Universidade de Aveiro
Departamento de Electrónica,
Telecomunicações e Informática

Virtual and Augmented Reality – 2021
Introduction to course

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Team

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Topics

- Introduction to Virtual Reality (VR) Augmented (AR) and Mixed Reality (MR)

- Definition, historical perspective, evolution, and applications

- Frameworks for MR

- Input and output devices, tracking

- 3D user interfaces and interaction techniques

- Human-Centered Design for MR

- Human factors in MR

- Evaluation of MR applications

- Traditional and emerging applications

http://sweet.ua.pt/bss/disciplinas/RVA/RVA-home.htm

Lectures and Lab classes (tentative)

1 (Oct/12) - Introduction to the course, syllabus, assessment, bibliography
Paper presentation guidelines

2 (Oct/19) - Introduction to VR select a Paper
VR Frameworks

3 (Oct/26) - Introduction to AR and MR
Introduction to Unity

4 (Nov/2) - Input Devices and trackers / Paper presentation
Introduction to Unity and mini-project

5 (Nov/9) - Human Centered Design for MR / Paper presentation
Introduction to Unity select mini-project

6 (Nov/16) - Output devices / Paper presentation
H/W demo

7 (Nov/23) - Paper presentation
Frameworks for AR (Unity/Vuforia)

8 (Nov/30) - Human factors in MR – Paper presentation
Mini-project

9 (Dec/7) - Evaluation in MR – Paper presentation
Mini-project

10(Dec/14) - Mini-project mid-term presentation   submit sides

11 (Dec/21) - Research work at DETI/IEETA - Paper presentation
Mini-project

12 (Jan/4) - Research work at DETI/IEETA - Paper presentation
Mini-project

13 (Jan/11) – Paper presentation
Mini-project

14 (Jan/18) –   Presentation and demo of Mini-project/ Exam

Lectures and Lab classes

- ~1h30 – lecture + paper presentation and discussion

- ~1h30 – lab session

- 2 sessions devoted presentation and demo of the mini-projects (follow up and final presentations)

Main bibliography

- Jerald, J., The VR Book: Human-Centered Design for Virtual Reality, ACM and Morgan & Claypool, 2016

- LaValle, S., *Virtual Reality - Virtual Reality*. Cambridge University Press, 2017 (http://vr.cs.uiuc.edu/)

- LaViola, J., Kruijff, E., McMaha, R., Bowman, D, Poupyrev, I. J., *3D User Interfaces: Theory and Practice*, 2nd ed., Addison Wesley, 2017

- Schmalstieg, D., Hollerer, T., *Augmented Reality: Principles and Practice (Usability).* Addison-Wesley Professional, 2016

- M. Billinghurst, A. Clark, and G. Lee, "A Survey of Augmented Reality", *Found. Trends Human-Computer Interaction,* vol. 8, no. 2, pp. 73–272, 2015

- Journal and Conference Papers …

Assessment

- Exam – 35%

- Mini-project – 50% (15%+35%)

- Paper presentation and discussion – 15%

- **Working students must contact us until October 22 about the assessment**

Practical assignment
(general characteristics)

- Groups of two students

- Mini-project

- Development of a simple MR application using a human-centered approach, specific devices and libraries

- Existing code may be used, provided that it is **explicitly identified and its source adequately cited**

Our devices

VARLab
IEETA – room 0.24

Analyze and present a conference/ journal paper a book section or a MR framework/tool:

long paper (10+ pages) or book section or MR framework

Each student must:

- select a paper,
     a book section
        or
        another paper
        or a framework

bring your preferences to propose
                    until October, 26

- Read the paper presentation guidelines (presentation guidelines)

- Make a ~25 min (1 student) presentation

- Send the slides to (bss@ua.pt)

Some suggested papers to read, present and discuss
(but you may propose any other paper within scope you find interesting)

- C. Bermejo and P. A. N. Hui, "A Survey on Haptic Technologies for Mobile," ACM Computing Surveys., vol. 54, no. 9, 2021

- N. Ashtari, A. Bunt, J. Mcgrenere, M. Nebeling, P. K. Chilana, and A. Arbor, "Creating Augmented and Virtual Reality Applications : Current Practices , Challenges , and Opportunities," in *CHI '20 Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 2020.

- T. Nakamoto, T. Hirasawa and Y. Hanyu, "Virtual environment with smell using wearable olfactory display and computational fluid dynamics simulation," *2020 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, Atlanta, GA, USA, 2020.

- M. Slater et al., "The Ethics of Realism in Virtual and Augmented Reality," Frontiers in Virtual Reality, March, pp. 1–13, 2020

(Cont.)

- M. Murcia-López, T. Collingwoode-Williams, William Steptoe, Raz Schwartz, Timothy J. Loving, Mel Slater, "Evaluating, "Virtual Reality Experiences Through Participant Choices", *2020 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, Atlanta, GA, USA, 2020

- P. Wacker, O. Nowak, S. Voelker, and J. Borchers, "ARPen : Mid-Air Object Manipulation Techniques for a Bimanual AR System with Pen & Smartphone," in *CHI '19 Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 2019.

- M. Speicher, B. D. Hall, and M. Nebeling, "What is Mixed Reality ?," in *CHI '19 Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 2019.

- S. Thanyadit, P. Punpongsanon, and T.-C. Pong, "ObserVAR : Visualization System for Observing Virtual Reality Users using Augmented Reality," in *ISMAR 2019 - International Symposium on Mixed and Augmented Reality 2019,* 2019, pp. 258–268.

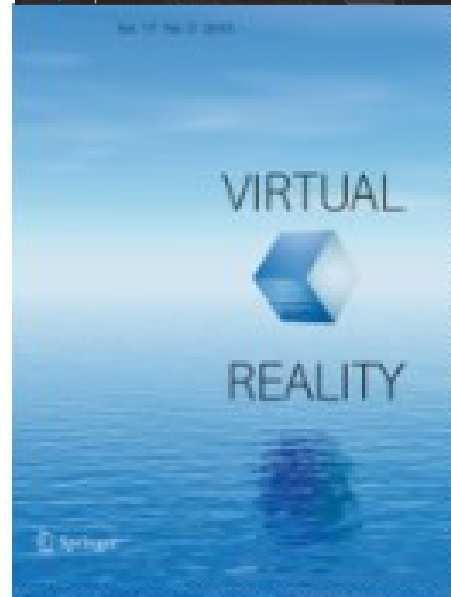# Where to find papers and topcs to present

http://ieeexplore.ieee.org/Xplore

http://dl.acm.org/

http://www.springer.com/computer/image+processing/journal/10055

http://ieeevr.org/2021/

https://ismar21.org/

https://vrst.acm.org/vrst2021/

Or other journals or conferences

Suggestions of alternative presentations

- Auditory perception and Audio rendering in VR

- Haptics, smell, robotics and BC interfaces in VR

- Unreal
https://www.unrealengine.com/en-US/

- ARCore
https://developers.google.com/ar/
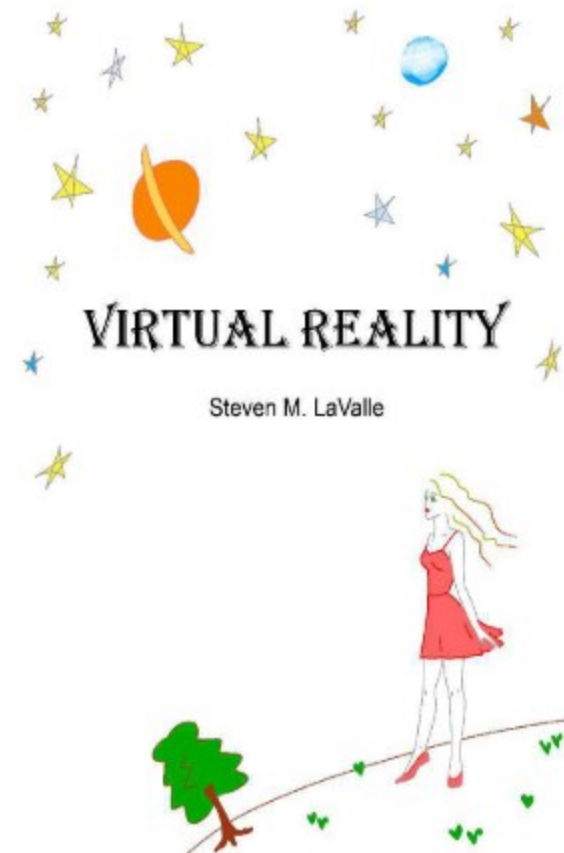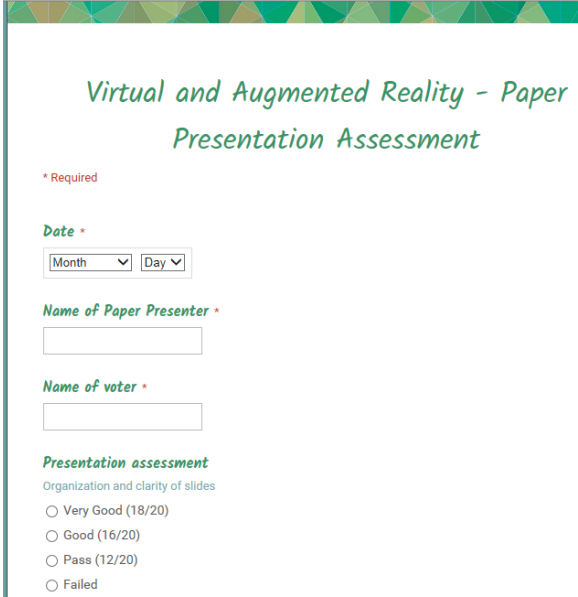
Discuss papers

- After each paper presentation:

    - All students vote on their colleagues presentation
        (link available in Moodle)

    - Everyone discusses the paper

    (Link available in Moodle)

Participate in testing a VR-based mini-game for stroke rehabilitation
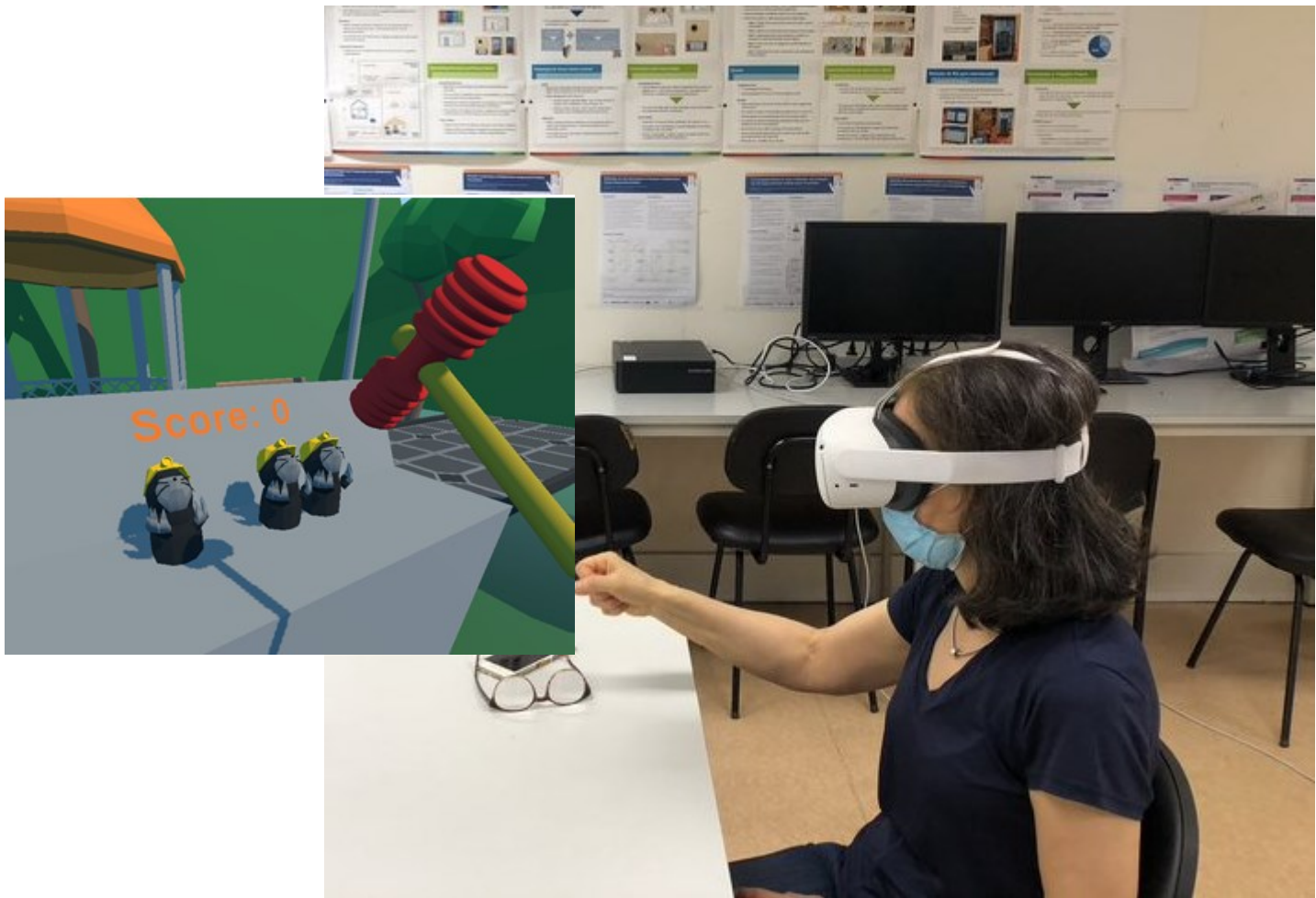
- Questions?

- Students' profile/background?

- Dates for exam and assignment presentation and submission?

- Voluntaries to present and discuss a paper on October 26?