UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Elements of Human-Technology Interaction

2627-2-F5109P022

Learning area

Applied Experimental Psychological Sciences

Learning objectives

Knowledge and understanding
By the end of the course, students will know and understand:

- the main concepts of Human-Technology Interaction, Human-Computer Interaction, User Experience, interaction design, accessibility and inclusiveness;
- the role of cognitive, perceptual, attentional, memory-related, motivational and social processes in the design and evaluation of interactive systems;
- the user-centred design cycle: needfinding, task analysis, requirements discovery, generation of design alternatives, prototyping, evaluation and revision;
- characteristics, potential and limits of emerging technologies such as virtual reality, augmented reality, mixed reality, conversational systems, AI/ML-based systems, social robotics, wearable technologies, game engines and recommender systems;
- the basic principles of computational thinking and prototyping with digital tools, including Figma and Unity3D;
- how innovative products integrating new technologies may generate benefits, risks or use problems due to design choices, technological constraints, user expectations or lack of understanding of the impact of technology.

Applying knowledge and understanding
By the end of the course, students will be able to:

- apply psychological, cognitive and interaction design principles to the analysis of concrete Human-Technology Interaction problems;
- identify needs, tasks, contexts of use, technological constraints and user requirements;
- critically evaluate interfaces, products and systems integrating new technologies, identifying design errors, good design practices, technological limits and possible effects on user experience;
- analyse innovative products, including products awarded or presented in international technology innovation contexts, distinguishing between the actual value of the solution, technological novelty, feasibility, sustainability, usability and user impact;
- propose design solutions consistent with user needs and technological constraints;
- select appropriate methods and metrics to evaluate the effectiveness of an interactive solution;
- develop or discuss a prototype, a design proposal or an evidence-based evaluation of a technology or product.

Making judgements
Students will develop the ability to make autonomous and critically grounded judgements on theories, empirical evidence, technologies, products and design solutions. In particular, they will learn to recognise implicit assumptions, strengths, methodological limitations, technological constraints and possible threats to validity; evaluate whether a technology is actually necessary or whether simpler, cheaper, more accessible or more effective solutions are available; and justify design trade-offs concerning usability, accessibility, cognitive load, safety, inclusion, trust, cognitive biases, privacy and social impact.
These skills will be developed through guided discussions, case analyses, presentations of technologies, products and scientific papers, invited talks, exercises and design-oriented activities.

Communication skills
Students will acquire communication skills to present and discuss technologies, products, scientific evidence and design solutions in a clear, structured and scientifically grounded way. Course activities will develop the ability to use the disciplinary vocabulary of HCI, UX and interaction design; present emerging technologies by describing components, capabilities, limits and implications; communicate critical evaluations of technological products; discuss scientific papers and design cases; and collaborate in small groups while making each member's individual contribution explicit.

Learning skills
The course promotes students' ability to continue learning autonomously in a rapidly evolving technological field. Students will be guided to approach a new technology systematically, analysing its definition, components, capabilities, limitations, costs, metrics and applications; identify scientific sources, technical documentation, tutorials, examples, use cases and comparisons between solutions; distinguish reliable sources, commercial sources and non-neutral opinions; and transfer the acquired competences to new technologies and application contexts.

Contents

The course provides an overview of Human-Technology Interaction, with particular attention to the application of psychological knowledge to the design, prototyping and evaluation cycle of interactive technologies. The course will address user-centred design, methods for understanding user needs and tasks, prototyping and evaluation techniques, and the application of these methods to digital interfaces, web tools, immersive technologies, conversational systems, artificial intelligence, robotics, wearable technologies, serious games, gamification and innovative technological products.
A relevant part of the course will be devoted to the critical evaluation of products integrating new technologies. Students will analyse how design choices, interaction quality, appropriateness of the technology, understanding of user needs and consideration of possible impacts can determine the success, failure or acceptability of a product.
The course is not programming intensive. Computational concepts will be introduced at a basic level and used as tools to understand, design and prototype interactive systems.

Detailed program

- Introduction to Human-Technology Interaction: HTI, HCI, UX, UI, interaction design, accessibility, inclusiveness and human-centred technologies.
- Cognitive and psychological foundations of interaction design: perception, attention, memory, cognitive load, human error, mental models, affordances, trust and onboarding.
- User-centred design: needfinding, task analysis, requirements discovery, interviews, questionnaires, observation, personas, scenarios, storyboards and design alternatives.
- Prototyping: low- and high-fidelity prototypes, paper prototyping, wireframes, Wizard of Oz, video prototyping, mockups and interactive prototypes.
- Evaluation: usability testing, heuristic evaluation, cognitive walkthrough, VR heuristic evaluation, A/B testing, live prototyping, metrics and limits of evaluation.
- Product evaluation and new technologies: analysis of innovative products, identification of design errors and good design choices, evaluation of usability, accessibility, safety, trust, inclusion, and psychological and social impact.
- Learning and evaluating a new technology for UX design: components, types, capabilities, limitations, costs, metrics, risks of overestimation, user familiarity and simpler alternatives.
- Web UX and interface design tools: information architecture, typography, grids, wireframes, design systems, mockups and prototyping with Figma.
- Computational thinking: algorithms, flowcharts, variables, structures, objects, classes and simple C# exercises.
- Unity3D and real-time technologies for UX design: game engines, 2D/3D environments, Unity Experiment Framework, interactive prototypes and human-behaviour experiments.
- Artificial intelligence and human-machine collaboration: AI/ML as interactive technologies, AI-ready design, cognitive biases, AI collaborators and design and ethical implications.
- Conversational and recommender systems: voice-based UX, conversational UX, conversational agents, question answering, personalisation and recommender systems.
- Virtual, augmented and mixed reality: XR hardware, input devices, calibration, latency, perception, immersion, presence, sickness and interaction techniques.
- Human-Robot Interaction and smart technologies: social robots, user profiling, behaviour adaptation, spatial, verbal and non-verbal interaction, wearable technologies and Internet of Things.
- Serious games, gamification and technologies for wellbeing, therapy and education.
- Discussion of scientific papers, invited talks and contemporary application cases.

Prerequisites

Interest in Human-Technology Interaction and in achieving a basic understanding of how digital technologies work is required. Basic knowledge of psychology, especially perception, memory, learning, research methods and experimental design, enables a more aware use of the course contents.
No previous programming experience is required. Computational concepts will be explained in an intuitive way through examples, exercises and links to cognitive and design concepts.

Teaching methods

Lessons will be held in presence and in English. Streaming, recordings or digital materials may be made available as study support when possible, but they do not replace active participation in the course activities.

The course combines lecture-based teaching, invited talks, guided discussions, case analyses, collaborative activities, flipped-classroom activities on emerging technologies, exercises, student presentations, product analyses and design/prototyping-oriented activities.

The planned structure is:

34 hours of lecture-based teaching in presence, devoted to lectures, theoretical concepts, methods, technologies, research evidence, application cases and tools for design and evaluation;

18 hours of interactive teaching in presence, devoted to discussions, exercises, group activities, student presentations, technology analyses, product analyses, paper discussions, invited talks and supervised activities;

Attendance is strongly recommended, as interactive activities contribute to the development of the applied, critical and communication skills targeted by the course.

Assessment methods

The final exam is oral. Optional in-course activities, consisting of in-class activities, may contribute up to 6 points to the final grade. The grade is expressed out of 30. Points obtained through in-class activities are added to the evaluation of the final exam, but the final grade cannot exceed 30/30; honours may be awarded on the basis of the overall quality of the exam, critical autonomy and completeness of preparation.

In-class activities may include:
active participation in labs, exercises, invited talks and students' presentations: cumulatively up to 1 point;
in-class presentations, with slides, of at least 2 technologies agreed with the instructor: up to 1 point for each presentation;
in-class presentation, with slides, of at least 1 scientific paper agreed with the instructor: up to 1 point;
in-class presentations, with slides, of at least 2 innovative products integrating new technologies, for example products awarded in recent
editions of CES or in other international technology innovation contexts agreed with the instructor: up to 1 point for each presentation.
Even if the sum of the points obtained in individual activities exceeds 6 points, the maximum contribution of in-class activities to the final grade is 6 points.

Product presentations must analyse not only the technical characteristics of the product, but also user base analysis, design choices, possible design errors, good solutions, usability, accessibility, understanding of user needs, user familiarity with the technology, technical limitations, risks of overestimating technological capabilities, and possible psychological, social, ethical or practical impact.

The final exam consists of one of the following two options, to be agreed with the instructor:

Option A: UX project presentation, possibly as group work, up to 27 points. The project may involve the design, prototyping, revision or evaluation of an interactive solution, an emerging technology or a product integrating new technologies.

Option B: presentation of two scientific papers, approximately 15 minutes each, and an individual oral interview on the course material, including slides, technologies, invited talks and presentations discussed during the course, up to 23 points.

Students must agree on the project topic, technology, product or paper with the instructor and send the presentation at least one week before the exam date. Project work and technology/product presentations may be organised in groups of at most three students. In group work, each member's individual contribution must be

specified. The final mandatory assessment component maintains an individual component.

Assessment will consider: accuracy and completeness of theoretical knowledge; ability to connect psychological principles, HCI/UX methods and technological features; ability to apply design, prototyping and evaluation methods; ability to critically analyse technologies, products, scientific papers and application cases; ability to recognise design errors, good design practices, technological limitations and possible impacts on users; clarity of exposition; appropriate use of disciplinary terminology; autonomy in deepening topics; quality of collaboration and clarity in distinguishing individual contributions.

Students who do not take part in in-class activities can still take the final exam; in that case, the topics and competences normally developed through those activities may be discussed during the oral interview.

Textbooks and Reading Materials

eaching materials will be made available on the course e-learning platform and, when appropriate, through the University Digital Library. Materials may include lecture slides, scientific papers, book chapters, invited-talk materials, examples of presentations and project work, tutorials and documentation on Figma, Unity3D, C#, computational thinking and prototyping tools.
Recommended textbook:
Rogers, Y., Sharp, H., & Preece, J. Interaction Design: Beyond Human-Computer Interaction. Wiley.
Suggested reading:
Hodent, C. The Gamer’s Brain: How Neuroscience and UX Can Impact Video Game Design. CRC Press.
Additional materials and readings, including resources on virtual reality, conversational UX, Human-Robot Interaction, artificial intelligence and evaluation of innovative products, will be indicated on the course e-learning page.

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION | INDUSTRY, INNOVATION AND INFRASTRUCTURE | REDUCED INEQUALITIES