GLOBAL MUSIC: THE WORLD BY EAR
The CIA Fact Book v1.0 – a 190 channel concert sonification

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ABSTRACT
The CIA FactBook v1.0 is a multichannel music work created in response to the call for pieces for the ICAD Sonification Concert at the ICA, London. The piece was created using the ICAD supplied world dataset, and extended extensively by items from the CIA online Factbook[1]. The work was realized in Pd[2], with the aid of data and signal processing objects from the IEM[3] Pd libraries. The 190 resulting audio channels are spatialised through use of an ambisonics surround system, diffused through 8 physical speakers in this realization.

1. DESIGN OBJECTIVES
The piece was constructed in four stages: pre-compositional planning, the development of mapping strategies, sound design, realization and spatialisation.

1.1. Pre-compositional planning
The following objectives were taken into account when designing the piece, with special consideration for recommendations for sonification environment design set-out in [4]:

- it was essential that the work represented the data clearly, in an understandable way which requires no prior knowledge or visual support. It is hoped that the listener will have a view of the relationships within the data which has been sonified through this musical work.
- the work must also be enjoyable and entertaining musically.

Fulfilling both of these objectives is essential for a sonification designed for public concert presentation, so a number of initial experiments were conducted into the design of sounds to be used within the piece. Initially, sounds were created within a post-digital microsound aesthetic [5] but during the course of production it became clear that although general trends were perceptible, greater sonic differentiation between data channels were necessary to make the experience musically satisfactory. A alternative method of articulating the data was then evolved, which focused on the generation of rhythmic cell structures articulated by designed sounds which were segregated into family groups by world region. This permitted a distinctive sound-world, where easy aural access to the data could be combined with an engaging musical surface.

2. MAPPING AND DATA MANIPULATION
All parameters from the basic data set were employed, and this information was extended through use of the CIA factbook (oil production, oil consumption, and exchange rate), and parameters from the extended data-set. The data was first pre-processed and analysed in Microsoft Excel in order to permit the mapping choices outlined below to fulfill the design objectives for the piece. Initial audio sketches were rendered to determine the effectiveness of selected mapping strategies.

2.1. Preprocessing
The world dataset provided, together with information extracted from the CIA pages presents a very wide numerical range. The challenge was to map the parameters in such a way that extremes could be clearly audible, yet the musical structure of the work would not be compromised. After initial experiments and a parametric study, the data was minimally pre-processed by simple arithmetic to restrict extremes by expressing area, and population for each country as a log of the highest ranking value. This way, the relationships remain clear, yet the range is more useful compositionally. Other data, such as sum and mean were calculated, and used to build useful approximations for missing values where necessary.

2.2. Mapping choices and aural results
The function of the mapping patch is to generate rhythmic structures which reflect the data, and articulate the sound set. To avoid a sterile, mechanical presentation it was decided to map parameters through a specially constructed groove control subpatch, responsible for the micro-scale placement of individual beats. Sanitation (urban/rural) parameters were mapped to backbeat timing, and drinking water (urban/rural) parameters to frontbeats, introducing small-scale timing inaccuracies to generate a musical tension in the resulting rhythmic cells. The dynamic articulation of each beat is determined by male and female life expectancy parameters. The energy and timing regularity of the resulting rhythmic unit provide a good metaphor for the economic development of the respective nation: I have chosen to invert the relationship, so that countries with the least drinking water and sanitation are presented with complex, incessant polyrhythms. The population of each nation is quantised into the metric distribution of the rhythmic unit, and the GDP parameters control the activation of individual beats in the resulting structure. This method allows for data with unusual relationships such as high population and low GDP to be easily perceived as unequal rhythmic sub-units (e.g. 7 in the time of 8, etc), and as such, they stand out.
musically from their surroundings. The structural timescale of the piece is controlled by oil money - oil exporting nations are set against those which consume it, whilst those countries without local natural resources are given relative textural isolation.

The aural result is that developed West receives correspondingly stripped-down, minimal and inactive structures: a metaphor for the homogeneity of globalization. (Superpower nations result in a single, monotonous block of sound). Instead, our attention is musically drawn towards developing nations, with an aural focus on those with unusual metrics.

2.3. Sound design

The piece works by manipulating a specially created database of 1900 sampled sound units. Each unit is a microsound with a distinctive timbre, lasting no longer than .5 second at most. A pd patch was created to generate the database from a series of creative sound design experiments in symbolic sound’s Kyma workstation. The resulting sounds were then categorized and structured through the automated selection system described below.

With sampled, designed sounds, rather than synthesized sounds, there is a danger that the resulting materials may lack control in an auralisation context. This is mitigated here through the segregation of sounds into family units mapped to the world region parameter. Selection by region was determined by the ASPEN/EXPLORE [6] audio batch processing system, which provides a simple audio processing interface capable of parametric extraction and basic timbral similarity grouping. Just as world regions are simply labels, the respective distinctiveness of each timbral line forms a label for each nation. There is no analogous mapping or direct metaphor for this labeling parameter, save that you can hear each thread as being distinctive (due to the use of 10 sub components per region), yet belonging to a basic overall framework.

The results are distributed in physical space, mapped to a flattened version of the provided long. and lat. co-ordinates. The spatial extent occupied by the sound is determined by the distance from the center of the nation to the capital city. An initial mix for stereo headphone listening used binaural processing: although the spatial relationships of the original were maintained, the timbre of the audio had become unnecessarily compromised. The headphone mix included on the icad CD uses the standard studio processes of reverb, delay, and equalization to create a space in the mix for each nation at the cost of representing the geographical spatial location parameters retained in the 8 channel mix.

3. CONCLUSIONS

Parameters have been chosen and sounds designed with the aim of making inequalities in the data clearly audible.

The resulting structures needed to work musically, so a system of articulating the sound sources was devised to provide unique aural structures for each nation. This system used the creation of rhythm as the main information articulation metaphor, and the resulting musical surface is subsequently spatialised. The spatialisation is expandable to between 8 and 100 channels of physical replay. Although an enjoyable concert work with a focus on musical material, dynamics and clarity of presentation has been produced, it should be noted that this can enlarge the risk of end-users being able to misinterpret the aural data due to the fact the sound structures are articulated by rhythmic processes which may have their own intrinsic relationships. Such ambiguity is kept to a minimum in this work through the use of only one rhythmic cell per nation.

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3.1. Future work

Work on the project is ongoing: the composer is currently developing a fully periphonic realisation in 3rd order Ambisonics, suitable for replay on systems with a height parameter. The piece is rendered in 96k/24bit high definition audio: additional details can be obtained from www.ambrosefield.com as the project develops.

4. REFERENCES

[1] CIA