MuseSpace: A Touchable 3D Museum with Maximum Usage of Haptics

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1. Introduction

We present a networked haptic virtual museum; MuseSpace. The main objective of our MuseSpace is to build a virtual musical instrument museum for both education and entertainment. In our MuseSpace, various touchable musical instruments and artifacts are displayed and people can touch them freely by using haptic devices, while in real museums, people are usually not allowed to touch them by keeping those instruments and artifacts in glass showcases in order to prevent possible damages from touches. In addition, we enhance the accessibility, e.g. navigation control, instrument handling, with the help of haptic devices. One of the significant advantages of MuseSpace is that it provides visitors with the chances to experience instruments more interactively by supporting diverse interface media: audio, video, and touching.

2. Design and Implementation of MuseSpace

Screen shots of our touchable 3D Museum are shown in Figure 1. Haptic support endows the virtual museum with more immersive and interactive qualities. MuseSpace allows haptic navigation and three types of haptic interactions with users: touch, play, and Non Player Character (NPC) interplay.

Figure 1. Screen shots of MuseSpace: audio, video and haptic interface (top-left), playable drum (top-right), playable piano (right-center), puzzle game (bottom-right), NPCs responding to touches (bottom-left), touchable exhibits (bottom-center)

MuseSpace primarily offers an exhibition hall filled with many musical instruments and artifacts. Users can walk around in the hall while looking and even touching the artifacts that they are interested in, also can play musical instruments.

Each of the artifacts has its own haptic properties such as stiffness, damping, static and dynamic friction. Those properties contribute to produce various senses of touch when those are synchronized with graphical properties of the artifacts. For example, if stiffness, damping, static and dynamic friction are set to 1.0, 1.0, 0.0 and 0.0 respectively, such combination generates feeling to touch glassy objects. Currently, we can produce more than nine different senses: those can be experienced in our haptic puzzle game.

In MuseSpace, users can play 3D sound generating musical instruments: drum and piano, by using haptic devices and collaborative playing with remote users are also possible; more than two users can play drum or piano as a group at the same time over networks. The NPC interaction allows users to experience haptic reactive NPCs. There are four types of NPCs that have their own tempers; their mood changes as users touch them with haptic devices and NPCs show their feelings through reactions.

In addition, users can navigate the inside of MuseSpace by using haptic devices as a navigation controller. This function was developed because of inconvenience when users should use a keyboard, a mouse and a haptic device at the same time. Although a keyboard and a mouse are sufficient for exploring other general virtual environments, in haptic virtual environments, users may have difficulties in controlling a haptic device as well as a keyboard and a mouse simultaneously; sometimes need a skill to move quickly their hands from one device to another. With the navigation control by the haptic device, users can move around MuseSpace with more ease.

3. Conclusions

MuseSpace is a touchable 3D museum which adopts the maximum usage of haptics. MuseSpace provides haptic device based navigation and three types of haptic interactions; touch, play, and haptic reactive NPC. Users can play networked musical instruments by using haptic devices together with remote friends and try the haptic puzzle, all for edutainment purpose. To evaluate the usefulness of MuseSpace comparing with that of traditional audio-visual virtual museums, we conveyed a survey dozens of users and concluded that MuseSpace provides superior experiences in the aspects of immersiveness, reality, edutainment, and interactivity. In addition, the survey results show that haptic sense recreation is also promising.

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