Acting 2.0: When Entertainment Technology Helps Actors to Perform

Daniel Kade
Mälardalen University
Västers, Sweden
danie.kade@mdh.se

Rikard Lindell
Mälardalen University
Västers, Sweden
rikard.lindell@mdh.se

Hakan Ürey
Koç University
Istanbul, Turkey
hurey@ku.edu.tr

Oğuzhan Özcan
Koç University
Istanbul, Turkey
oozcan@ku.edu.tr

ABSTRACT

Motion capture shoots involve a wide range of technology and entertainment production systems such as motion capture cameras, tracking software and digital environments to create entertainment applications. However, acting in this high-tech environment is still traditional and brings its own challenges to the actors. Good acting and imagination skills are highly needed for many motion capture shoots to deliver satisfying results.

In our research, we are exploring how to support the actors and use a head-mounted projection display to create a mixed reality application helping actors to perform during motion capture shoots. This paper presents the latest enhancements of our head-mounted projection display application and discusses the use of this technology for motion capture acting as well as the potential use for entertainment purposes.

ACM Classification Keywords

H.5.1 Information Interfaces and Presentation: Multimedia Information Systems - Artificial, Augmented, and Virtual Realities; J.5 Arts and Humanities: Performing Arts; H.5.1 Information Interfaces and Presentation: Multimedia Information Systems - Evaluation/methodology

Author Keywords

Mixed Reality; Head-mounted Projection Display; HMPD; Acting; Motion Capture: Laser Projector

INTRODUCTION

Motion capture acting has been used for many animations in movies, computer games, commercials and more to enhance the quality of motions and the representation of emotions on 3D avatars. To support the demand of believable and natural looking animation, motion capture actors perform movements to play out the scenes placed onto the digital avatars. However, motion capture acting, as it is performed today, does not provide a natural acting environment. This is mostly because motion capture actors do not see and feel the virtual environment they act for, while acting. In many cases this can result in unnatural motions such as stiff looking and emotionless movements.

We aim at developing knowledge through creating computational artefacts and exploring how to support actors within a motion capture environment. Our research towards supporting motion capture actors has lead to a deeper understanding of the demands on motion capture actors and what technology can be applied to a motion capture environment.

As a result of initial interviews and user studies, we have developed a prototype that allows to further explore the needs of actors and the ways of supporting them while acting [7]. Our prototype creates a virtual acting scene around the actors and provides digital key elements to trigger and support the actors performance and moods.

The developed prototype is a head-mounted projection display (HMPD) using a laser projector and a retro-reflective material to display the image. A smartphone is used as a processing unit and as sensor platform, detecting head movements.

We conducted user tests with professional actors that used our prototype. This gave us important details on what parts need to be improved to allow for a more immersive experience.

Moreover, we have also explored to use the prototype for entertainment and gaming purposes, which has shown potential to explore the uses of prototype further for gaming and entertainment applications.

STATE-OF-THE-ART

As we discovered in earlier research, motion capture acting could benefit from the support of showing the virtual content in real-time while acting [7]. One way of doing this would be

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to use projections covering the walls of a room to show the acting scenery.

In the 'RoomAlive' research project, the walls of a room were covered with digital scenery with the help of six projectors to create an immersive gaming experience [5]. In other research, actors acted on a theatre stage where scenery was projected to the back of the stage and digital characters, controlled by motion capture actors, were projected on a screen that was set up in front of the theatre stage [2]. The problem with such setups is that it is not practical for motion capture acting as it requires time to set up the rather static technology and is not flexible as motion capture scenery and setup can and has to be changeable quickly. Another issue with using projections is that motion capture cameras would be affected by their emitted light.

Therefore, we perused the approach of using a head-mounted projection display (HMPD) with low emitting lights that suits the requirements of motion capture acting.

The use of HMPDs to project digital content onto reflective surfaces [3] as well as non-reflective surfaces [8, 9] to allow interactions between users and the system was researched already. These technologies and findings create a theoretical basis for our research.

Low light-emitting laser projectors, as we use, have also been used in research projects before [4]. There, a shoulder-mounted projector was combined with a depth camera to project images to non-reflective surfaces and to allow gestural interactions. Even other systems like e.g. the CastAR, could be categorized and called a similar technology. Nonetheless, there were some important differences that did not suit the requirements of motion capture acting. For example, our system needs to record head movements and should not limit the actors in their movement capabilities or block the actors' vision or large parts of the face, as facial motion capture would not be possible anymore. Furthermore, we needed a basic system that allows for a solid setup that sits firm on the head of an actor; as stunts and athletic movements could occur within motion capture acting.

CURRENT RESEARCH AND UPCOMING PROJECTS

As we have not been able to find an off-the-self solution for our approach to provide visual acting scenery and support to actors, we have worked on creating a HMPD using a pico laser projector that is connected to a smartphone processing the digital content and controls [1]. The image is then projected to a retro-reflective cloth that redirects the projection towards the users eyes and creates a perception of having a bright image the feels physically closer as the actual position of the reflective material. This concept is depicted in figure 1.

Previous versions of our prototype focused on the technology and the applicability in motion capture. Currently, we are improving the look and feel, the ergonomics and the features of the prototype. Designing a head-mounted projection display, that is ergonomic, functional and appealing to the user is a challenge on its own. Therefore, we are trying to get our current version towards a prototype that looks closer to a product but still complies with the requirements of a motion capture environment.

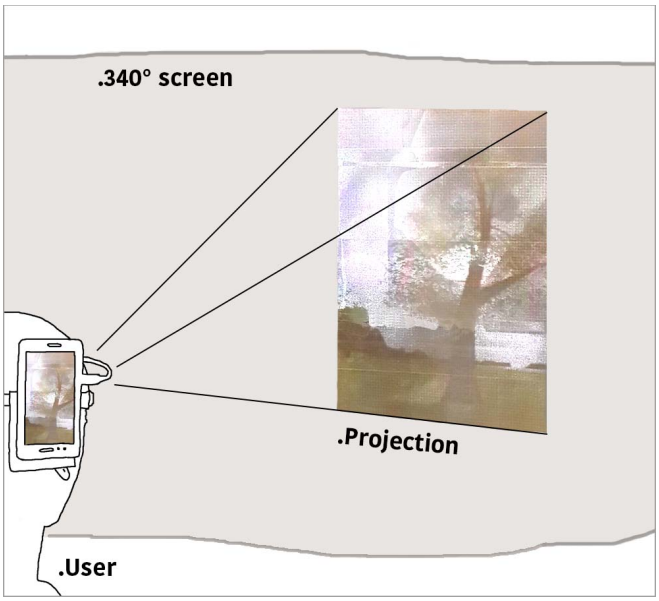

Figure 1: Image showing the concept of our head-mounted projection display setup

Using a head-mounted projection display in motion capture, involves that the device needs to be robust, as actors might need to perform movement intense motions. Moreover, it involves that the setup time is rather fast and simple, as well as that software is dynamic and the projected environments can be adjusted and changed quickly. Still we must also consider the ergonomics of our device to provide a better experience. Therefore, we explore what locations the current hardware pieces could be placed on a users head and how a sturdier fit could be achieved. One issue that we encountered with our current version is for example that the placement of the mobile phone on the side of a user's head is perceived during the head rotations as an extra weight pulling the users head. Therefore, a placement on the top head or back head in a more centered way might be better.

IMPLEMENTATION

Our current prototype consists of two Lithium Polymer batteries ($2\times3,7V \times 2000mAh = 14,8Wh$) that are used as power source for a stripped down pico laser projector, SHOWWX+ from Microvision. 3D printed housings were constructed to mount the parts on an adjustable headband and to protect the electronics from shocks. The architecture setup can be seen in figure 2 The projected digital content, as well as the head motions are processed on the mobile phone that is mounted to our prototype. For head motions, we use the smartphones inbuilt gyroscope sensor. The smartphone is a Samsung Galaxy S4+, running an app created in Unity 4.

As projection surface, we covered a room with a retro-reflective screen, as shown in figure 3. The retro-reflective material is no. 6101 from RB Reflektör with high-quality optical properties. This allows having a bright retro-reflected

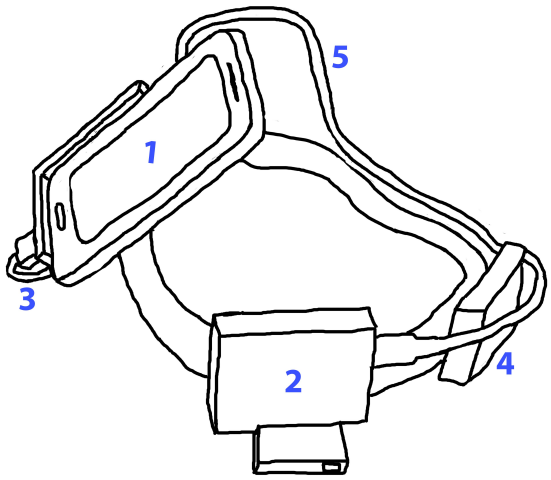

Figure 2: Image showing the hardware architecture with 1) Smartphone, 2) laser projector, 3) MHL adapter, 4) battery pack and 5) hdmi cable

image and creating the perception of the image being spatially closer to the user as when only projecting an image to a wall.



Figure 3: The left image shows a view from the outside of the room covered with retro-reflective material, the right image shows a view into the room.

Figure 4 shows the current version of our prototype with 3D printed housings to set a basis for exploring new shapes and forms towards a more ergonomic look and feel as well as exploring the locations of hardware components.

SUPPORT FOR ACTORS

To support actors with their work, we show the digital environment to the actors in real-time while acting. In other words, we provide the scenery to the actors and try to trigger their emotions and moods through sounds, animations or the atmosphere of the projected environments. Through the use of the smartphones gyroscope, the actors can look around in the digital world freely and use the locations and events in the depicted scenario for their artistic expressions. We have created different digital scenarios in the game engine Unity to

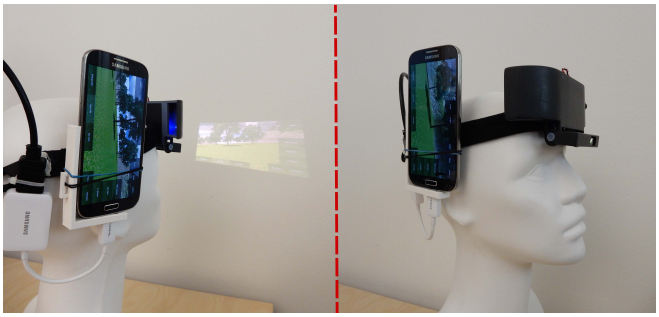

Figure 4: Both images show the hardware components of our head-mounted projection display

test how and if actors can be supported through our application. To validate our application, we will test these scenarios with professional actors and write about the experiences in the future.

MIXED REALITY IN ENTERTAINMENT

In prior research, we have shown that our mixed reality HMDP application can be used in gaming applications [6]. Here, we created a simple Asteroids like game where the gamer's controlled a centered crosshair to shoot asteroids by moving their heads. At the same time head movements were used to look around in the environment. This research revealed a first clue that our HMPD could be used for simple gaming applications. In this research we had only a limited area as screen, basically only covering a ca. 3m long wall. With the setup of our new test room, we achieve a 360 CAVE like experience. The field of view was also limited to the projectors given 44 x 25. Just recently we attached a standard fish eye lens for mobile phones to the projector and achieved an approximately 1.9 times enlargement of the field of view. Both improvements allow for a more a better and more immersive gaming experience and we are interested to explore the improvements in further research.

User that we tested with our gaming application showed interest in our application and even developed a competitive gaming atmosphere. Furthermore, the users stated that the gaming controls were rather easy. Users were engaged and showed a willingness to use the prototype for private use [6].

These findings and improvements are definitely a drive for us to further explore gaming and entertainment applications for our mixed reality setup. To allow for a more interactive gaming experience and more game ideas, we consider external wireless inertial sensors as potentially interesting and plan to add these to our current prototype.

Nonetheless, to allow for more ideas and inventions, we first have to provide a sturdier prototype and some basic features to show the potentials of the device. This is what we are aiming at and will place our future research around.

CONCLUSION

With our mixed reality prototype, we are exploring the possibility to use the head-mounted projection displays as acting

support, as well as for a possible application for gaming and entertainment.

We have demonstrated our current status and discussed how we see that actors can profit from our mixed reality application. Moreover, we discussed how we have used our prototype for gaming applications and we have discussed an initial idea on how to further investigate the use of our system for gaming and entertainment applications.

Through improvements of our prototype, we hope to provide an even more immersive acting support and allow for more use cases in gaming and entertainment applications.

FUTURE WORK

Apart form the already-mentioned improvements of ergonomics, features, and appearances, we are interested to further explore the us case of gaming and entertainment applications for our prototype. Moreover, we are planning to test the prototype with professional actors to validate the use in motion capture acting. Furthermore, we plan to use 3D sound to enrich the capabilities of the prototype and to allow a more immersive experience.

REFERENCES

1. Kaan Akşit, Daniel Kade, Oğuzhan Özcan, and Hakan Ürey. 2014. Head-worn mixed reality projection display application. In *Proceedings of the 11th Conference on Advances in Computer Entertainment Technology*. ACM, 11:1–11:9.
2. Anthousis Andreadis, Alexander Hemery, Andronikos Antonakakis, Gabriel Gourdoglou, Pavlos Mauridis, Dimitrios Christopoulos, and John N Karigiannis. 2010. Real-time motion capture technology on a live theatrical performance with computer generated scenery. In *Informatics (pci), 2010 14th panhellenic conference on*. IEEE, 148–152.
3. Mark Bolas and David M Krum. 2010. Augmented reality applications and user interfaces using head-coupled near-axis personal projectors with novel retroreflective props and surfaces. In *Pervasive 2010 Ubiprojection Workshop*.
4. Chris Harrison, Hrvoje Benko, and Andrew D Wilson. 2011. OmniTouch: wearable multitouch interaction everywhere. In *Proceedings of the 24th annual ACM symposium on User interface software and technology*. ACM, 441–450.
5. Brett Jones, Rajinder Sodhi, Michael Murdock, Ravish Mehra, Hrvoje Benko, Andrew Wilson, Eyal Ofek, Blair MacIntyre, Nikunj Raghuvanshi, and Lior Shapira. 2014. Roomalive: Magical experiences enabled by scalable, adaptive projector-camera units. In *Proceedings of the 27th annual ACM symposium on User interface software and technology*. ACM, 637–644.
6. Daniel Kade, Kaan Akşit, Hakan Ürey, and Oğuzhan Özcan. 2015. Head-mounted mixed reality projection display for games production and entertainment. *Personal and Ubiquitous Computing* 19, 3 (2015), 509–521.
7. Daniel Kade, Oguzhan Özcan, and Rikard Lindell. 2013. Towards Stanislavski-based Principles for Motion Capture Acting in Animation and Computer Games. In *Proceedings of CONFIA 2013, International Conference in Illustration and Animation*. IPCA, 277–292.
8. Pranav Mistry and Pattie Maes. 2009. SixthSense: a wearable gestural interface. In *ACM SIGGRAPH ASIA 2009 Sketches*. ACM, 11.
9. Pranav Mistry, Pattie Maes, and Liyan Chang. 2009. WUW-wear Ur world: a wearable gestural interface. In *CHI'09 extended abstracts on Human factors in computing systems*. ACM, 4111–4116.