AUFRANDE

IMT Atlantique
Bretagne-Pays de la Loire
École Mines-Télécom

THE UNIVERSITY of ADELAIDE

Position Description

1. General Information

Name of the position	**Augmented Reality and Psychology**
Foreseen date of enrolment	January 2025
Position is funded by	• COFUND, Marie Skłodowska-Curie Actions (MSCA), Horizon Europe, European Union • Institut Mines Telecom (IMT) Atlantique • The University of Adelaide (UoA)
Research Host	IMT Atlantique
PhD awarding institutions	IMT Atlantique & The University of Adelaide
Locations	Primary: Brest, France Secondary: Adelaide, Australia
Supervisors	Prof. Gilles Coppin, IMT Atlantique Prof. Anna Ma-Wyatt, Adelaide University Dr. Étienne Peillard, IMT Atlantique Dr. Morgane Roger, Naval Group
Group of discipline	Computer Science, Psychology

2. Research topics (only one of these projects will be funded)

Project 1: *From lab experiments to on-field applications: the effect of movement and motion on perception in Augmented Reality*
Augmented Reality (AR) allows to present digital images, objects and environments superimposed on the real world. Though, due to technical limitations, the rendering of these digital elements remains different from the real elements. Current research in the field focuses on making these digital elements as close as possible to the real ones and to measure the differences in users' perception caused by these differences. Those controlled studies are often conducted in labs, with carefully designed environments and procedures, to ensure their accuracy and reproducibility. However, these strict conditions lead the users to perform tasks that are often very different from real AR applications. In particular, users are usually seated, with restricted movement capabilities. However, movement and motion, whether self-movement including proprioception and external motion, are known to play an important role in perception.

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This project aims to investigate differences that can be observed between lab experiments and actual AR application, in order to provide a way to transpose AR research regarding basic perception issue from labs to ecological applications. The focus of this work will be to understand how motion cues from the real environment may conflict with those from the AR environment, and if so how to resolve these conflicts. Applications for this work could improve the provision of information to people with low vision, for example, while moving in the environment or while driving.

Supervisors: Prof. Gilles Coppin (IMT Atlantique), Prof. Anna Ma-Wyatt (Adelaide University), Dr. Étienne Peillard (IMT Atlantique), Dr. Morgane Roger (Naval Group)

Research Fields: computer science, psychology, augmented reality, visual perception

Project 2: *From lab experiments to on-field applications: the effect of light and shadows on perception in Augmented Reality*

Augmented Reality (AR) allows to present digital images, objects and environments superimposed on the real world. Though, due to technical limitations, the rendering of these digital elements remains different from the real elements. Transparency, occlusion, luminance, or shadow defect can appear and are still a challenge to completely overcome. Current research in the field focuses on making these digital elements as close as possible to the real ones and to measure the differences in users' perception caused by these differences. Those controlled studies are often conducted in labs, with carefully designed environments and procedures, to ensure their accuracy and reproducibility. However, in real applications, the real background onto which are displayed the augmented elements can highly vary. Differences in luminance, shadows, brightness or even colours can occur, making the final rendering and results highly dependent on this environment. Furthermore, when interacting with AR elements in a real environment may require a suite of behavioural responses – acting on an object or perceiving it only.
This project aims to investigate differences that can be observed between lab experiments and actual AR applications, in order to provide a way to transpose AR research regarding basic perception issue from labs to ecological applications. We will develop an approach in which we take into account the real scene complexity (using natural scene statistics derived from the human vision literature) to adjust the appearance of digital elements in scene. We will test human performance for interacting with these objects using both perceptual and action based tasks.

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Research Fields: computer science, psychology, augmented reality, visual perception

Project 3: *Immersive representation of interacting visualisations in Augmented Reality*

Augmented Reality (AR) allows to present digital images, objects and environments superimposed on the real world. It can be used to render elements all around the user, and help him or her to interact with complex immersive data, such as robot swarms or procedure guidance augmentations.
How to represent such data is still a major challenge. Many elements can require the user's attention as the same time, and the superimposition of many data in real environments, coupled with AR related issues such as incomplete occlusions, can easily overwhelm users. In addition, AR is known to increase workload and context switching between real and augmented elements can also create attention cost. Balancing these constraints could produce a new way of presenting data, but any solutions in this area are likely to be context specific. That is, it will be necessary to understand how to characterise and resolve conflicts between data visualisation and elements in the environment to enhance a user's performance using the AR application.
This project aims to improve such 360° immersive visualizations while taking into account the perceptual specificities of AR. We will compare performance on immersive 360deg visualisations with more restricted views using a real-world scenario. Part of the contribution of this project will be the development of a protocol to assess how gains in data assessment can be related to the minimisation of attentional interference.

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Research Fields: computer science, psychology, augmented reality, visual perception

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3. Employment Benefits and Conditions

L'École Nationale Supérieure Mines-Télécom Atlantique Bretagne - Pays de la Loire (IMT Atlantique) offers a 36-months full-time work contract (with the option to extend up to a maximum of 42 months).

The remuneration, in line with the European Commission rules for Marie Skłodowska-Curie grant holders, will consist of an annual gross salary of 30,300 EUR. Of this amount, the estimated salary to be perceived by the Researcher is 1,975 EUR net per month. However, the definite amount to be received by the Researcher is subject to national tax legislation (3.5 %).

Benefits include

- Becoming a Marie Skłodowska-Curie fellow and be invited to join the Marie Curie Alumni Association
- Access to all the necessary facilities and laboratories at IMT Atlantique, Lab-STICC and the University of Adelaide.
- Tuition fee waiver at both PhD enrolling institutions.
- Yearly travel allowance to cover flights and accommodation for participating in AUFRANDE events.
- 10,000 EUR allowance to cover flights and living expenses for up to 12 months in Australia.
- 49 days paid holiday leave
    - Contractual doctoral students benefit from the paid leaves, under the same conditions as all employees of the Institut Mines-Télécom
- Sick leave
    - Serious illness leave, granted after three years' service and examination by the medical committee - provision which can only be applied in cases of contract extension beyond three years, as it is granted after three years' service (article 61-1),
    - Leave for occupational injury or illness (article 63)
    - Exceptional leave of absence for family events (article 54)
    - Ordinary sick leave with compensation based on seniority (article 60-1)
- Parental leave
    - Maternity or adoption leave (article 62)
    - Paternity leave (article 62 bis)

4. PhD enrolment

Successful candidates for this position will be enrolled by the following institutions and must comply with their specific entry requirements, in addition to AUFRANDE's conditions.

Applicants must demonstrate sufficient background and experience in independent supervised research to successfully complete a PhD. This includes holding Master of Science or Master of Engineering or another similar world-class master's degree containing a minimum of 12 credit points by research, with an overall Grade Point Average (GPA) of 5.0 or higher and a GPA of 6.0 or higher in the Research Component.

Applicants must demonstrate English language proficiency in the form of an English test that has been taken within the two years preceding the date of commencement. The following test types are accepted:

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- IELTS (International English Language Testing System) Academic
- TOEFL (Test of English as a Foreign Language) Internet Based Test
- PTE (Pearson Test of English) Academic
- C1 Advanced (formerly CAE - Cambridge English: Advanced)

IMT Atlantique

Applicants from foreign countries may have to be evaluated by French Authorities before being allowed to be hosted by IMT Atlantique. In case of denial, the employment will not be carried out.

More information: https://www.imt.fr/en/education/our-degrees/phd/

The University of Adelaide

Short-listed applicants will need to demonstrate their suitability for entry to the program. More information: https://www.adelaide.edu.au/graduate-research/future-students/how-to-apply#step-4-apply-online

More information: https://www.adelaide.edu.au/degree-finder/2023/hdrdoctor_philosophy.html

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