EE267 Project Proposal

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1 Introduction and Motivation

Inspired by a recent popular small game on facebook messanger, "Master Archer Game," we are proposing an immersive archery game, and we hereby introduce our VR version that we call "PhD Archer Game," as its creators are two PhD students. The motivation of providing such archery gaming experience is not just for joyful fun time for user him/herself, but also some human perception studies.

To compare how users react to and perceive the 3D environment in different settings of the immersive experience, we would like to find out that if virtual reality environment really provides the better user experience in gaming that requires users to perceive physics and 3D geometry perception. On the other hand, among various immersive experience, such as analygraph, virtual reality head mounted device, and plain LCD screen but with near 3D contents, how users would succeed the best in the gaming and obtain the most joyful gaming experiences is also of our great interest.

2 Related Work

Over the literature research, we have found several experimental or pioneering works that we found particularly insightful and instructional. Domenico Sammartino, for example, implemented a virtual-reality cross-bow game, which employs external motion sensors to capture the user's behavior [1]. In his technical report, he specifically discusses that the acceptable dimensions of stereoscopic arrow should be constrained. Further, he suggests that in order to provide a realistic game experience, the game should be able to visualize the real position and pose of the cross-bow as well as the arrow itself. As a final product, Sammartino implements the archery game with Unity3D game engine and the OptiTrack system, delivering a stereoscopic-3D cross-bow game. In addition, in 2016 Yiran Zhao *et al.* present a wearable device that can analyze the behaviors of the archer by using accelerometers [2]. Though this work is not for entertainment purpose, we found it useful, as it guides an approach to apply electronics to the archery. Beyond the technical papers, we have also studied several professional or interdisciplinary publications. For example, Stanislaw H. Czyz *et al.* quantitatively study the archers' performance [3]. Specifically, they provide a score vs. target distance model, or in other words, accuracy as a function of target distance, which provides a control reference to which we can compare with our recorded user behavior.

3 What will we create?

The key difference of the proposed project over an usual archery game is that we do not only provide the gamin experience itself; we aim to study how these experiences can be used to provide better immersive experience and how well human users can interact with virtually created contents.

Say, if our target is not only a plain bulleye target, but is instead William Tell carrying fruits on his head, will the user be more cautious while shooting the archer, or the user will still recklessly trial and error to shoot the arrow on target? We will also record the trials the user attempts to study how humans correct their depth perception if the first few shots are failures.

We will strive to incorporate the real world physics laws into the game, with environmental hyper parameters such as sound effect, strength of the wind, weights of the arrow, and even the movements of the target. We are proposing a comprehensive immersive archery experience for users to enjoy themselves or furthermore, to enjoy the gaming experience with a bunch of friends through a match. We will allow users to upload and post their new high scores on social networks such as facebook, to compete their archery skills with friends. We imagine that where there is competition, there should be more fun since this is an intrinsic tendency for human to compete and the feelings of winning sometimes is the best reward itself.

The expected product will be an iOS game that is compatible with the HMD housing we have worked with through this quarter, while other variation versions such as analygraph might also be presented to the test users for further comparison. The game will be implemented with Unity engine. The pose measurement will be done with iOS' built-in interfaces. Last but not least, the "shoot" event will be trigger by touching the iPhone's touch screen, which can be done with the trigger button on the housing.

4 Timeline

date	milestone
May 27th	Proposal submitted
May 29th - May 31st	Build Gaming Environment (Unity)
Jun 1st - Jun 3rd	Build Archery Engine (Physics Parts)
Jun 4th - Jun 6th	Build Archery Engine (Aesthetic Parts)
Jun 6th - Jun 8th	Assemble whole parts with Facebook API
Jun 9th	Demo Day!!
Jun 9th - Jun 12th	Report Writeup and Final Wrap-ups

References

[1] Domenico Sammartino, "Integrated Virtual Reality Game Interaction: The Archery Game," University of Hertfordshire Master's thesis (2015).

[2] Yiran Zhao, Kevin Curtin, Shanu Salunke, Nghia Huynh, Alexander Leavitt, and Clint Zeagler, "E-Archery: Prototype Wearable for Analyzing Archery Release," UBICOMP/ISWC Heidelberg, Germany (2016).

[3] Stanisaw H. Czyz and Sarah J. Moss, "Specificity vs. Generalizability: Emergence of Especial Skills in Classical Archery," Frontiers Psychol. **7**, 1178 (2016).