

# Adapting 3D Selection and Manipulation Techniques for Immersive Musical Interaction

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As Virtual Reality headsets become accessible, more and more artistic applications are developed, including immersive musical instruments. 3D interaction techniques designed in the VR/3DUI research community, such as navigation, selection and manipulation techniques, open numerous opportunities for musical control. For example, navigation techniques such as teleportation, free walking/flying and path-planning enable different ways of accessing musical scores, scenes of spatialized sounds sources or even parameter spaces. Manipulation techniques provide novel gestures and metaphors, e.g. for drawing or sculpting sound entities. Finally, 3D selection techniques, such as ray-casting, cone selection, virtual hands and image-plane selection, facilitate the interaction with complex visual structures which can represent hierarchical temporal structures, audio graphs, scores or parameter spaces. However, existing devices and techniques were developed mainly for applications such as industrial design or medicine, and with a focus on efficiency, i.e. minimizing error rate and task completion times. They were therefore not designed with the specificities of musical interaction in mind.

After quickly reviewing existing 3D interaction techniques, we will focus on selection techniques and describe their limitations for musical expression. For instance, existing techniques focus either on the selection of a single object, or on sequential selection of multiple objects. For musical interaction however, parallel selection of musical parameters can be a strong requirement. Input devices commonly used for 3D interaction, such as wands and gloves, may also put constraints on expressive control, by limiting parallel interaction, haptic feedback and input freedom.

We will then present a first attempt at providing an input device and the associated 3D selection technique for musical interaction in virtual environments. It allows for per-finger selection and control of multiple virtual sonic entities or of multiple parts of a single entity, e.g. to explore a volumetric texture. It builds on existing selection techniques such as cone and virtual hand selection. The input device is composed of a Leap motion device that tracks the fingers, vibration sensors attached to each finger and a surface attached to the hand that the fingers can scratch / hit. The resulting sound for each finger can be conveyed to sound entities selected in the virtual environment for excitation or modulation.