Master's thesis topics 2024-2025 at CWI DIS

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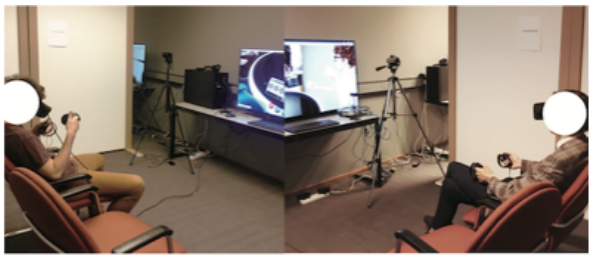
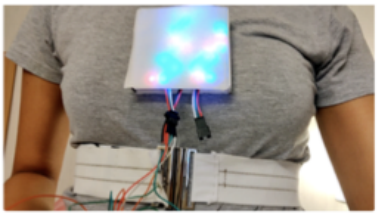

- Master's students in Human Computer Interaction, Artificial Intelligence, Cognitive (Neuro-)science and/or Industrial Design across any Dutch university / institute are welcome to apply
- You will be doing a scientific internship with us here in Amsterdam as part of your master's thesis project
- We strongly encourage publishing at top-tier conference venues (e.g., CHI, UbiComp, CSCW, …), and will mentor you as such
- If the topics below interest you, get in touch by email, and will share more detailed information
- You are welcome to propose your own topic, so long as it's within the broad areas of **Human Computer Interaction**, **Affective Computing**, **eXtended Reality** (**AR/VR/MR)**, or **Human-AI Interaction**.

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Topic: Transparent and Trustworthy Human-AI Interaction

Contact: Abdallah El Ali (aea@cwi.nl)

Description:
When dealing with AI-generated or AI-edited content, AI system disclosures (such as AI labels) can influence users' perceptions of media content [1]. For example, effective AI labels can enable viewers to immediately recognize AI's involvement, allowing them to quickly evaluate source credibility, verify the accuracy of the content, acquire contextual knowledge, and make informed decisions around the trust and authenticity of such content.

This topic includes several sub-topics:

(1) **Remote audience engagement with news using behavioral and physiological sensors:** This project explores remote or in-situ sensing of audience engagement using a range of behavioral and physiological sensors. The research will focus primarily on objective measures of human engagement (e.g., using computer vision for head tracking) to infer engagement with the news. This topic is a collaboration with the AI, Media, Democracy lab (https://www.aim4dem.nl/). More details per request.

(2) **User perceptions of human and AI news using voice assistants:** This topic explores user perceptions of human and AI-generated news delivered using a range of voice assistants (see e.g., [2]).

(3) **Intelligent disclosure-aware user interfaces**

(4) **Intelligent visualization techniques for disclosures**

These topics are in collaboration with the AI, Media, Democracy lab (https://www.aim4dem.nl/), where the master's student is expected to be part of. More details per request.

Skills (can differ by topic):
- Sensors; computer vision; signal processing; visualization; HCI research methods; quantitative and qualitative analysis
- Recommended: Interest in physiological and behavioral sensing; interest in journalism and news media

[1] Abdallah El Ali, Karthikeya Puttur Venkatraj, Sophie Morosoli, Laurens Naudts, Natali Helberger, and Pablo Cesar. 2024. Transparent AI Disclosure Obligations: Who, What, When, Where, Why, How. In Extended Abstracts of the 2024 CHI Conference on Human Factors in Computing Systems (CHI EA '24). Association for Computing Machinery, New York, NY, USA, Article 342, 1–11. https://doi.org/10.1145/3613905.3650750
[2] Shruti Rao, Valeria Resendez, Abdallah El Ali, and Pablo Cesar. 2022. Ethical Self-Disclosing Voice User Interfaces for Delivery of News. In Proceedings of the 4th Conference on Conversational User Interfaces (CUI '22). Association for Computing Machinery, New York, NY, USA, Article 9, 1–4. https://doi.org/10.1145/3543829.3544532

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Topic: Exploring wearable haptic interfaces for biosignal visualization in (social) VR

Contact: Abdallah El Ali (aea@cwi.nl)

Description:
Haptic stimulation is an intrinsic aspect of sensory and perceptual experience, and is tied with several experience facets, including cognitive, emotional, and social phenomena. The capability of haptic stimuli to evoke emotions has been demonstrated in isolation, or to augment media. This project will build on our prior work on visualizing biosignals [1,2,3,4], and exploring virtual agent biosignals through haptic displays, to create new forms of social experiences in social VR that leverage physiological signals and body-based actuation. This project may possibly include a (paid) research visit to Nara Institute of Science and Technology (NAIST) in Japan.

[1] Abdallah El Ali, Xingyu Yang, Swamy Ananthanarayan, Thomas Röggla, Jack Jansen, Jess Hartcher-O'Brien, Kaspar Jansen, and Pablo Cesar. 2020. ThermalWear: Exploring Wearable On-chest Thermal Displays to Augment Voice Messages with Affect. In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (CHI '20). Association for Computing Machinery, New York, NY, USA, 1–14. https://doi.org/10.1145/3313831.3376682
[2] Sueyoon Lee, Abdallah El Ali, Maarten Wijntjes, and Pablo Cesar. 2022. Understanding and Designing Avatar Biosignal Visualizations for Social Virtual Reality Entertainment. In Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems (CHI '22). Association for Computing Machinery, New York, NY, USA, Article 425, 1–15. https://doi.org/10.1145/3491102.3517451
[3] A. El Ali, R. Ney, Z. M. C. van Berlo and P. Cesar, "Is that My Heartbeat? Measuring and Understanding Modality-Dependent Cardiac Interoception in Virtual Reality," in IEEE Transactions on Visualization and Computer Graphics, vol. 29, no. 11, pp. 4805-4815, Nov. 2023, doi: 10.1109/TVCG.2023.3320228.
[4] Abdallah El Ali, Ekaterina R. Stepanova, Shalvi Palande, Angelika Mader, Pablo Cesar, and Kaspar Jansen. 2023. BreatheWithMe: Exploring Visual and Vibrotactile Displays for Social Breath Awareness during Colocated, Collaborative Tasks. In Extended Abstracts of the 2023 CHI Conference on Human Factors in Computing Systems (CHI EA '23). Association for Computing Machinery, New York, NY, USA, Article 58, 1–8. https://doi.org/10.1145/3544549.3585589

Skills:
- Required: Information visualization (sketching + prototyping); biosensors (e.g., HR, EDA, EMG); HCI research methods; quantitative and qualitative analysis; statistics
- Recommended: Hardware prototyping (e.g., Arduino), fabrication, thermal, vibrotactile, and/or multimodal output

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Topic: Virtual Avatar Co-embodiment and the Sense of Agency

Contact: Abdallah El Ali (aea@cwi.nl)

Description:
Virtual avatar co-embodiment refers to situations where two or more users embody a single, shared avatar (e.g., in Virtual Reality). This offers a multi-user experience characterized by

shared control over the avatar's movement, allowing for the creation of stronger bonds between humans at a distance. Prior experiments have shown that participants who co-embody a virtual avatar report high levels of perceived control, with lower levels of actual control [1], making it a promising method for VR-based rehabilitation and training.

In this project we will build on our prior work in which we implemented non-verbal coordination between co-embodied participants using position-aware haptic feedback [2]. Initial results showed that participants reported a lower Sense of Agency (SoA) with haptics than without. However, the type of haptics, and the type of shared avatar representation could have impacted the findings. This raises questions about how best to design haptic feedback and avatar representations for convincing virtual co-embodiment.

In this project, you will start from an existing VR system [2] and explore one of several directions relating to the design, implementation, and (quantitative) analysis of haptic feedback, avatar embodiment, or a combination of both. Other directions may be considered as well. Depending on the direction taken, this can be a collaboration with TU Delft IDE. This project may possibly include a (paid) research visit to Nara Institute of Science and Technology (NAIST) in Japan.

[1] D. Kodama, T. Mizuho, Y. Hatada, T. Narumi and M. Hirose, "Effects of Collaborative Training Using Virtual Co-embodiment on Motor Skill Learning" in IEEE TVCG, vol. 29, no. 05, pp. 2304-2314, 2023. doi: 10.1109/TVCG.2023.3247112
[2] Karthikeya Puttur Venkatraj, Wo Meijer, Monica Perusquía-Hernández, Gijs Huisman, and Abdallah El Ali (2024). ShareYourReality: Investigating Haptic Feedback and Agency in Virtual Avatar Co-embodiment. In Proc. CHI '24, ACM, NY, USA, 1–14. https://doi.org/10.1145/3613904.3642425

Skills:
- Required: Electronics (e.g., Arduino), programming (e.g., Android, C#), user evaluation, quantitative analysis
- Recommended: interest in haptic actuators and design, AR/VR, quantitative and qualitative analysis

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Topic: Investigating immersion and presence in 360° Videos using grip force analysis

Contact: Ashutosh Singla (Ashutosh.Singla@cwi.nl), Abdallah El Ali (aea@cwi.nl)

Description:
With the increasing availability of head-mounted displays (HMDs) and wearable technology that enable immersive media experiences, we are witnessing a shift in the way videos can be delivered and consumed. The rising demand for 360° videos and the exploration of immersion/presence in virtual reality (VR) experiences signify a significant shift in this field. This thesis aims to explore the time point at which users feel immersed and forget about the real environment while watching 360° videos with a HMD. The thesis incorporates a simple task where users hold a ball in their hand while viewing 360° videos. Throughout the viewing session, continuous measurements of grip force or pressure are recorded using EMG and acceleration/gyroscope sensors. The analysis of changes in grip strength over time provides insights into the user's sense of immersion/presence. The findings from this research contribute to understanding the psychological and physiological aspects of user experience in immersive virtual reality environments. In this thesis, hardware prototyping with a particular emphasis on pressure sensing is focused on. The thesis involves utilizing conductive yarn and various sensors to develop a ball that can measure grip force or

pressure continuously. Furthermore, the experimental design, test setup, selection of the specific 360° videos needs to be discussed with the supervisors. The subjective test may include any pre- or post-experiment questionnaires to capture user feedback. This is a joint project with Ashutosh Singla (https://scholar.google.co.in/citations?user=iI1PSjkAAAAJ&hl=en).

Skills:
- Required: Arduino (physical prototyping), soldering, electronics, EMG sensing; Interaction design; Unity/C#, experiment design (controlled), controlled user studies, statistics
- Recommended: Interest in physiological signals; HCI research methods; qualitative analysis