Sensorimotor Learning in Gesture-Sound Interactive Systems

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Motivations

The considerable expansion of gesture interfaces in human-machine interfaces, from mobile computing systems to video games, constantly bring novel technological systems and usages and where the user actions and gestures are central.

We believe that the effects of sensorimotor learning are insufficiently studied and should be taken into account in the developments of interactive sound systems.

A better understanding of the sensorimotor learning mechanisms of the gesture-sound coupling is necessary to provide efficient methodologies for the evaluation and optimization of interactive systems

Objectives

The general goal is to study sensorimotor learning occurring in gesture-sound interactive systems, and in particular its evolution over time.

Three different perspectives are considered:

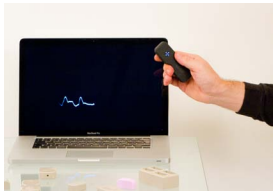
sound control in digital music instruments, such as alternate musical interfaces using gestures and body motion

gesture learning with audio feedback, with potential applications in rehabilitation or pedagogy (sport, music)

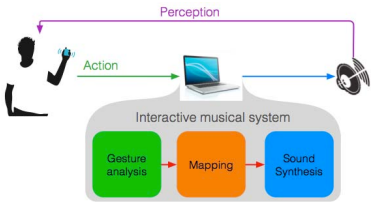
interactive sound design, to guide users "sonically" when manipulating objects

Gesture Control of Digital Sounds

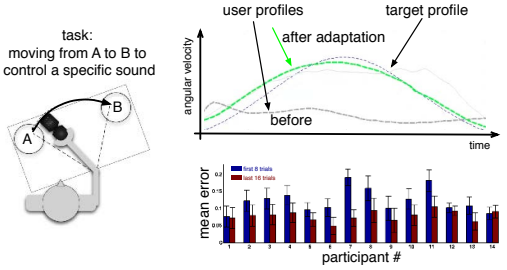
Digital sound synthesis can nowadays be controlled using large variety of motion sensing systems, from inertial measurement units or video cameras.



MO interfaces (Ircam-NoDesign): wireless inertial measurement units



Experiments: sensorimotor adaptation during a "sound control" task



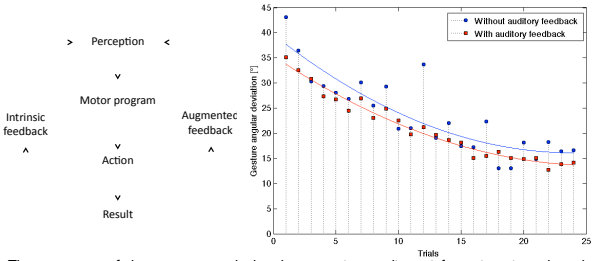
Preliminary results show that sensorimotor adaptation occurs during the task that consisted in reaching a specific sound quality

Rehabilitation : Learning Gestures with Auditory Feedback

A specific aim of our project is to investigate the potential of auditory feedback as a guidance for movement in rehabilitation. A few experiments tend to show benefits of auditory augmented feedback on subjects with hemiparesis and gait disorder but extended experiments are necessary to understand the mechanisms of learning in such specific conditions.

The objective is to develop and evaluate gesture-sound interactive systems that can help rehabilitation of patients. Experiments are carried out first on healthy patients to understand the mechanisms involved. Other types of systems may benefit from this work such as sensory substitution (*e.g.* audition *vs* sight) and virtual reality.

Experiments: effect of the auditory feedback on the adaptation to a visuo-motor perturbation



The movement of the arm was tracked and convert into auditory information given through a headphone. When the perturbation (a distortion in the gesture control and monitoring) is suppressed, the "after-effect" showed a more stable and quicker learning of the gesture with the auditory feedback.

References

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