11:45 **Refreshments and Opening words**

12:00 **Pierre Grandjean**, Philippe-Aubert Gauthier, & Alain Berry (U. Sherbrooke)

Wave Field Synthesis and High-Order Ambisonic Comparison: How directional metrics leads to localization cues?

Several multichannel format allow for sound field reproduction. According to the context, physical or perceptive sound field reproduction could be preferred. Recent works allows for the physical measurements and spherical harmonic expansion of directional metrics thanks to spherical microphone array. By using this measurement method, a physical (or objective) evaluation of several sound field reproduction approaches is achieved. In this way, different sound field reproduction methods such as Wave Field Synthesis (WFS) and High-Order Ambisonic (HOA) can be compared, based on objective directional cues. The next logical step is to understand which measured directional metrics is the most correlated to auditory localization. During this presentation, in a first part, we briefly present WFS, HOA, and spherical microphone used for the objective evaluation of sound field reproduction. The second part will be an interactive discussion about how proceed to perceptual (or subjective) evaluation of directional metrics importance for human localisation.

12:30 **Nicolas Bouillot** (Society for Arts and Technology)

Multiple live and simultaneous rendering of spatial audio with SATIE: from independent far-field and near-field renderings to spatial audio driven haptic floor

The presentation will give an overview of SAT Metalab's SATIE engine, illustrated by two use cases: i) rendering near-field and far-field audio using two distinct and heterogeneous speaker systems, and ii) rendering simultaneously spatial audio for an arbitrary speaker system, and for our scalable haptic floor. Our Spatial Audio Toolkit for Immersive Environment (SATIE) is a lower-level audio rendering process controlled via OSC messages of a given protocol. SATIE offrs custom (and adaptable) loudspeaker formats, user definable 3D audio rendering protocols, and open audio authoring methodologies. The basic SATIE environment, built on top of the SuperCollider kernel is optimized, modular and extendable. SATIE is also integrated with our full pipeline for the creation of immersive experience (see our Édition in Situ (EiS) software), that allows for live edition of virtual 3D environment. Current works include the development of a geometry-based audio ray tracer (vaRays) generating impulse responses.

13:00 **Ajin Tom**, Joshua Reiss, & Philippe Depalle (McGill U.)

An automatic mixing system for multitrack spatialization for stereo

One of the most important tasks in audio production is to place sound sources across a stereo field so as to reduce masking and immerse the listener within the space. This process of panning sources in a multitrack to achieve spatialization and masking minimization is a challenging optimization problem, mainly because of the complexity of auditory perception. We propose a novel panning system that makes use of multitrack sub-grouping, spectral decomposition, frequency-based spreading and an optimization algorithm to create a well spatialized mix with increased clarity while complying to the best panning practices. We also investigate objectively if this positioning strategy reduces inter-track auditory masking by using the MPEG

psychoacoustic model I and various other masking metrics, extended for multitrack. Our subjective and objective tests compares the proposed work with past intelligent panning systems and human mixes. The results will be discussed.

13:30 **Ilja Frissen**, Johannes Scherzer (McGill U.), & Hsin-Yun Yao (ClearCom, Inc.)

The impact of head movements on speech intelligibility in multi talker environments presented on virtual audio displays

The Coordinate Response Measure corpus was used 3 to measure how head movements affect speech intelligibility of two, four, or six concurrent talkers that are spatialized over headphones using virtual 3D audio. In two conditions, participants moved their head aided by a visual target tracking task. In one condition, the changes in the spatial location of the talkers were compensated for (i.e., the talkers were world-fixed) while in the other there was no such compensation (i.e., the talkers were head-fixed). In an additional baseline condition, participants did not move their heads. Contrary to expectation, the world-fixed condition impaired speech intelligibility.

14:00 **Coffee break**

14:15 **Vincent Roggerone**, Cynthia Tarlao, Catherine Guastavino (McGill U.) & Jonathan Vacher

(Einstein College of Medicine, NYC)

Blurred Snapshot model predicts the upper limit for circular auditory motion perception

When considering a circular trajectory, dynamic sound localization is the subject of a debate between a snapshot model versus a motion-sensitive model. This study addresses this issue by the mean of the upper limit for circular auditory motion perception (UL). In experience 1 and 2, we investigate the influence of spectral content on the UL using Band Limited Noises (BLN). It was found that increasing the center frequency and/or the bandwidth of a BLN increased the UL. In experiment 3, we made strong links between UL and front-back confusions. Based on these empirical findings, we developed a blurred snapshot model of the UL. This model predicts well results of the 3 experiments and therefore is an argument in favor of the snapshot theory.

14:55 **Cynthia Tarlao**, Vincent Roggerone, & Catherine Guastavino (McGill U.)

Optimal number of loudspeakers for circular trajectories in VBAP

Composers have shown increasing interest in moving sounds in circular trajectories around their public with the help of spatialization methods. In that respect, the instinctive reasoning about the optimal number of loudspeakers for better spatial rendering is that the more, the better. We explored that question for vector-based amplitude panning (VBAP), which introduces artefacts in continuously moving sound trajectories due to constructive and destructive interferences at the ears. Our working model is that our ability to determine the direction of a sound revolving around us relies on resolving front-back confusions, based on head-related transfer functions (HRTF). But do those VBAP artefacts impact the HRTF so that more loudspeakers might not always be better? Using circular arrays of 4 to 24 loudspeakers, we found that on average, performance plateaus at 12, with no significant difference with 24, nor 8. We also confirm the limitations of our auditory system by front/back confusions.

15:15 **Plenary session: Constellation**

Open session on the new Electronically-Enhanced Reverberation System that is to be installed in the MMR

16:00 **Closing Remarks**