

## STSM Detailed Work Plan – John Williamson

Gestural control is an interesting candidate for the navigation of high-dimensional data, since gestures offer a high degree of expressivity by allowing both temporal organization of movement and a large control dimensionality. The question is how such gestural control can effectively be used to conduct, activate, navigate or manipulate audio systems like for instance Interactive sonifications which lie in the focus of research topics in WG3 of ConGAS. Conceptually more complex than a "direct mapping" of gestural attributes or the use of dynamic gestural patterns (like movement sequences) are those control strategies where the control flow emerges from the tightly closed interaction loop including the user and the controlled system. Pointing without a pointer ("Pointing Without a Pointer", Williamson and Murray-Smith, CHI 2004) is such a technique to allow continuous entropy reduction and thus an interesting new sort of control loop.

In the STSM we plan to join the different approaches from these sort of interactions with the approach of Model-based sonification, which starts from an action/excitation-oriented perspective. In result, a new sonification model could be created that augments existing interaction styles in a yet unexploited area, and which could also be promising for the control of other audio systems.

The STSM will focus on the control mechanisms rather than on the use of body-gestural control. But the model will be general enough to cover articulated body gestures as a special case. This work is intended to bring some of the techniques developed at the Dynamics and Interaction group in Glasgow to the sonification of high-dimensional data. These techniques are focused around interaction by control of perception combined with probabilistic inference and display. For example, a fully probabilistic item selection interface which can be adapted to many input devices has been developed. An attractive goal is to combine the above mentioned control strategies for audio systems with probabilistic sonification model ideas that arose during a visit of Thomas Hermann in Glasgow.

One of the aims of the STSM is to develop systems for exploring high-dimensional data sets, incorporating predictive models of likely user interest. Monte-Carlo sampling can be used to project "search particles" into these hypothesized areas of interest from which sonifications can be produced of the data in these areas. As the exploration is interactive, the user can explore and control the interaction to modify the flow of particles in the search space. Systematic modulation of the feedback can then be introduced to allow the user to indicate their interest in the available attributes and areas of the data set; this information can then be used dynamically update the "interest" densities in the data set. These techniques should provide an extremely compelling interactive interface for exploring and sonifying data sets which is both theoretically elegant and highly flexible.