Turning Gigabytes into Gigs

"Songification" and Live Music Data

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Abstract

Complex data is challenging to understand when it is represented as written communication even when it is structured in a table. However, choosing to represent data in creative ways can aid our understanding of complex ideas and patterns. In this regard, the creative industries have a great deal to offer data-intensive scholarly disciplines. Music, for example, is not often used to interpret data, yet the rhythmic nature of music lends itself to the representation and analysis of temporal data.

Taking the music industry as a case study, this paper explores how data about historical live music gigs can be analysed, extended and re-presented to create new insights. Using a unique process called 'songification' we demonstrate how enhanced auditory data design can provide a medium for aural intuition. The case study also illustrates the benefits of an expanded and inclusive view of research; in which computation and communication, method and media, in combination enable us to explore the larger question of how we can employ technologies to produce, represent, analyse, deliver and exchange knowledge.

Introduction

> "A band is as good as it sounds
> whether they play at Woy Woy or the Fillmore."
> Billy Thorpe (James, 1969)

Choosing to represent data in creative ways can advance the understanding of complex behaviours and ideas. Most data exploration and representation relies heavily on visual tools in the forms of tables, graphs, maps, and intricate and compelling visualisations. Whilst visualizations provide strong support for determining patterns in data, auditory pattern recognition has been comparatively underutilized and untested in data exploration and interpretation. One technique for data analysis that does exploit auditory perception is sonification; "the transformation of data relations into perceived relations in an acoustic signal for the purposes of facilitating communication or interpretation" (Kramer et al., 1999, p. 4). This paper presents the results of a pilot project to better understand creative industry data through the creative extension of sonification; specifically, presenting music industry data as music to musi-

cians in order to improve analysis of the history of live music performances ('gigs') in Melbourne, Australia.

Sonification

Sonification is typically associated with scientific data and specifically in the interpretation of large quantities of scientific results. Researchers have adopted sound as the basis for data analysis in a number of cases for various reasons, some of which include:

- Its capacity to involve 2-3 dimensions of data typical of visualisations
- Its capacity to better represent temporal patterns and changes in data
- Its ability to be combined with visualisations, adding another dimension when the eyes are busy at another task

Walker (2000, p. 18) notes that sonification is often considered a superior method when visualization techniques have failed, e.g. for radiation monitoring (e.g. Geiger counter) or for discoveries such as the "quantum whistle". Given this context its not surprising that the relatively recent field of sonification studies is dominated by the application of sonification techniques in science-based disciplines along with analysis of the psychological and technical acoustic subtleties involved in the procedure.

There are however a number of different types and techniques used in sonification. The functions of sonification can be broken up in to four broad categories: (1) alarms, alerts, and warnings; (2) status, process, and monitoring messages; (3) data exploration; and (4) art and entertainment (Walker and Nees, 2011). This paper is particularly concerned with (3) data exploration and (4) art and entertainment. Data exploration functions are intended to communicate information about a dataset or subset of relevant information about a dataset and can be considered what is most generally meant by the term 'sonification'. Data exploration sonification techniques include parameter mapping (for examples see Flowers and Hauer, 1992; 1993; 1995; Flowers, 2005; Grond and Hermann, 2011; Stockman et al., 2005; Grond and Berger, 2011; Smith and Walker, 2005), and model-based sonification (for examples see Hermann, 2011; Hermann and Ritter, 1999; 2002; 2004; Bovermann et al., 2006).

The fourth listed function of sonification, art and entertainment, primarily uses datasets as the basis for musical compositions. This approach often takes the sounds that result from a sonification process and combines them with more traditional musical instruments. Compositions driven by datasets include the works of Quinn (2001, 2003), and performances such as "Listening to the mind listening: Concert of sonfication at the Sydney Opera House" (2004) and "Global music – The world by ear" (2006) (as cited in Walker and Nees, 2011, pp. 5-6). There have been a number of excellent creative adaptations of sonification where musical composition is not the primary focus. "The Quotidian Record" by Brian House (2012) sonifies the location-tracking data of the artist's movements for a full year, highlighting the habitual patterns and daily rhythms of his travels. The inherent rhythms and patterns found in music are also explored by Paul (2012), through the "Sonification of Everyday Things", using lasers and the measure of distance to create audio loops for everyday objects. Jones and Gregson (2012) together with Britten Sinfonia have created a continuous piece of music based on Twitter activity, a creative mashup of sound excerpts used to communicate the overall types of conversations, thoughts, and feelings of 500 Twitter users. There is also a strong use of sonification applied to data depicting natural occurrences, such as climate change (Crawford, 2013), tree growth (Traubeck, 2011), and solar wind (Alexander, 2009). The focus of these creative examples is not on data exploration, but more on creative sonification techniques.

One study that has pushed their creative work into data exploration has been "Darwin Tunes" (MacCallum and Leroi, 2012), creating musical loops that depict different stages of evolution. This project has placed an emphasis on the musicality of the loops by crowdsourcing input from critics to create sound that is pleasing and interesting. As a result, this research has placed itself somewhere in the gap between the function of data exploration (3) and art and entertainment (4).

This gap, between the evidentiary demands of science and the affective aspirations of art and entertainment, is not as wide as it might first appear. Increasingly some science based disciplines are required to understand the 'artistic' aspects of their work – the ways in which certain design decisions affect the success of data visualizations for example, or how computer scientists frequently consid-

er the 'aesthetics' of their code and the way physicists describe the 'beauty' of certain theoretical formulations. Similarly, there has been a significant computational turn in the humanities and creative arts which has profoundly changed the way research is undertaken in these disciplines (Berry, 2011). The technique of Songification proposed in this paper also explores this conjunction between data exploration and the more creative side of sonification through extending musical presence in audio analysis. This technique has the additional effect of opening up avenues for data exploration to members of the creative industries themselves.

Give me a 'G' - Songification

Songification is the extension of sonification through enhanced auditory data design; using music in place of sound to communicate and interpret data. By transforming auditory 'beeps' into music, we intend to create a data format that is easier to listen to and will extend the time listeners will spend interpreting the data, leading to better understanding and analysis. The technique of songification arose from work with The Ultimate Gig Guide (TUGG) database application (http://tugg.me, see Verhoeven and Gionfriddo, 2013). TUGG charts the Australian music industry at the level of individual performances from the mid-1960s. The existing data in the TUGG dataset relates primarily to the city and surrounds of Melbourne and currently consists of over 11,000 gigs performed by almost 2,000 bands/performers in 816 venues across the greater city area. This data has been predominantly sourced from gig guides published in an influential popular music magazine during this period (Kent, 2002).

TUGG was specifically developed by creative industry researchers to better understand the flow of live music culture across historical periods, through studying the itineraries of bands and the socio-spatial location of music performances (Bennett, 1997). Creative industry analysts can perform flexible queries on the TUGG data, view their search results in both google map and list form, generate printable reports or download data in a CSV format for statistical analysis.

Several challenges have arisen from this approach to representing the results of TUGG research queries. For example, the shifting scale of travel distance between music venues is difficult to view in

the google maps. Bands often played gigs around various inner city venues before travelling a much longer distance to a country located venue (sometimes in the one night). In these cases it's difficult to see the intricacies of adjacent movements around the city in the same map view as a gig in a rural location without losing a great deal of important detail. Furthermore, the static nature of the google maps means it is neither possible to 'see' the sequential order of a band's gigs; nor to perceive variations in the temporal 'stagger' between events.

To better represent these variations of spatial scale and temporal sequence we undertook a process of data sonification in which we represented a sequence of live music gigs as sound frequencies. Although, from a purely analytical perspective, the results of this procedure were promising, they were less successful as a listening experience – to the extent that they compromised any advantage gained from the approach. It was clear we needed to enhance the design of the auditory data in order to provide a better medium for aural intuition. By transforming our research data into music we not only created an improved experience for discerning the relations and rhythms in the data, but we also provided an inclusive, 'vernacular' opportunity for non-professional research participation, in this case by engaging musicians and music fans themselves.

Music about Music for Musicians

Songification raises the question of whether creating music based on music industry data might also engage the live music communities themselves. Our intention is to turn the data into something that resembles and gives tribute to the phenomena we are representing. As MC Zirconium states, "If I am listening to radiation emanating from distant parts of the universe, I want to feel horrified by the scientific majesty of it all" (as quoted in Angliss, 2011). We are consciously not just representing data, we are representing the movement, longevity, and intensity of gigs in a city and its vicinity. We are turning live music data into music.

The benefit of songification in this sense is ramifying. By "thinking through" our research in formats that make the most sense to the communities and industries we are studying we have an opportunity to engage them on their terms. The typical division between academics-as-agents (generating Analysis) and non-academ-

ic communities as the objects of research (generating Content) can be limiting for researchers, particularly in the humanities and creative industries. Songification ensures that our music industry research explicitly acknowledges that although academics might enjoy written texts for developing and communicating their thinking, other communities might prefer to think visually or in this case aurally. By recognizing from the outset that there are multi-modal approaches to knowledge we also recognize that it is possible to create recursive opportunities for research design, in which the typical temporal relationship of exploration followed by analysis and then the delivery of results belies a lack of genuine engagement with the communities under study.

Method

The process of sonification was centred around exploring individual bands itineraries which changed spatially and in the frequency of performance over time. One particular point of interest was the movement of artists in and out of the CBD, or the spread of gigs from the city, suburb, and beyond. The variable of distance (from the CBD) and changes over time (itineraries) was particularly suited to music by looking at distance as variation of pitch from a central note and change over time as the temporal sequence of music. Three contemporaneous Australian artists with different music styles and patterns of venue attendance were selected for sonification: *Max Merritt and the Meteors*, *Doug Parkinson*, and *Billy Thorpe and the Aztecs*. Using TUGG all gigs were search for a specific band (for example *Max Merritt and the Meteors*) and their associated attributes needed for analysis (band name, date, and venue location in latitude and longitude) were exported. The following approach to sonification used in the method is parameter mapping, defined as representing "changes in some data dimension with changes in an acoustic dimension" (Walker and Nees, 2011, pp. 6-7) through event-based data.

The distance to each of the gig venues from the Melbourne CBD was calculated in metres using a Google Maps API. This figure was then translated into frequency (Hz). The range of this data is from 584 metres/Hz to 151413 metres/Hz – the later which is impossible to register. As a result, we need to take this range of data and translate it proportionally (pro-rated) to a narrower range – one that we can hear and recognise easily. The lower and upper limits of this

range were chosen as C3 (130.81 Hz) to B7 (3951.07 Hz). In musical terms this is from C below middle C to B, 4 octaves above middle C.

To translate these frequencies to notes that can be recognised, the nearest note on the 12 note scale was chosen for each frequency. This was then further transposed to the nearest note in the C major scale. What resulted was an array of C major notes which represented the distance that the venue was from the CBD. When the notes/gigs were played in the sequence in which specific bands played at the venues we produced the following band gigs sonification. The resultant inharmonious 'beeps' however, defeated the idea that the sonified data could be easily shared. [File 1: 'Max Merritt Sonification MP3. Listen]. To songify the data and make it easier to interpret patterns and honour the musical provenance of the band that generated the data further enhancement was needed.

The length or duration of each note was set to the number of days between the current gig and the next gig played by the band. Therefore, the bigger the delay between gigs, the longer the note. When all notes/gigs were played in succession we produced a melody that was represented as a lead guitar riff in keeping with the period and band attributes of the performances under study. As you can hear from File 2: Max Merritt Lead Riff, [File 2: Max Merritt Lead Riff MP3. Listen] this guitar melody is 'easy listening' compared to the inharmonious 'beeps' produced by the sonification method. To augment this melody and to create a full band sound, backing tracks were written in the style of the respective performers.

The process to create the backing tracks involved firstly identifying the average beat for each artist. This was done by looking at tracks on YouTube of the artist and tracking the beat to a metronome – the average beat rate could then be calculated. The method for producing the chord structure varied depending on the band. For example, the backing chords for the *Max Merritt and the Meteors* track was obtained by going on to a popular guitar tabbing website and obtaining all the chords that had been tabbed for the band. The four most common chords were then used for the track and played in the order of what was most musically pleasing. The backing track for *Doug Parkinson* was more difficult as there was just one tab available. Therefore, YouTube was used to determine the playing style of the band and the common chord structures. The backing track for *Billy*

Thorpe and the Aztecs was based on a basic 12 bar blues riff as per the average song on his playlist.

To date, there have been three pieces of music written and performed live using this process of songification for the bands during the height of live music in Melbourne (1965 to 1972): *Max Merritt and the Meteors* [File 3: Max Merritt Songification MP3. Listen], *Billy Thorpe and the Aztecs* [File 4: Billy Thorpe Songification MP3. Listen], and *Doug Parkinson* [File 5 Doug Parkinson Songification MP3. Listen]. These tracks have also been performed on stage before an audience by the research team in order to emphasise the significance of serendipity in live music events and their songification.

Findings

The process of songification led to innovative methods for studying and understanding the creative industries and creative labour. The shift from sonification to the more musical songification and the creativity involved in this shift has created a better product for data exploration, interpretation, and understanding. The ensuing musical renditions of band itineraries encourage the listener to spend time with the data by playing the tracks through multiple times. This is advantageous over pitched 'beeps' simply through the willingness of the analyst to listen to music over inharmonious sounds, resulting in more attentive interpretations of the data and wider opportunities for engaging non-academic music specialists in the research.

We limited our songification to the use of pitch (the perceptual dimension of frequency) and note length to display patterns in itineraries. Subsequent investigations could use other sound dimensions (e.g. loudness, tempo). Further research could also be applied to a number of key aspects of this project. For example, in order to test sound parameters should greater distances be represented by higher pitches (a "positive" mapping polarity)? Are there other, more sensible ways to represent patterns in the data? Is the scaling of pitch in keeping with the changes conveyed? Extending our work further, we intend to explore the understanding of sound metaphors (the expectations and feelings that are evoked by a particular use of sound) particularly as they apply in and differ between specific contemporary music scenes.

Conclusion

With the advent of 'big data', the impetus for researchers to focus their investigative efforts on the determination of patterns in data, in order to make 'sense' of large, multidimensional information, has only ramified. To date, most data exploration however, relies on visual tools; failing to exploit the evident advantages of our auditory senses, and necessarily excluding those with sight impairment.

As creative industry researchers we need to use all the resources at our disposal; technical, social and perceptual. As music industry researchers we might even more specifically ask, what properties of space can be experienced through listening? How might the auditory representation of spatial data enhance geographic analysis? What might the practice of live music offer in terms of a cognitive enterprise rather than merely artistic contemplation and enjoyment? And conversely, how might the representation of auditory data be enhanced through artistic extension? In what ways can the use of auditory technologies extend human capability and comprehension? The process of songification suggests at the very least, that it ain't all over 'til the big data sings.

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