

# Glove Puppetry Cloud Theater Through a Virtual Reality Network

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(a)



(b)



(c)

Figure 1: (a) Chinese glove puppetry, (b) Puppetry's opera in cloud theater, (c) Interactive digital glove puppetry

## ABSTRACT

Chinese glove puppetry is a traditional art with a long history and widely spread in the folk ever. This paper presents a collaborative work in multi-user virtual reality system for puppetry's opera. According to our developed system, each user has a unique perspective on any shared virtual world and interaction through our virtual reality network. This system achieves human-computer interaction and realizes the interaction between people. In addition, it brings an entertaining experience to users and easy to operate for all ages. In order to cultural preservation, we can record a grandmaster's puppet show performance in our system. Our research not only delivers a balance of art and technology in culture creativity, but also preserve folk art.

## CCS CONCEPTS

• Human-centered computing → Virtual reality

## KEYWORDS

Virtual Reality, Cultural Heritage, Glove Puppetry.

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## 1. INTRODUCTION

United Nations Educational, Scientific and Cultural Organization (UNESCO) have officially announced the glove puppetry as "Intangible Cultural Heritage of Humanity" in 2012 [UNESCO 2012]. Glove puppetry is a type of opera using cloth puppets that originated during the 17th century in China's Fujian province. It is a traditional art with a long history and it widely spread in the folk ever. Glove puppetry had since established itself contemporarily as a popular art form in Taiwan. The puppet's head uses wood carved into the shape of a hollow human head, the puppet's torso and limbs consist entirely of cloth costumes, as shown in Fig 1(a). At the time of the performance, a gloved hand enters the puppet's costume and makes it perform. Some papers have been proposed for a single user playing glove puppetry [Lin et. al. 2018]. In this paper, we present a cloud theater of puppet's performance in virtual reality network. The main contributions of this investigation are as follows:

1. This paper presents a collaborative work in multi-user virtual reality system for puppetry's opera.
2. In order to cultural preservation, we can record a grandmaster's puppet show performance in our system.

## 2. RELATIVE WORK

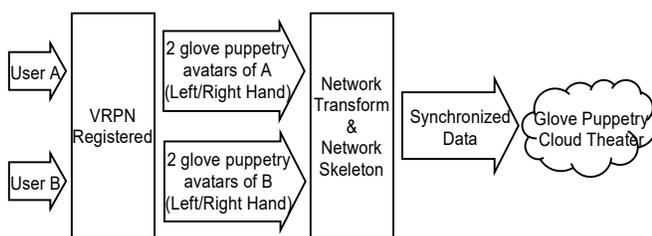
The recent explosion of Virtual Reality offers unprecedented opportunities for learning, communication and entertainment in

cultural spaces. VR/MR can play a key role in the presentation of the past and of polysemic cultural practices which can create new sensations and meanings. J-M. Day and D-L. Way developed a set of motion capture detects user action, and drive the corresponding 3D avatar content with preset 3D animation [Day et. al. 2018]. Head Mounted Display (HMD) of VR combined with Kinect motion capture sensor, allowing the user to view the space environment in addition to the White Crane Dance animation and the user can observe the operation status of 3D avatar. Lin et al. provided a method which can let users control the virtual puppets through the computer [Lin et. al. 2018]. The Leap Motion will catch the hand gesture of the user and show the motion of the puppets on the computer screen. User can choose different puppets, scene and music according to your own preferences though the system that we construct. Virtual glove puppetry system is aimed to make more users to enjoy the pleasure of this traditional art in a lower cost.

### 3. OUR APPROACH

In this paper, we provided a multi-user virtual reality which supports different users to share the same virtual space from individual computers, which means that each user has a unique perspective on any shared virtual scene or interaction. We developed core technologies and applications of multi-users VR. Users can not only see each other in our multi-users VR system, but also observe each other's actions to reflect the interaction with the virtual object situation. In other words, in order to connect and communicate with others in the same virtual space, users need to take into account that others see and experience the scene differently from themselves.

Fig. 2 illustrates our system architecture of glove puppetry cloud theater. The software of our system mainly consists of Leap Motion and VRPN (Virtual Reality Peripheral Network). When a user registered as a host of our system, server adds player and generates two glove puppetries avatars in the scene, which controlled by the user's hands joint data grabbed separately. The Network Transform component handle data transformation through the network system. The Network Skeleton component synchronize the skeleton data of every glove puppetry registered in the glove puppetry cloud theater.



**Figure 2: System Architecture of Glove Puppetry Cloud Theater**

Leap Motion Controller is attached to HTC Vive for capturing the motion of user's hands and deliver the formatted data to computer throw VRPN. User's forefinger controls the head of the puppetry,

the thumb and little finger controls the left and right hands of the puppetry, as shown in Fig 1(c). This system can just run at the local host with two virtual puppetries in the scene. When multiplayer involved in the case, each of them need a Leap Motion, a HTC Vive and a computer connected to network. Users can see perform scenes in real time on their own computer synchronously, as shown in Fig 1(b).

Users, without any professional training, can personally manipulate a character of glove puppetry to finish a puppetry performance by their hand actions. They also can get an animation through giving the record command to our system if they want. This research not only achieves human-computer interaction, but also realizes the interaction between people. It brings an entertaining experience to users and easy to operate for all ages. Even more important is that the application of glove puppetry play embodies the protection of the art of glove puppetry animation.

### 4. CONCLUSION

The cloud theater of glove puppetry targeted at interactive virtual reality experiences the understanding of culture. Our research not only delivers a balance of art and technology in culture creativity, but also preserve folk art. Virtual Reality has become accessible and affordable which makes new media art a new vision. This research's achievements and experiences will provide and relocate the traditional art.

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