduated and not yet in graduate school)? :
Yes

Does the study (or proposed study) have Institutional Review Board (IRB) or relevant authority approval? :
No

If review of your study for approval is pending, please indicate the date you expect a review.:
November 15th

Name of faculty sponsor (if you have more than one, please list all here separated by commas, do not include affiliations or honorifics [e.g., Dr.], do not capitalize all letters of author names):
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First author contribution:
Study conception and design;Data collection;Data analysis or analysis plan;Interpretation of data;Conclusions or implications;Writing and revising the abstract

To what extent did the faculty mentor(s) contribute to the project? :
Study conception and design;Data analysis or analysis plan;Interpretation of data;Writing and revising the abstract

If you are the first author of two abstracts accepted for presentation at MPA, would you prefer to present both posters in the same session or in separate sessions?:
Not applicable

Abstract:

Given the rapid ubiquity of artificial intelligence (**AI**), it is crucial to understand the neural, physiological, and cognitive mechanisms underlying human information processing during human-AI interactions. Previous research has focused solely on behavioral responses to AI-generated misinformation and general human-AI interactions. Instead, this study examines the neurological and physiological correlates associated with the information verification processes. This study used a multimodal analysis to investigate how individuals assess the authenticity of information presented by different AI systems. To begin, participants assessed exposure and attitudes toward AI technology. Participants were then randomly assigned to interact with one of 5 chatbots (*configured using OpenAI's Custom GPTs*) varying in behavioral profile, persuasion routes, and suggestion methods. Each chatbot exhibits behavior based on archetypal profiles that embody a spectrum of information distributors, ranging from an honest professor to a Machiavellian and charismatic misleading skeptic. The chatbots employ subtle and tactical deception, misinformation, and persuasion methods to convince the participants of faulty information regarding general knowledge topics. After a timed discussion period with the chatbot, participants completed an assessment of the issues and concepts discussed in the AI conversation originating from the general knowledge concepts and questions.

We utilized an integrative approach to characterize the neural and physiological signatures indicative of cognitive load. Several documented physiological metrics which have been previously beneficial in measuring cognitive load were acquired while participants interacted with the chatbot: EEG signals were recorded via a 32-channel Brain Vision system, pupillary responses were recorded via an eye tracker, and oxygen saturation was recorded via a wrist-mounted pulse oximeter. We plan to examine EEG oscillations, cognitive pupillary reactions, and pulse oximetry to elucidate the neural dynamics associated with the perceived authenticity of AI-provided information. We predict that cognitive load will vary as a function of the behavioral profile of the chatbot and, specifically, that Machiavellian deceit will result in the highest cognitive load. Specific physiological patterns, such as increased EEG theta activity, more significant pupillary response, and decreased blood oxygen, will indicate high cognitive load. The results of this project have the potential to contribute to a theoretical framework of human-AI information processing and offer insights for developing digital literacy interventions and cognitively optimized AI systems. By identifying neural and physiological correlates of information verification—including EEG patterns, eye movements, and core vitals—this study lays the groundwork for enhancing user interactions with AI technologies to support critical thinking, increase awareness, and reduce susceptibility to misinformation.

Short Abstract:

This study uses EEG and multimodal analysis to investigate neural and physiological markers of cognitive load in human-AI interactions. By analyzing responses to chatbot profiles varying in persuasion and deceit, it aims to identify indicators of information verification to inform digital literacy and system design that enhances critical thinking.

Data Blitz:
Yes