Detailed Work Plan: Audio feedback in predictive HCI methods

The aim of this short term mission is to work at the Medialogy Department of the Aalborg University in Copenhagen to a project with Prof. Stefania Serafin. The work that we would like to do together is related to an ongoing project about a well known HCI predictive model in an audio perspective: the Fitts' model has been analyzed providing different audio interactive displays and interfaces in which the user had to perform simple tuning tasks. In fact, frequency tuning is the direct transposition of spatial aiming if one accepts the notion of auditory vs. visual objecthood given by Kubovy [2]. Sliding/tuning gestures carry many similarities in different contexts the musical and the interaction one. The metaphor used was a clear Fitts task, even if the studies of velocity profiles can still lead to many expressive considerations. Several inferfaces has been already used (a Tehremin, a sliding interface, a webcam inferface) and we want to focus our research on one of them: the croaker, a digital intonarumori. In particular we would like to test it with everyday sound as feedback and in a navigation task.

In fact, the action of steering a path within a corridor, as used in some Fitts-like experiments [1], can be linked to the metaphor of a violinist trying to "balance" her sound. Such situation is represented by the so-called "Schelleng diagram" [3].

The Schelleng diagram indicates the theoretical minimum and maximum bow force as a function of the relative bow position along the string. Between the bow-force limits, Helmholtz motion is established. Helmholtz motion arises from the stick-slip interaction between bow and string, and is characterized by a single corner travelling back and forth on the string under an approximately parabolic envelope. While the corner is between the bow and the nut or finger, the string is sticking to the bow. When the corner is on the shorter part of its journey, between the bow and the bridge, the string is slipping under the bow.

The idea behind this experiment is to reformulate equilibrium in continuous interaction as navigation within the corridor of playability in Schellengs plots, using the croaker interface.

Motivation

The human-computer interaction and the predictive models which are used to evaluate interfaces are mostly based on visual feedback: very often the user is supposed to have just one sense which is not helped nor substituted by any other one. New interfaces need to be designed in order to realize a multimodal interaction between the user and her machine: this necessity can be tested and explored by studying well known predictive laws in other sensory domains. Sensory substitution as well as sensory illusion and multimodality can be useful in designing and experiencing a new interface. The main idea is to study interfaces where the information is conveyed through different modalities. The effectiveness of the multimodal interaction will be evaluated using predictive models which have been demonstrated to be useful in this kind of context too. Gesture interaction with audio feedback, and in general non verbal interaction, can be considered the natural application of our study. Gesture and sound seem naturally connected in a clear and obvious way: the image of instrument players learning to use their body in order to produce sound is indeed widespread and compelling enough. While each instrument needs specific gestures to be played in a correct and pleasant way, invariant laws regulating gestures across all instruments may be found. A computer can be considered as a musical instrument, perhaps not new but still far from having a coded tradition related to musical gesture. Musical gesture can be simply thought as a gesture that produces sounds in a continuous feedback loop: this is a general definition that can be used in many interactive contexts besides the musical one. Acoustic events play an important role in our general perception of the environment and can have a strong impact on our affects. This is especially true when acoustic cues are used to enhance or to complement the visual modality:

- audio feedback can be very informative when visual feedback is missing;
- sound conveys information about the environment (e.g. the material of a stroked surface, the brand of a car, the genre of a person walking or the voice of a person).

References

[1] J. Accot and S. Zhai. Performance evaluation of input devices in trajectory-based tasks: An application of the steering law. In *Proc. of CHI'99*, Pittsburgh USA., 1999.

[2] Kubovy and Van Valkenburg. Auditory and visual objects. *Cognition*, 2001.

[3] J.C. Schelleng. The bowed string and the player. *J. Acoust. Soc. Am.*, 53(1):26–41, 1973.