



Universidade de Aveiro
Departamento de Electrónica,
Telecomunicações e Informática

Virtual and Augmented Reality 2023-24



Beatriz Sousa Santos,
Paulo Dias, Bernardo Marques

Team

Beatriz Sousa Santos; Paulo Dias, Bernardo Marques

(bss@ua.pt; paulo.dias@ua.pt; bernardo.marques@ua.pt)

<https://sites.google.com/view/varlab/home>



Topics

- Introduction to Extended Reality (XR): Virtual Reality (VR) Augmented (AR) and Mixed Reality (MR)
- Definition, historical perspective, evolution, and applications
- Frameworks for XR
- Input and output devices, tracking
- 3D user interfaces and interaction techniques
- Human-Centered Design for XR
- Human factors in XR
- Evaluation of XR applications
- Traditional and emerging applications

Lectures and Lab classes

- Lecture / Invited talk + paper presentation and discussion
- lab session
- 3 sessions devoted to presentation and demo of the mini-projects (follow up and final presentations)

Lectures and Lab classes (tentative)

- 1 (Sep/19)** - Introduction to the course, syllabus, assessment, bibliography
Previous years assignments, paper presentation guideline
Home work: Install and star learning Unity
- 2 (Sep/26)** - Research work at VarLab
VARLab research and Visit; groups
Hw: Decide on a paper to present
- 3 (Oct/3)** - Introduction to XR (VR, AR and MR)
Unity; present list of mini-projects
Hw: Decide on a mini-project
- 4 (Oct/10)** - Input Devices and trackers
Unity; mini-project selection
Hw: Start designing mini-project
- 5 (Oct/17)** - Human Centered Design for XR
Designing and conceptualization of mini-project
Hw: Prepare requirements
- 6 (Oct/24)** - Interaction in XR / Paper presentation
Mid-term presentation **Submit sides**

- 7 (Oct/31)** - Output devices / Paper presentation
VR Practical Class
- 8 (Nov/7)** - Human Factors for XR / Paper presentation
AR Practical Class
- 9 (Nov/14)** - Evaluation in XR / Paper presentations
Mini-projects
- 10 (Nov/21)** - Paper presentation
Mini-project follow-up pitch presentation
- 11 (Nov/28)** - Invited Talk / Paper presentation
Mini-project
- 12 (Dec/5)** - Invited Talk / Paper presentation
Mini-project
- 13 (Dec/12)** – Invited Talk / Paper presentation
Mini-project
- 14 (Dec/19)** – Exam (?)
Final presentation of Mini-project Submit materials

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
- Journal and Conference Papers ...

Assessment

- Exam – 35%
- Mini-project – 55% (15%+40%)
- Paper presentation and discussion – 10%
- **Working students must contact us until October 4 about the assessment**

Practical assignment

(general characteristics)

- Groups of two students
- Mini-project
- Development of a simple XR 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**

VARLab IEETA – room 0.24



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

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

Each group pf two students:

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



bring your preferences to propose
until October 4

- Read the paper presentation guidelines ([presentation guidelines](#))
- Make a ~20 min 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)

- H. Ye, J. Leng, C. Xiao, L. Wang, and Fu, “ProObjAR: Prototyping Spatially-aware Interactions of Smart Objects with AR-HMD”, *CHI Conference on Human Factors in Computing Systems (CHI’23)*, 2023.
- . Bhardwaj and K. Kaushik, "Metaverse or Metaworst with Cybersecurity Attacks", *IT Professional*, vol. 25, no. 3, pp. 54-60, May-June 2023.
- M. Becher *et al.*, “Situated Visual Analysis and Live Monitoring for Manufacturing,” *IEEE Comput. Graph. Appl.*, vol. 42, no. 2, pp. 33–44, 2022.
- J. Shang, S. Chen, J. Wu, and S. Yin, “ARSpy: Breaking Location-Based Multi-Player Augmented Reality Application for User Location Tracking,” *IEEE Trans. Mob. Comput.*, vol. 21, no. 2, pp. 433–447, 2022.
- S. Zou, Xianyin Hu, Y. Ban, S. Warisawa, "Simulating Olfactory Cocktail Party Effect in VR: A Multi-odor Display Approach Based on Attention", *2022 IEEE Conference on Virtual Reality and 3D User Interfaces (VR)*, pp.474-482, 2022.

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

- A. Jing, J. Mcdade, G. A. Lee, and M. Billinghamurst, “Comparing Gaze-Supported Modalities with Empathic Mixed Reality Interfaces in Remote Collaboration”, *ISMAR 2022 - 21th IEEE International Symposium on Mixed and Augmented Reality 2012, Science and Technology Papers*, 2022, pp. 837–846.
- C. Bermejo and P. A. N. Hui, “A Survey on Haptic Technologies for Mobile,” *ACM Computing Surveys*, vol. 54, no. 9, 2021.
- J. Ratcliffe, F. Soave, et al., “Extended Reality (XR) Remote Research: a Survey of Drawbacks and Opportunities”, *CHI Conference on Human Factors in Computing Systems (CHI ‘21)*, Article 527, 2021.
- P. Casey, I. Baggili, and A. Yarramreddy, “Immersive Virtual Reality Attacks and the Human Joystick,” *IEEE Trans. Dependable Secur. Comput.*, vol. 18, no. 2, pp. 550–562, 2021.

Where to find papers and topics to present

<https://ieeexplore.ieee.org/Xplore/home.jsp>

<http://dl.acm.org/>

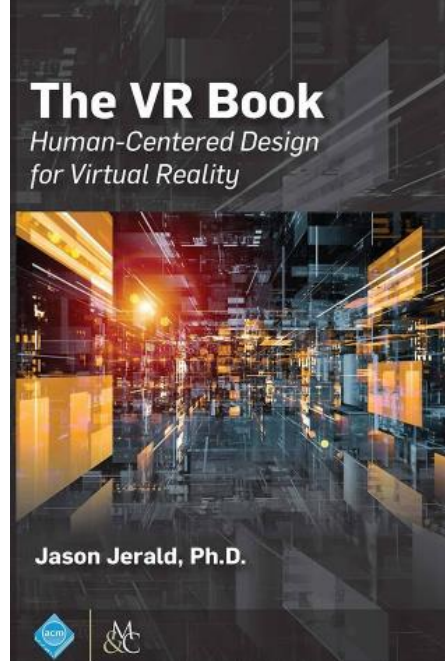
<http://www.springer.com/computer/image+processing/journal/10055>

<https://ieeevr.org/2023/>

<https://ismar2022.vgtc.org/>

<https://vrst.acm.org/vrst2022/>

Or other journals or conferences



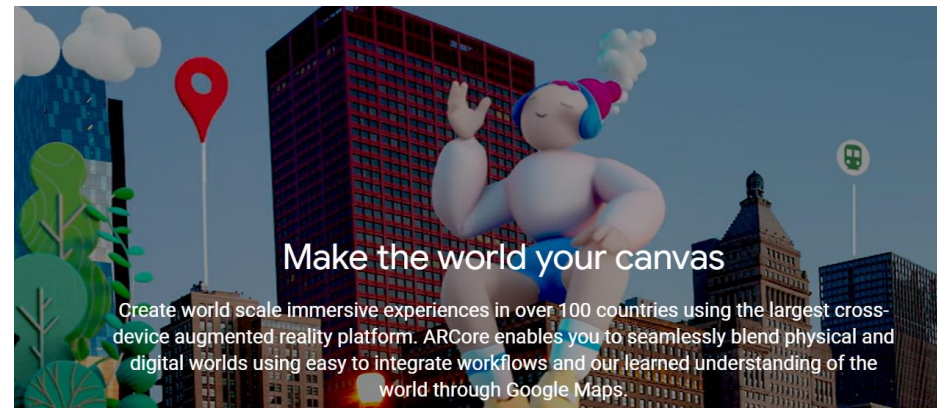
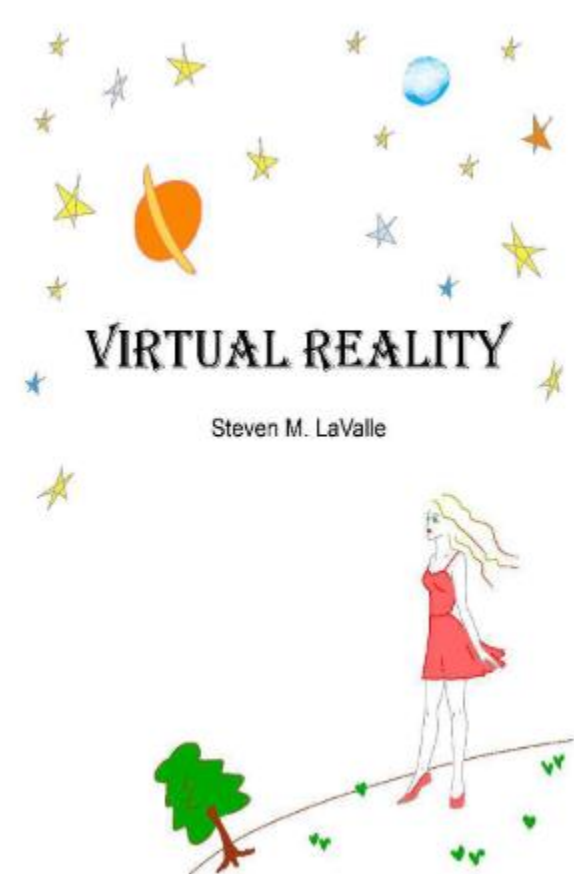
Suggestions of alternative presentations

- Auditory perception and Audio rendering in VR
- Haptics, smell, robotics and BC interfaces in VR

- E.g. ARCore

- <https://developers.google.com/ar>

Or other approved topic



Discuss papers

- After each paper presentation:
 - All students vote on their colleagues presentation
(link available in Moodle)
 - Everyone discusses the paper

(E-voting available in Moodle)



E-VOTING

Paper presentation vote

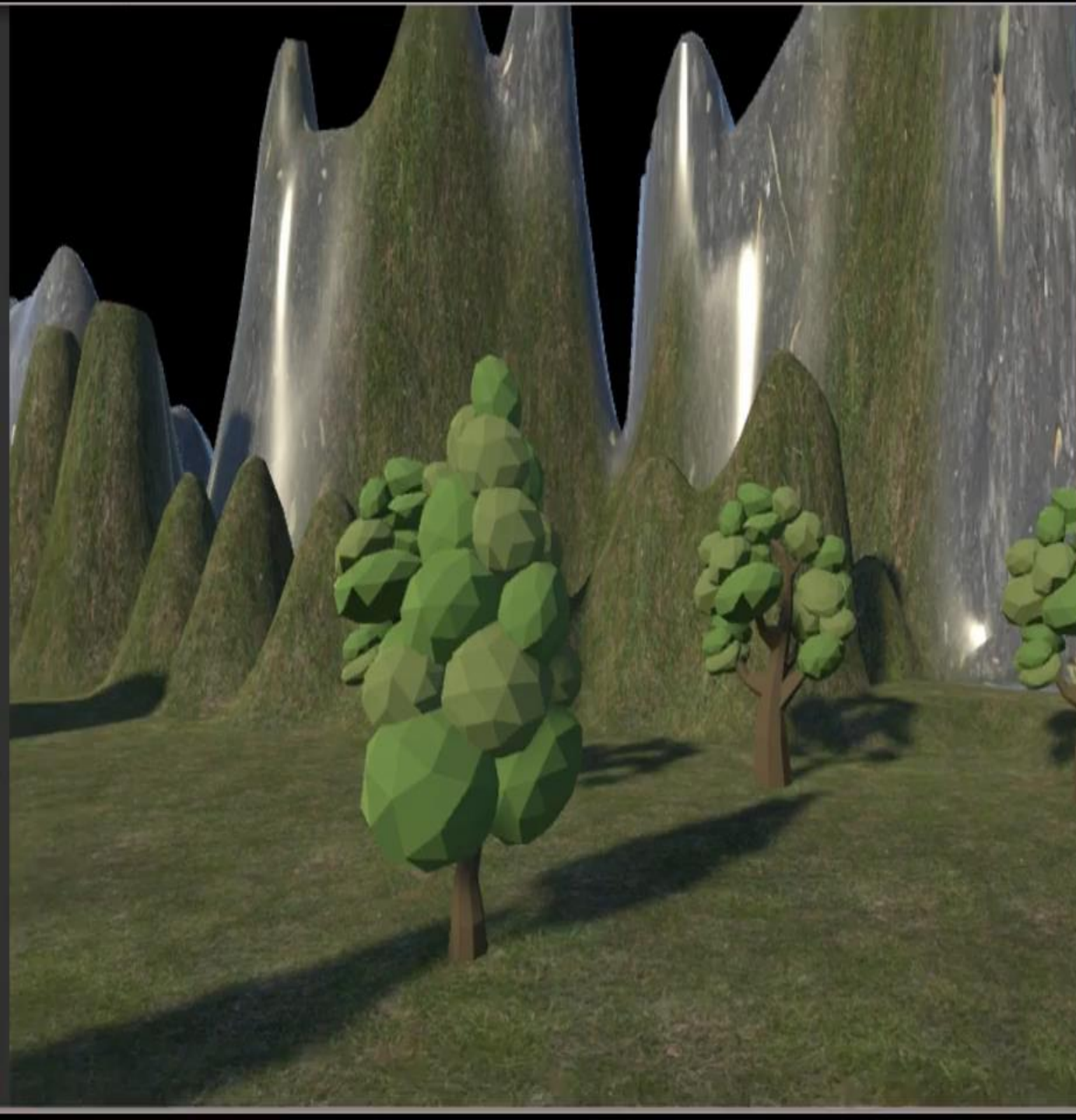
VR Puzzle Box

RVA - 2020/2021

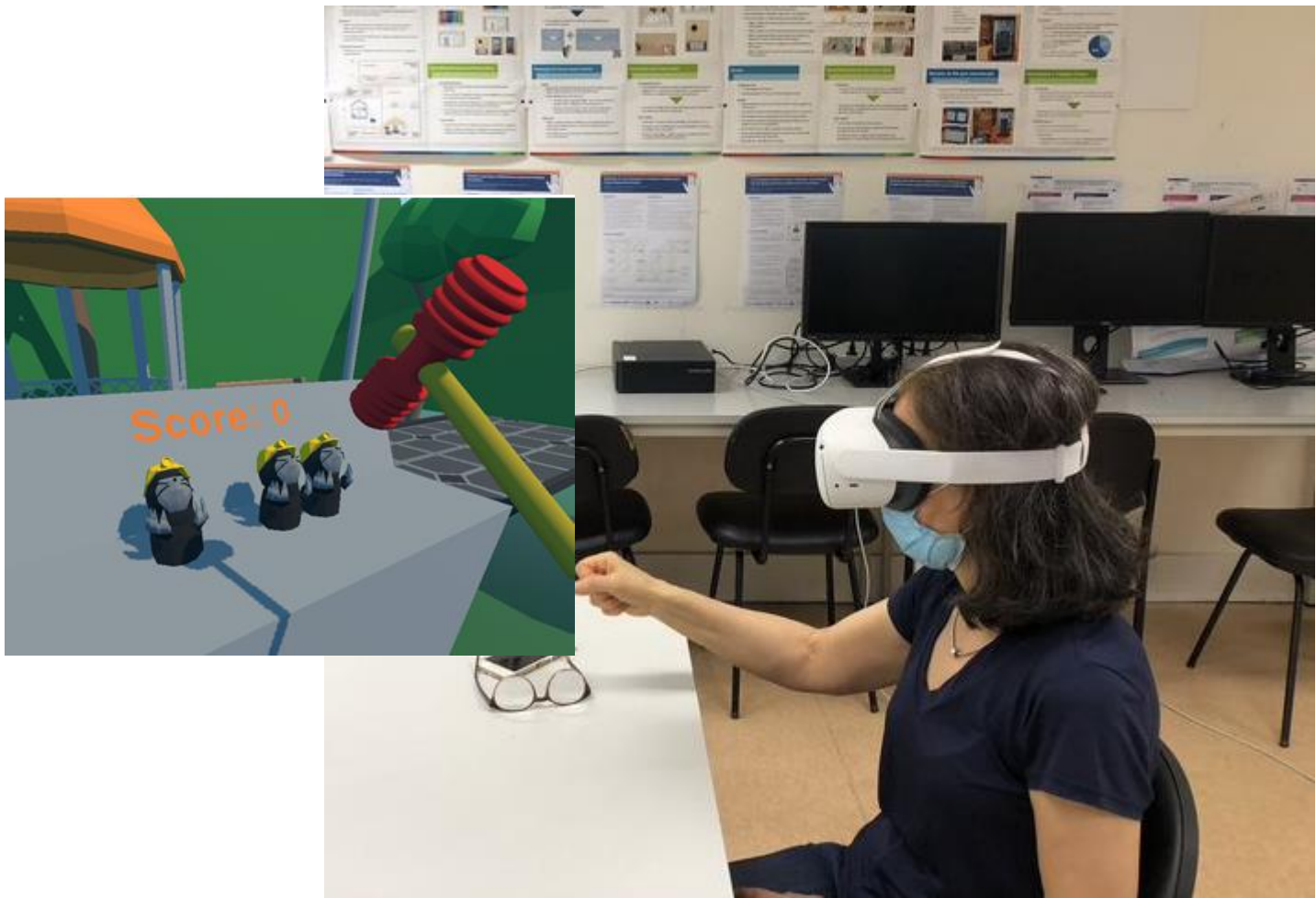
André Santos - 84816



Harry Potter inspired chess in Virtual Reality



Participate in testing VR/AR applications



- Questions?
- Students' profile/background?
- Date for exam (Dec 19??)
- Voluntaries to present and discuss a paper on October 24th?

