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Towards the Full Experience of Playing Drums on a Virtual Drum Kit

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ABSTRACT

A key concept of drums kits is the ability to customize elements and their placement. It is part of the creative process which influences the playing style. We discuss elements of drum kits customization, existing haptic interactive systems for drums, and technologies which would make it possible to implement a virtual drum set which provides the full experience of playing drums.

MOTIVATIONS

Drums is a particular musical instrument in the sense that each musician builds his own drum set to create his own sound. Each element produces a particular sound, takes a significant space, and costs a significant amount of money. Few musicians can afford a drum kit with tens of drums and cymbals like Terry Bozzio¹ or Mike Portnoy².

Electronic kits use pads and piezo sensors with a MIDI expander, and produces music similarly to synthesizers. Recent kits replaced pads with drumheads, which gives a more realistic and enjoyable haptic sensation. These kits give make it possible to customize the sound of each drum element. However the haptic feedback is not customizable, and these kits still need as many physical elements as virtual elements. A virtual drum kit would make it possible to build any kit possible.

HAPTIC DRUMS

Research about haptic drum focused on the emulation of a drum sound [1]. Authors emulate a stroke on a drum head with a mechanical apparatus. However the user just presses a button to trigger the mechanical actuation. This does not reproduce the experience of playing drums. Later studies presented a drum emulation system [2], which uses a PHANToM [3] haptic device. There is more interaction, but it is still far away from the experience of playing a full drum set. The Ubiquitous Drums project is a step forward in this direction [5]. Input

¹<http://terrybozzio.com/about-terry/kit-setup/the-big-kit/>

²<https://www.mikeportnoy.com/drums/mirage/>

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sensors on the hands and feet make it possible to play drums without drum kits. However in this case there is no haptic feedback, and no actual drum kit.

To summarize, to our knowledge, there is no full haptic virtual drum kit which provides a full drumming experience with extensive customization of the drum elements.

TECHNOLOGIES

Technology is a key limitation for this application. The actuation apparatus has to react as fast as extreme limbs movements, and resist to arm strength. Typical robotic arms hardly reach this level of performance [3]. We envision using alternative technologies such as a SPIDAR [4] or Electro-Muscle Stimulation [6]. Besides, haptic drum kit have no visual aspect. However this is critical for actual play. Thankfully recent advances in VR headsets enables crating the sensation of being surrounded with the drum kit.

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