

Coding One Term Projects

EEG-Driven Interaction in Human-Machine Communication

1. Project Description

In this project, we invite you to combine the technical skills you have learned with your creativity, as you explore how human-machine communication can become more intimate, expressive, and personal. You will create an interactive experience using EEG data collected in class, which will drive an interaction between a human and a digital agent—an agent that could take the form of an environment, artwork, or virtual object. The aim is to develop a compelling narrative about human-machine interaction, exploring how technology can connect with physiological data and create meaningful engagements.

Think of this project as an opportunity to tell a unique story on the intersection of biological and computer systems—a story that leverages your technical abilities and imagination. Your digital agent will be responsive to the biomarkers of neural activity, using this data stored in CSV files to guide its behaviour. The interpretation of these signals is open-ended; you have the creative freedom to decide what your data represents and how the agent should respond, thus making the technology feel more *human* and connected.

1.1 Objectives

The final project is an opportunity to showcase your learning by developing a computationally creative interactive design. The project should:

- Demonstrate the proficiency in critical, independent thinking, Python programming, and creative inquiry.
- Apply key concepts from the lectures and tutorials to build the interactive aspects of your project delivered in the form of well formatted, readable and error free code.
- Reflect on your process, learnings and challenges. This should be delivered as a written report following the [ACM Conference Proceedings Primary Article Template](#)

1.2 Requirements

- **EEG Data Utilisation:** You will collect EEG data using the Muse headband during class, and a basic script will be provided for processing and cleaning the data. Your focus will be on creatively using this EEG data to drive interactions with your agent. You are encouraged to decide what the EEG data represents—whether it reflects emotional states, focus levels, or another condition—and how it shapes your agent's responses.
- **Creative Inquiry:** Create a narrative element through an interactive experience that expresses your views on the future of human-machine communication.
- **Python Skills Integration:** The project should showcase multiple Python skills learned during this course, such as data handling , file input/output (I/O) operations, and Object-Oriented Programming. These skills should be used to create a cohesive and functional interactive system.
- **Interactive Design:** Your project should feature an engaging, interactive component—it could be anything from a game-like experience in Pygame to a creative virtual interaction where EEG data drives visual or auditory responses. The interaction should clearly establish a connection between EEG signals and the behaviour of the agent.
- **Agent Concept:** Design an "agent" that responds to EEG input. This agent can take many forms: a digital artwork that changes colors and patterns based on your mental state, a virtual object that reacts to your emotions, or something else entirely. The focus should be on creating a dynamic, responsive interaction.

2. Submissions

2.1 Creative Brief Submission (due Friday 15/11 2024)

Before you start developing your project it is important to dedicate some time to conceptualise the idea you want to share. Your Creative Brief should include:

- **Concept Description:** An explanation of the narrative and the interaction you want to create. Describe the story your project will tell about human-machine communication and the meaning of EEG data in your project.
- **Technical Scope:** An outline of the techniques and resources you plan to use, including any specific libraries (e.g., Pygame, pandas), software, and data.
- **Contextual Research:** Situate your project within the broader field of robotics. Mention artists, engineers, or designers who have influenced your approach

and how your work builds on these ideas.

- **Reflect Individual or Collaborative Effort:** You may work individually or in pairs, with expectations scaled accordingly. If you decide to work in pairs be sure to describe in detail the responsibilities each person had in the project development. Work has to be divided so that each person has a role in both the creative and technical side of the project.

2.2 Final Report & Files (due 2pm (14:00) GMT, Friday 06/12 2024)

Report

Report showing the process of the project development and your independent inquiry is as important as the code files. It should clearly document your work. For this purpose you are provided with the Association for Computing Machinery (ACM) Template used for conference publications.

The report should include:

Abstract: Summarise the key elements of your project, including its purpose, key findings, and contributions. This section should provide a concise overview that highlights the unique aspects of your work.

CCS Concepts: Provide the ACM Computing Classification System (CCS) concepts that are relevant to your project. Use appropriate keywords and categories that reflect your project's focus on topics such as human-machine interaction, physiological data analysis, and creative coding.

Keywords: Include a list of keywords that represent the core topics of your project, such as EEG data, creative robotics, human-machine communication, physiological computing, Pygame, and interaction design.

Report Sections:

1. **Introduction:** Provide an overview of the concept and objectives of your project. Explain what motivated the idea and how it fits within the broader context of human-machine communication.
2. **Background:** Describe the research that informs your project. This could include a review of related works—relevant projects, technologies, artists, or research papers that influenced your approach. Establish how your project builds upon or diverges from these inspirations.
3. **Technical Implementation:** Detail the technical aspects of your project. This section should include:

- **Data Processing:** Explain how the EEG data was collected, processed, and cleaned. Include any challenges faced and how they were addressed.
 - **System Architecture:** Describe how the project was structured, including any key classes, functions, or modules developed. Discuss your use of Object-Oriented Programming, data handling, and integration of libraries (e.g., Pygame).
 - **Agent Design:** Outline how the agent was developed, its different states or behaviours, and how it responds to the processed EEG data.
4. **Process:** Discuss the creative process behind designing the interaction. This section should emphasise the narrative element and the connection between physiological data and your digital agent. Describe the aesthetic choices and the conceptual reasoning behind the interaction design.
 5. **Results:** Present your process of testing and refining the interaction. Highlight what worked well, what challenges you encountered, and how you iterated upon peers feedback or technical issues.
 6. **Reflection:** Critically evaluate the outcomes of your project. Reflect on how effectively the project meets your original objectives, and discuss the significance of the interaction you've designed. This section should also mention any limitations of your project and suggest areas for future development.
 7. **Conclusion:** Summarise what you learned during the development of your project. Consider both the creative and technical lessons, and reflect on how this experience contributes to your understanding of human-machine interaction.
 8. **References:** List all resources cited in your report, including articles, books, documentation, and other projects that informed your work. Use the APA citation format.

Project Files

Project files should be organised into folders so that after the zip extraction the project can be run immediately. The failure to meet this requirement will result in the Project Files not being considered in the final grade. Please use the requirements file to include any imports needed. More information on using the requirements in your project can be found in the [pip](#) and [Microsoft](#) documentation.

Report in a pdf format and Project Files should be submitted as a Zip folder via Moodle and via email to sonia.bionic@gmail.com , maximum file size 100MB.

3. Assessment

Projects are marked against 5 assessment criteria.

- **Enquiry:** active learning and reflection. It's how you explore, research and learn about your subject. Enquiry is central to all creative learning at UAL.
- **Knowledge:** how you inform your work, explore diverse cultures and connections and appreciate what you do in a wider context.
- **Process:** your journey of learning. It's how you take risks and experiment. And how you keep the creative momentum going – developing ideas from start to finish.
- **Communication:** telling the story of your learning and making. It's how you share your learning with an audience, presenting and explaining your work to different people.
- **Realisation:** the work you create and how this reveals what you've learned. It's taking a look back and evaluating the work you've produced.

A detailed explanation can be found on the Assessment and Marking Criteria UAL page ([Assessment | UAL](#)). The components of the grading scale Assessment Criteria Level 7 are as follows:

3.1 Feedback

Date to expect feedback by: 20 January 2025

You will receive feedback online via Assessment Feedback. Please note grades and feedback are indicative until confirmed following the Exam Board.

Submission queries: Please contact cci.pg@arts.ac.uk and/or sonia.bionic@gmail.com in advance of the submission deadline.