Course program and reading list

Semester 3 Year 2023

School: Sammy Ofer School of Communications M.A.

A Neuroscientist Perspective on HCI

Lecturer:

Prof. Amir Amedi amir.amedi@runi.ac.il

Course No.:	Course Type :	Weekly Hours :	Credit:
2895	Elective	2	2

Course Requirements :	Group Code :	Language:
Final Paper	233289501	English

Course Description

Course subjects

Lesson	Topic	Date	Time
1	Intro to the brain and the senses	26.7	10:00-12:15
2	Overcoming critical periods using technology, neuroplasticity	2.8	10:00-12:15
3	Sensory substitution tech and perceptual learning	9.8	10:00-12:15
4	Novel senses and expanding human perception	16.8	10:00-12:15
5	Phenomenology of sensory perception	23.8	10:00-12:15

6	Interfaces for exploring the connections between the brain and the body	30.8	10:00-12:15
7	From the lab to the wild: research-based implementations in the real world	6.9	10:00-12:15
8	The future of neuroscience inspired HCI	13.9	10:00-12:15

Course Goals

Course Description:

In each class, a specific topic will be covered that links between neuroscience and HCI. The class will start with a lecture, sometimes by a guest speaker, from different areas of related expertise, followed by presentations related to the topic, led by 2-3 students. Finally, a research-based discussion will be conducted, focusing on consolidating the information learned during the class. This discussion will enable dialogue on future directions related to the topic.

Technology is extending human abilities. What effect does this technological symbiosis have on our brains and minds? And how should we design technology for a symbiotic future?
In this course we will explore how to take inspiration from neuroscience for HCI related implementations, and how to ask research questions about the brain which are meaningful for HCI.

As one of the domains within neuroscience that is most relevant for HCI, we will explore the human sensory experience. In particular we will examine how technology can be used for exposing hidden connections between the senses, and enhancing the human experience. Topics will include, but are not limited to, sensory substitution by means of technology, uncovering connections between the senses, enhancing human neuro-wellness using brain based technologies, and more.

Course Goals:

This course will provide students with knowledge that can enhance their decision-making skills in the field of interaction design. By gaining an understanding of how technology can interact with our sensory systems and affect our brains, HCI designers and researchers

will be able to adopt a more human-centered approach in their work. The course will delve into the mechanisms of the brain, laying a foundation for an in-depth exploration of topics at the intersection of neuroscience and HCI.

Throughout the course, students will develop a neuroscience-based thought process that is relevant to their work. They will explore cutting-edge topics in neuroscience and their connection to HCI, and actively participate in presentations, discussions, and lectures by the course staff and guest speakers. By the end of the course, students will have gained a deeper understanding of how to apply neuroscience based principles to their work.

Schedule and proposed topics/program (content and order may change according to the guest lecturers' availability):

Grading

Requirements:

1. Attendence and participation
2. Presentation of a topic
3. Final assignment

Assignments and Grade Composition:

- Paper review before presentation (20)
- Topic presentation - pass/fail
- Presentation reflection (30)
- Feedback to x other presenters - pass/fail
- Final assignment (50)

Additional Notes

Production protocols:

The school allows usage of the technological infrastructure in accordance with the production protocols as published on the school's website.

Content:

All content produced as part of the workshops will follow ethical guidelines and will not contain inappropriate or offensive remarks.

The school maintains the exclusive right to publish and present selected student works in school events and in the media.

Reading List

Sample course readings:

- Heimler, B., & Amedi, A. (2020). Are critical periods reversible in the adult brain? Insights on cortical specializations based on sensory deprivation studies. *Neuroscience & Biobehavioral Reviews*.
- Bach-y-Rita, P., & Kercel, S. W. (2003). Sensory substitution and the human–machine interface. Trends in cognitive sciences, 7(12), 541-546.
- Kolb, B., & Whishaw, I. Q. (1998). Brain plasticity and behavior. Annual review of psychology, 49(1), 43-64.
- Amedi, A., Hofstetter, S., Maidenbaum, S., & Heimler, B. (2017). Task selectivity as a comprehensive principle for brain organization. Trends in cognitive sciences, 21(5), 307-310.
- Ciesla, K., Wolak, T., Lorens, A., Skarżyński, H., & Amedi, A. (2022). Speech-to-touch sensory substitution: a 10-decibel improvement in speech-in-noise understanding after a short training. Scientific Reports.
- Abboud, S., Maidenbaum, S., Dehaene, S., & Amedi, A. (2015). A number-form area in the blind. Nature communications, 6(1), 1-9.
- Maimon, A., Yizhar, O., Buchs, G., Heimler, B., & Amedi, A. (2022). A case study in phenomenology of visual experience with retinal prosthesis versus visual-to-auditory sensory substitution. Neuropsychologia, 108305.
- Hofstetter, S., Zuiderbaan, W., Heimler, B., Dumoulin, S. O., & Amedi, A. (2021). Topographic maps and neural tuning for sensory substitution dimensions learned in adulthood in a congenital blind subject. NeuroImage, 235, 118029.
- Yizhar, O., Giron, J., Chetrit, D., Ostrin, G., Friedman, D., & Amedi, A. (2021). Body Ownership of Anatomically Implausible Hands in Virtual Reality. Frontiers in human neuroscience, 631.