ACHI 2023

Usability of An Immersive Authoring Tool

An Experimental Study for the Scenarization of Interactive Panoramic Videos

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Presenter's informations & Topics of research

- Daniel, Xuan Hien MAI
- **PhD** at IBISC Lab, Univ Evry, Paris-Saclay University
- **System Architect (R&D)** at WideWebVR

- Master in Game Programing (2018)
- Master in Virtual Reality & Intelligent System (2019)

Models and tools for designing interaction techniques for educational applications in panoramic video

anrt association nationale recherche technologie

Cifre Conventions

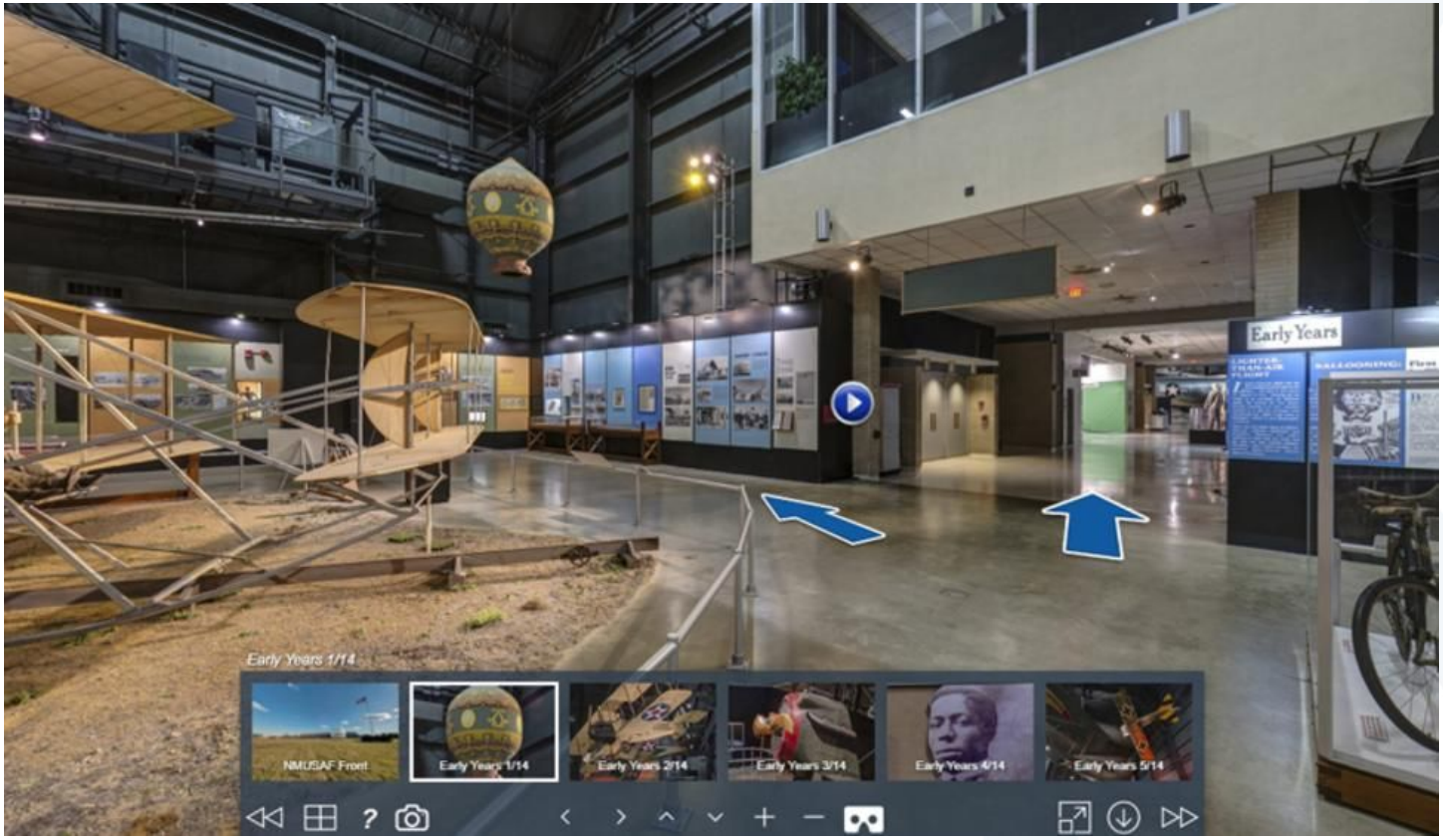
Outlines

- **Context**
- Background and related work
- Hypothesis
- Experiment
- Conclusion & Prospects

Virtual Reality Environment

**virtual gallery space developed by the University of Sheffield*

Interactive 360 videos



National Museum of the U.S. Air Force Virtual Tour

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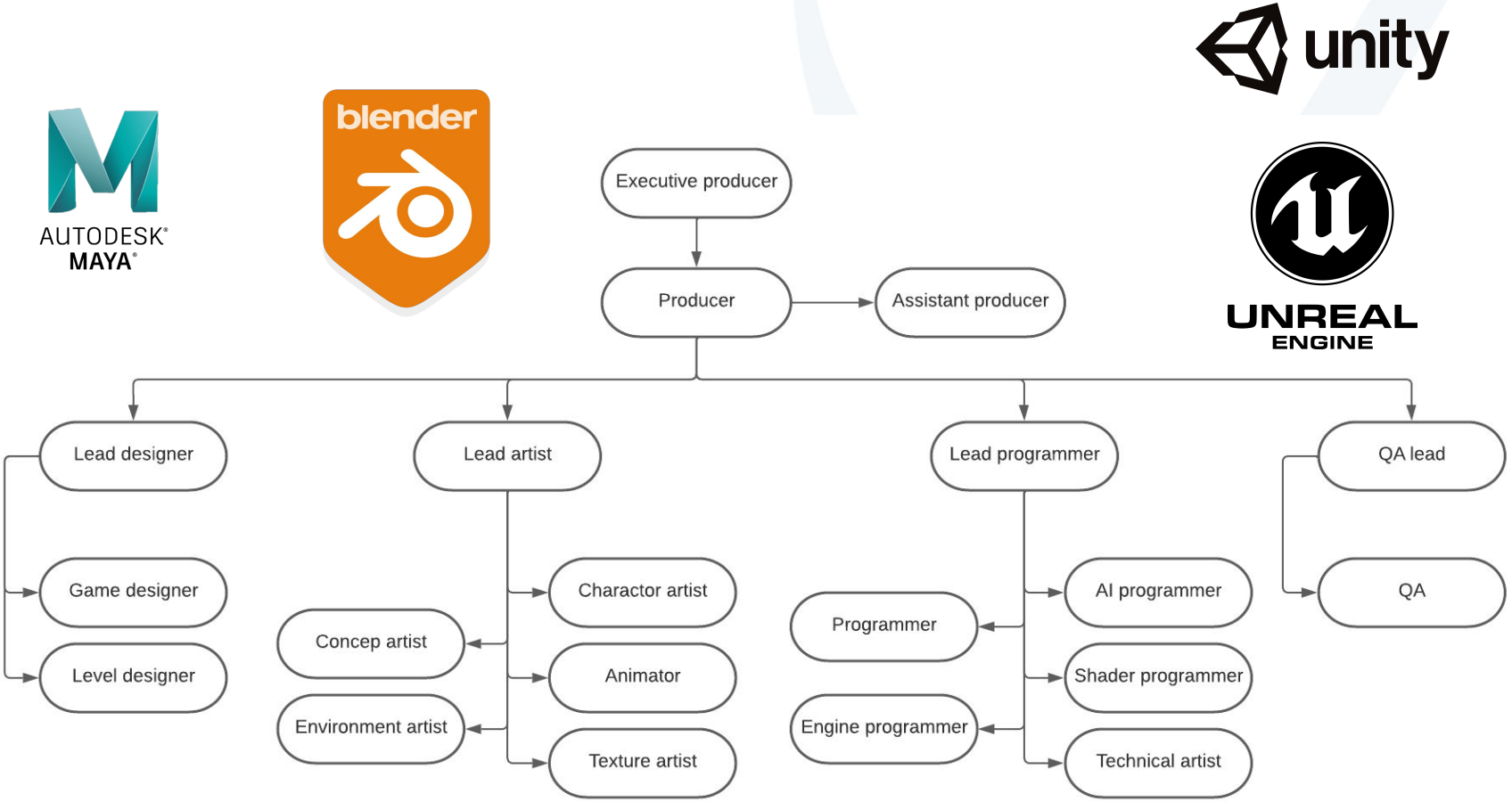
Roles in the video game industry



** Sundström, Y. (2013) Game design and production: frequent problems in game development.*

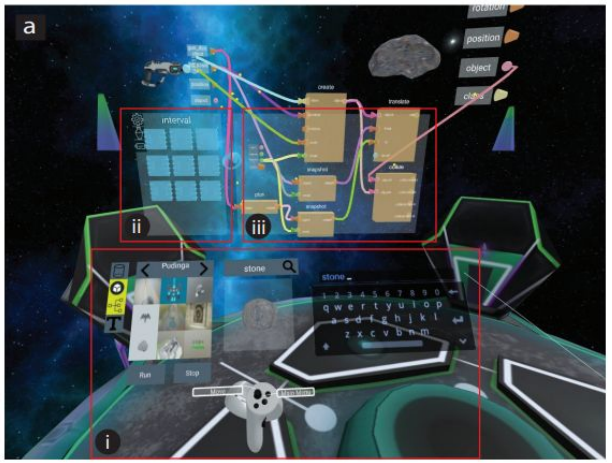
Authoring Tools

AUTODESK® MAYA®

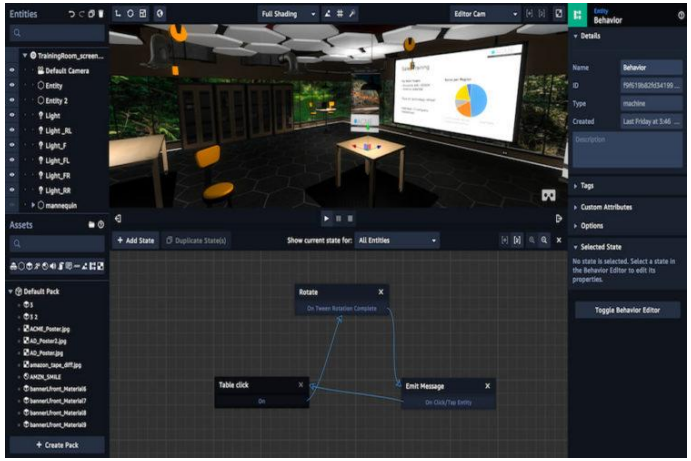
blender

unity

UNREAL ENGINE



FlowMatic



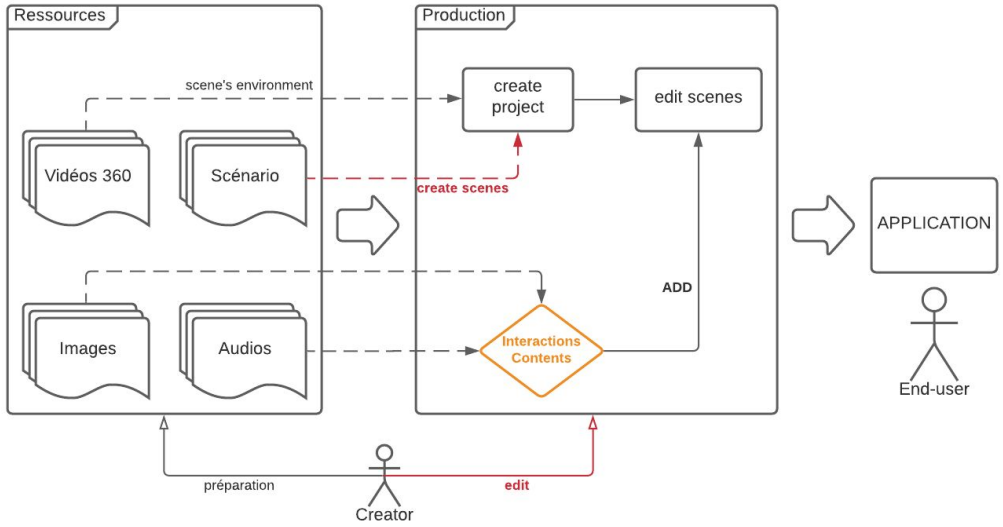
Amazon Sumerian

InstaVR

Immersive Authoring Tool

- *Educational applications developed from interactive 360 videos*
- *An immersive authoring tool*: no-code & E.A.S.Y*

  **a solution allowing trainers without programming skills to create educational environments*



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Hypothesis

- H1 : the difference in navigation, selection and manipulation actions during task execution between the VR and WIMP interfaces will lead to a difference in usability between them
    - *In the context of this experiment, operations requiring spatiotemporal coordination of panoramic videos are supposed to have better accuracy and execution time in VR compared to WIMP.*
- H2 : the use of a VR headset for the authoring tool will not significantly increase mental load or symptoms of cybersickness compared to a traditional WIMP interface
- H3 : participants using the VR interface will exhibit higher motivation than those using the WIMP interface in this experiment

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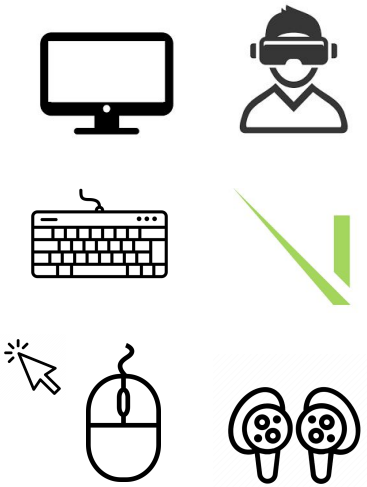
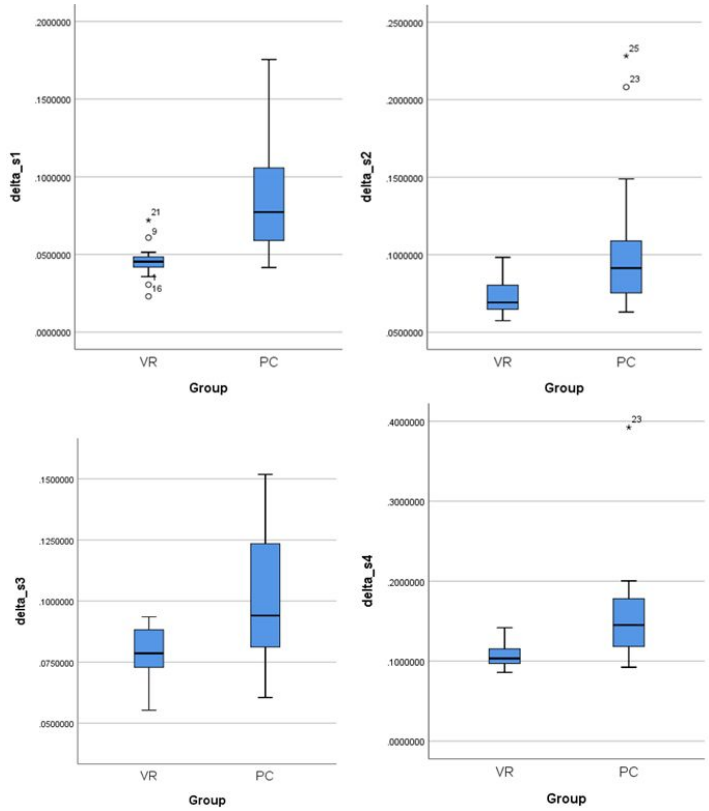
Experiment

- 30 participants from 20 to 50 years old, with an average age of 30.7 years
- 15 participants each VR and WIMP interface
- **The main tasks: positioning and configuring a virtual object on a fish in a panoramic video by superimposing a virtual marker on the fish.**



- Head movements
- Joystick or mouse movements
- Creation, deletion and movement of objects
- Recording of movement of the virtual marker
- Usability : (1) Effectiveness (2) Efficiency (3) Satisfaction
- Cybersickness (SSQ, NASA-TLX), Satisfaction (SUS) and Motivation (SIMS)

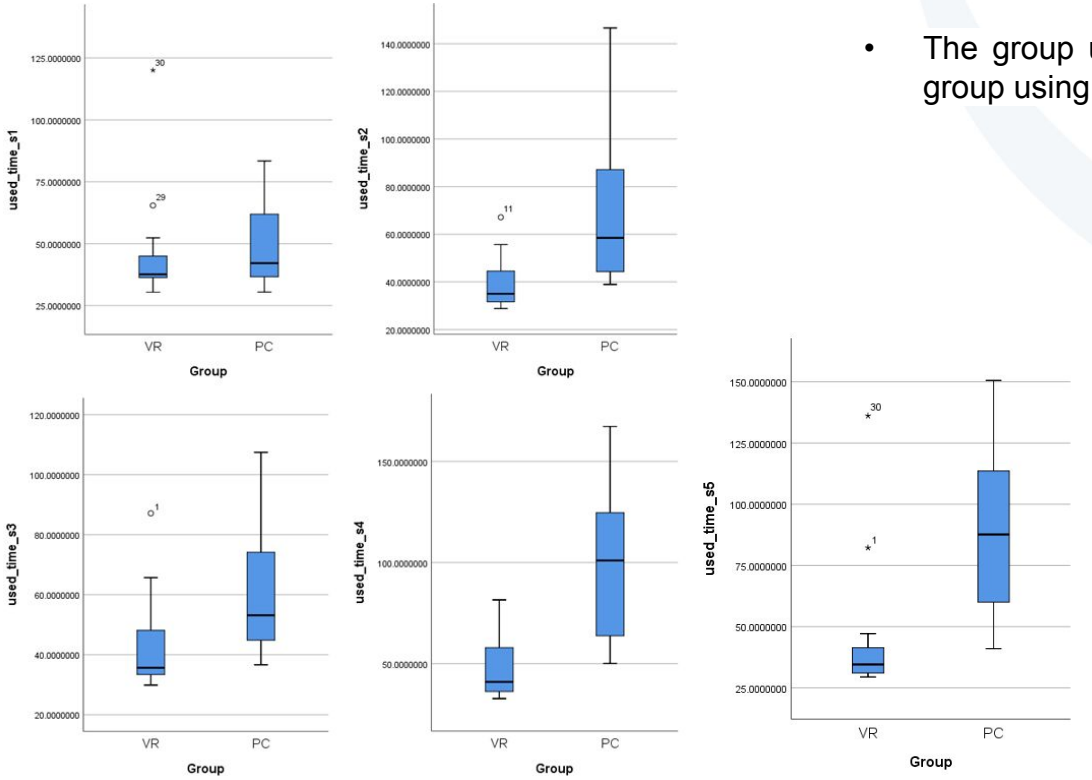
Effect of interactive interface on effectiveness



- At time *t* in the video
  - marker *m* had position **pm**
  - fish *f* had position **pf**
  - **dt (pm, pf)** : distance between marker & fish
- Relative distance between two consecutive periods *t+1* and *t*
  - Δ **(t+1, t) = d (t+1) - d (t)**
- the VR group recorded more stable trajectories than the WIMP group

Distribution of Mean Trajectory Differences for VR and WIMP Groups per Sequence

Effect of interactive interface on efficiency Satisfaction



- The group using VR completed tasks faster than the group using WIMP interface on the 5 missions

- **Satisfaction :** no significant difference between the VR group but the averages of the SUS indicated that both systems resulted in an acceptable level of user satisfaction.

Distribution of Execution Time Differences for VR and WIMP Groups by Sequence

Cybersickness & Motivation

SSQ	Group	Sig. Shapiro-Wilk	Sig. Mann-Whitney U	Levene Test	T-Test
Nausea	VR	,009	,001		
	WIMP				
Oculomotor	VR	,150		,447	,023
	WIMP				

- Participants using the VR headset experienced significant cybersickness
- A greater feeling of oculomotor disorders among the VR group than the WIMP group

- These differences of intrinsic motivation and external regulation highlighted a greater sense of autonomy for the VR group compared to the WIMP group.

	Group	N	Medium	S.D	Sig. T-Test
Intrinsic Motivation	VR	15	23,80	2,883	0,017
	WIMP	15	19,73	5,496	
Identified regulation	VR	15	20,73	5,663	0,121
	WIMP	15	17,53	5,276	
External regulation	VR	15	8,93	4,559	0,031
	WIMP	15	13,87	7,080	
Amotivation	VR	15	9,33	4,065	0,225
	WIMP	15	11,93	7,015	

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Conclusion

- VR interface improves spatial perception and object movement speed compared to WIMP interface

- Simultaneous and uninterrupted trajectory recording enhances spatial navigation, resulting in better performance in terms of time and accuracy on the VR interface.

- Cybersickness analysis shows that nausea and oculomotor disorder are more pronounced on the VR interface than on the WIMP interface.

- Situational Motivation Scale questionnaires reveal a higher sense of autonomy and better motivation to complete tasks in the VR group.

Conclusion

- The experiment findings showed better results in terms of motion tracking as well as interaction execution time on the VR interface than on the WIMP interface
- The level of satisfaction was comparable between the two groups and fell within acceptable range, with no significant difference observed
  - **Usability** : the VR interface seemed better suited than the WIMP interface (superior spatiotemporal coordination of interactions)
- Although the VR interface had its issues with cybersickness, trainers still reported a higher level of satisfaction and motivation while performing tasks in VR as compared to the traditional WIMP interface.
- The immersive environment based on interactive panoramic videos has also the other objects such as text and sound
  - requires further evaluation of cross-platform usability for the creation of these objects using an authoring tool
- Future : examination and evaluation the system's adaptability to various scenarios
  - developing a model for a scripting assistant

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