The River Sings: Notes on Sound and Software System Design

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The software-based sound design system for this first iteration of *The River Sings* was implemented using the Max 5 graphic programming environment (Cycling 74, 1997/2008) which is itself an elaboration of Puckette’s (1984; 1986; 2002) environment based on the *patcher* paradigm (Puckette, 1984; 1996; 2002) for the purposes of controlling musical signal processing hardware. In this instance, the Max environment was used as an environment for the design and implementation of a modular audio playback, routing and effects processing system for the installation.

Paul Moore’s concept for the piece centred around creating a voice from the River Foyle. Initial ideas had centered on the sonification of river flow data, with a view to elucidating an abstracted, yet still recognisable, river-based sound structure from the data; using this data to articulate a ‘voice’ for the river. However, on further examination, this approach was considered to be less suitable than originally anticipated: the river flow data available was sampled relatively infrequently and would have required significant additional control data to be added to recreate a soundscape which was recognisable as deriving in some way from the river. In contrast, source recordings from various points on the river provided the opportunity of elaborating on structures in the river soundscape which were already directly perceptually salient in terms of source recognition and to experiment with varying degrees of alteration/abstraction from these original sources; sufficient cues for source recognition were already directly accessible. Various aspects of the sound structures within the source recordings were examined with a number of audio processes with the aim of elucidating different structural aspects of these materials.

The first process which was found to yield successful results was the process of *phase vocoding* (Flanagan and Golden, 1966; Moorer, 1978; Fischman, 1997), a process which allows a user to manipulate the time and frequency data of an audio file independently; in this instance, this process was used to perform an extensive degree of *time-stretching*, whereby segments of a file were slowed down to fractions of their original playback rate whilst still preserving their frequency content (and thus, aspects of timbre based on frequency spectrum) as relatively unchanged. When applied to a rapidly-changing articulations of the water sounds, this presented a profoundly different perspective on these transient sounds: when slowed using this process individual splashes were transformed into gradually-evolving vocal-like sounds which were reminiscent of hisses and whispers. This approach formed the basis of the river soundscape in the installation.

The second process which was found to produce successful results in giving clear ‘voice’ to the river was a process known as *timbre-stamping*, whereby one audio source is used to produce a time-varying filter which can impose the broad structure of its frequency spectrum on a second file/source; cf Puckette (2007). Although this technique is based the application of Fourier analysis to digital audio data, it is analogous to the analogue process known as the *vocoder* (different from phase vocoder, above) which uses a relatively small number of band-pass filters to analyse a modulator signal (obtaining magnitude within these bands), then applying these magnitudes to a corresponding multi-band filter at output, which applies this filter to a carrier signal. The resulting ‘singing synthesiser’ or ‘singing robot’ effect has a venerable history in electronic music, used to signature effect in the work of Kraftwerk (1974). In the present case, through the use of a significantly increased number of frequency bands in the analysis process results in more subtle effects. The current application sees the timbre-stamping process applied to source
recordings of river materials; the resulting dynamically-changing filter is used to articulate a choral vocal sample, producing the effect of an ethereal river-choir hybrid, with the perceptual effect of the choir singing ‘into’ the river (or the river imposing its frequency contour onto the frequency components of the vocal sources). A number of such samples were created, which were then layered with microtonal offsets, such as those found in the work of American drone-music composer Phil Niblock, see (Niblock, 1993), producing a series of ebbing and flowing background drones over which a live vocal performance takes place featuring countertenor Mark Chambers performing a score by Frank Lyons. The dynamically-changing river-choir hybrids possess upper harmonic partials which vary in amplitude quite dramatically through this modulation process. This not only produces the hybrid timbre effect, but also increases the perceptual salience of some individual upper harmonics; c.f. Bregman (1990), resulting in the structure of the harmonic series being revealed through the river recording’s articulation. This effect may be further increased by the interaction of harmonic components which are close in frequency, the reason for the deployment of microtonal offsets after the work of Niblock.

A further application of the timbre-stamping effect is to be found in the piece’s live vocal feed. The performer sings into a microphone feed which is then used as the carrier signal which is subject to dynamic filtering from the timbre-stamping process, with filter characteristics again derived from source recordings of the river materials. This filtered vocal sound was then fed to a reverberation process, resulting in a modulated reverberation effect which created a dynamic, impressionistic virtual space which was ‘articulated’ by the river’s dynamically-changing frequency structure. As with the choral sample processing, above, the effect is of singing ‘into’ the river and hearing an ‘echoed’ response in the reverberation. In this instance, the river is mapped from frequency structure to virtual space.

The audio materials were integrated using a Max 5 modular audio patch (integrating processed recordings with the live timbre-stamping process noted above) and originally diffused over a standard 5.1 speaker array in the presentation space for immersive effect. The present iteration features a full octophonic array spatialised using ambisonics, based on the ICST ambiencode~/ambidecode~ externals for Max 5/6 (Kocher and Schacher, 2007).

References


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1 The countertenor voice, which possesses a particularly high upper pitch range in comparison with other male ranges, has frequently been considered to evoke associations of androgyny throughout musical history; there is an interesting parallel in that similar claims have been made for the electronic vocoder effect; c.f. Biddle (2004).


