

# UNIVERSITY OF SOUTH FLORIDA

## Defense of a Doctoral Dissertation

Exploring Scalability of Multimodal User Interface Design in Virtual and Augmented Reality

by

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For the Ph.D. degree in Computer Science and Engineering

Use of Extended Reality (XR) technology such as Augmented Reality (AR) and Virtual Reality (VR) has experienced significant growth, with continuous advances in mobile technology and head-mounted display (HMD) headset development. As applications that span more than one type of reality have started to emerge, there is a need for additional research regarding the user interfaces (UIs) developed for these multimodal systems. While some work exists towards the creation of user interface design guidelines in AR and in VR, little to no work has been done in providing recommendations for designing interfaces that work successfully across multiple XR modalities. To explore this, three studies were conducted using an existing military system, the Battlespace Visualization and Interaction (BVI) architecture. First, interviews with UX experts to gain insights into key design aspects required across modalities. Second, a usability study of initial UI mock-ups with Army subject-matter experts. Lastly, a usability study with army personnel using user interface designs implemented into both AR and VR modalities.

### Examining Committee

Yasin Yilmaz, Ph.D., Chairperson  
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Monday, March 20<sup>th</sup>, 2023

1:00 pm

Hybrid - ENB 313 & Teams

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**THE PUBLIC IS INVITED**

### Publications

- [1] **S. Garcia**, D. Laesker, D. Caprio, R. Kauer, J. Nguyen, and M. Andujar, "An immersive virtual reality experience for learning spanish," in Learning and Collaboration Technologies. Ubiquitous and Virtual Environments for Learning and Collaboration: 6th International Conference, LCT 2019, Held as Part of the 21st HCI International Conference, HCII 2019, Orlando, FL, USA, July 26–31, 2019, Proceedings, Part II 21. Springer International Publishing, 2019, pp.151–161.
- [2] **S. Garcia**, R. Kauer, D. Laesker, J. Nguyen, and M. Andujar, "A virtual reality experience for learning languages," in Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems, 2019, pp. 1–4.
- [3] **S. Garcia**, D. Caprio, and M. Andujar, "A bmi-ar framework for hands-free instruction," in 2021 IEEE International Conference on Systems, Man, and Cybernetics (SMC). IEEE, 2021, pp. 721–726.
- [4] **S. Garcia**, S. J. Abraham, and M. Andujar, "Exploring perceptions of bystander intervention training using virtual reality," in ACM International Conference on Interactive Media Experiences, 2021, pp. 253–257.
- [5] **S. Garcia** and M. Andujar, "Neurochat: Artistic affective state facial filters in online video communication," in Augmented Cognition: 15<sup>th</sup> International Conference, AC 2021, Held as Part of the 23rd HCI International Conference, HCII 2021, Virtual Event, July 24–29, 2021, Proceedings. Springer International Publishing Cham, 2021, pp. 23–32.
- [6] W. McClinton, **S. Garcia**, and M. Andujar, "An immersive brain painting: the effects of brain painting in a virtual reality environment," in Augmented Cognition: 13th International Conference, AC 2019, Held as Part of the 21st HCI International Conference, HCII 2019, Orlando, FL, USA, July 26–31, 2019, Proceedings 21. Springer International Publishing, 2019, pp. 436–445.
- [7] W. McClinton, D. Caprio, D. Laesker, B. Pinto, **S. Garcia**, and M. Andujar, "P300-based 3d brain painting in virtual reality," in Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems, 2019, pp. 1–6.
- [8] R. Lieblein, C. Hunter, **S. Garcia**, M. Andujar, C. S. Crawford, and J. E. Gilbert, "Neurosnap: expressing the user's affective state with facial filters," in Augmented Cognition. Enhancing Cognition and Behavior in Complex Human Environments: 11th International Conference, AC 2017, Held as Part of HCI International 2017, Vancouver, BC, Canada, July 9–14, 2017, Proceedings, Part II 11. Springer, 2017, pp. 345–353

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