

'SQUARE KILOMETRE ARRAY – LOOKING FOR GOD'

Art in the Age of Big Data

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Bio

Nigel Jamieson is a new media artist and Senior Lecturer in Digital Design at AUT University, Auckland, New Zealand. Research in interactive real-time 3D graphics and allied screen and network technologies is a continuation of Nigel's professional, international experience in the area of 3D animation, digital video graphics, interactive digital media, and digital art practice. Nigel's current research centers on dynamic near-to-real time visualization of complex systems, where narrative replaces simulation in the exploration of metaphysical knowledge systems through contemporary science and digital technologies.

Abstract

The SKA-LFG project is a live, real-time 3D graphical response to real-time observations from deep space combining Very Long Baseline Interferometry (VLBI) - a high resolution form of radio astronomy - high speed computer networks, real-time processing of VLBI data, interactive 3D graphics software, and virtual reality presentation systems. SKA-LFG combines science, technology, new media, and metaphysics within a time based art form linking three distinct perceptions of time – cosmic, computational, and human perceptual time. Through this joining of aesthetics, contemporary astronomy, and theories of human perception and cognition, SKA-LFG explores narratives of the sublime through computational simulation, dramaturgical narrative forms, interactive digital media, and Virtual Reality systems.

Introduction

'Square Kilometre Array – Looking for God' (SKA-LFG) combines science, technology, new media, and metaphysics within a time based art form linking three distinct perceptions of time – cosmic time, computational and network time, and human perceptual time. With its ability to look deep into space and time, Very Long Baseline Interferometry (VLBI) - a high resolution form of radio astronomy – allows study of the astronomical objects such as supernovae and black holes, providing clues to the evolution of the universe. Via high speed networks systems, VLBI data can be transferred for processing in real-time with filtered data driving customised high-end real-time 3D graphics (game engine) software linked to Virtual Reality (VR) presentations systems within gallery and web based contexts. This paper will discuss the SKA-LFG project in terms of data visualization using very large data sets, narrative versus simulation, and the aesthetics of the sublime in new media art.

Data Visualization and Big Science

Over the last two decades, data visualization has become a familiar feature of the new media art landscape. Accessing data sets from many sources – stock market fluctuations, weather and climate data, internet network traffic – artists have been able to exploit two distinguishing characteristics of digital computing; the ability of computers to process large data sets and to map one representational form onto another. The latter, a form of cross-representational media mapping, enables media of one form to take on the characteristic form of another; this can be turning a sound wave into an image, generating a 3D surface from a 2D image, and so on. This re-mapping of representational forms, coupled with the computing of large datasets, creates the practical conditions for data visualization in new media art.

Since access to computing first began to become the norm - at least for those living in so-called developed or first world countries - artists have used data visualization in a variety of ways to comment on contemporary society and culture. This process of data visualization for artistic expression relies firstly on the database as its raw material. The database, in this sense, can be described as the generation and storage of large sets of discreet objects of information which can then be categorized, organized and navigated, via the application of mathematical algorithms. As Victoria Vesna states in her editorial introduction to the book *Database Aesthetics; Art in the Age of Information Overflow*

“Databases and archives serve as ready-made commentaries on our contemporary social and political lives.”
Vesna 2007:XI)

From this Post-Modern vantage point, it can be said that collection, storage and retrieval of information, stands at the heart of this new cultural form, as well as the critical discussions of it - how is data collected, how is it held, and how is it used? As a result, concerns over information privacy, access, and manipulation, are themes that are often addressed in the work of data visualization artists. The narrative of the database then is a mechanistic narrative of un-freedom and control, often alienating and dystopian, redolent of Big Brother, playing on fears of the surveillance society and the inevitable reduction of all of human activity to quantified data sets and their re-mapped representational forms. Data visualization makes visible the invisible processes of the database and in this sense data stands as both form and content of the representation itself. The semiology of data visualisation can be analyzed in terms of its syntagmatic and the paradigmatic structures. This structural approach to textual analysis - developed by linguist Ferdinand de Saussure and expanded on by literary theorist and semiotician Roland Barthes - conceives the syntagmatic axis of language to be the horizontal, temporal, and distributional axis while the paradigmatic is on the vertical and integrational axis (Barthes:1977) The syntagmatic, distributional axis is that of narrative and story, ruled by the grammar and syntax of the representational form, on the other hand the integrational axis of the paradigm defines the 'storyness or non-storyness' of the representation. The narrative of the database is then a reflection of its 'databaseness'. Here data visualization stands apart from more traditional iconic narrative representational forms

– such as photography, literature and cinema – in that there is a favoring of the system over the sign. Lev Manovich observes in his essay *Database as Symbolic Form*

“Database (the paradigm) is given material existence, while narrative (the syntagm) is dematerialized. Paradigm is privileged; syntagm is downplayed. (Manovich: 2007:49)

One possible reason for this privileging of the system over the sign may well be that our innate connection to narrative representation in our cultural artefacts is challenged by the new computer model of the world. Narrative has always been mankind's way of making sense of the world and communicating this understanding to those that share the world with us. Narrative will not go down easily, so instead is subsumed by the database and becomes of secondary importance. SKA-LFG is concerned with restoring the aesthetics of more traditional narrative representations within the context of data visualization.

Art in the age of Big Data

As many commentators on the subjects of science, economics, business, data storage, visualization, and new media have noted, we are now truly in an age of 'Big Data'. There is near exponential growth of the generation, distribution, and consumption of data via high speed computer networks, distributed (cloud) computing, and the integration of computing into all aspects of our everyday lives. What does this mean for artists working within the context of the relatively new cultural form of data visualization? What are the challenges of the 'data deluge' for new media art practice? Or to point to a more focussed question – Does the paradigm of the deluge take preference over the content – syntagm - of the data itself? Are we describing the wood and ignoring the trees? One of the primary challenges of the SKA is how to handle massive datasets. Through the application of sophisticated algorithms and cloud computing pipelines the SKA hopes to be able to filter the data in real-time, to strip out the 'noise' of deep space, retaining what is of use for scientific analysis. SKA-LFG will then be able to make use of these real-time, or near to real-time data packets for visualization in 3D game engine software. It is in the mapping of the already filtered data that SKA-LFG will achieve its visual and narrative form.

Abstraction, simulation and narrative

An important form of data visualization is simulation. Simulation is the process whereby a real-world system is modelled using computing hardware and software. Examples of simulation can be found in all aspects of scientific investigation, modelling of weather and climate systems, simulation of vehicular traffic flow through a city for the purposes of town planning, or even in litigation scenarios where real-world events such as car crashes or aeroplane disasters are reconstructed for the purpose of persuasion. The first step in simulation is the development of a detailed computer model of the system. All relevant parameters are included to construct a model of the system under investigation and the simulation is the 'running' of the model over time. Parameter values can then be modified in order to study different outcomes based on differing input values. These simulations are then studied to better

understand the system itself under differing scenarios. Simulations are also common place within the entertainment industry, primarily in the rise of the video game but also in the visual effects of mainstream Hollywood cinema and 3D animated films. In the case of video games, particularly those that use real-time 3D graphics, places, actions, and events, real or imaginary, are incorporated into a model of the game world. The player then participates in the running of the system by playing the games and interacting with the places, characters, objects, and events programmed into the game world system. In 3D animated films, a 3D character is given a computer generated skeleton, or 'rig', that simulates the movement of a real-world human or animal. These skeletons may be modified for artistic and aesthetic reasons but the simulated skeleton should move and react like a believable creature as much as possible. Other applications that use similar technologies are found in flight simulators for training pilots and commercial warfare based video games used in military training. It is clear that these types of simulation are forms of narrative, or contain narrative. But what of scientific data driven simulations? If the new media form of data visualization can be applied to any form of data set, re-mapping it to form new representations, how does this process apply to simulations? Simulations, it could be said, are always inherently narrative, in that they attempt to tell a story of the system they represent. Through the application of data visualization techniques two choices are immediately clear; the choice between abstraction and narrative. Simulation to abstraction is not difficult to achieve in that no remnants of the original is necessary for an abstract representation. Narrative on the other hand creates an additional challenge in that the simulation will either reframe the original narrative content of the simulation or replace it with another. This process of remapping of narratives is the goal of SKA-LFG; restoring the spatial, temporal axis of narrative (syntagm), rather than the presentation of the model, or system (paradigm), under another guise.

The Sublime in (Big) Data Visualization

The concept of the sublime is central to SKA-LFG in two important ways. Firstly, the aesthetics of the sublime, the sublime as an aesthetic category, like that of the beautiful, and secondly, the sublime as it has been negatively referred to in relation to data visualization; the anti-sublime. The aesthetics of the sublime refers to the experience of awe where human perception is overwhelmed in its attempt to comprehend the object of contemplation in its entirety. It is through this overwhelming of the sensible faculties, that the mind through its cognitive reasoning demonstrates its ability to comprehend the phenomenon not only in its entirety but to comprehend something even bigger than the sensible object – God. The anti- sublime ideal in data art as set out by Lev Manovich in his essay of the same name (Manovich 2002) proposes that the current practices of data visualization in new media art is anti-sublime in that the feeling of awe and wonder, even of terror, is sanitized through data visualizations attempt to represent the masses of data at their source as being on a human scale. SKA-LFG restores the experience of the sublime through maintaining the narratives of the gods in the presentation of radio astronomical data sets. The heavens have been mapped with narratives over millennia. These narratives of creation, of the exploits, adventures, and tragedies of gods and goddesses form the narrative intent of the SKA-LFG project.

SKA-LFG project methodology

SKA-LFG is a new, long term collaborative project partnering the Institute of Radio Astronomy and Space Research (IRASR) at AUT University, Auckland, New Zealand, the School of Art and Design (AUT), the School of Mathematical and Computing Sciences (AUT), Colab Virtual Reality Laboratory (AUT), and international SKA research partners such as Commonwealth Science and Industry Research Organisation (CSIRO), Australia. With original proof of concept developed at AUT University's Warkworth based radio telescope, SKA-LFG is scalable to three exponentially higher resolutions;

- The VLA in New Mexico, USA, has 27 antennas. The data from the antennas is combined electronically to give the resolution of an antenna 36km across. <http://www.vla.nrao.edu/>
- MERLIN, operated by Jodrell Bank Observatory, UK, is the Multi-Element Radio Linked Interferometer Network, an array of 8 radio telescopes distributed around Great Britain, with separations of up to 217km. <http://www.jb.man.ac.uk/>
- The international SKA, will have several thousand antennas, working as a single lens up to 5,500 kilometres apart. <http://www.skatelescope.org/>

Each resolution will provide a unique set of scientific, technological, and aesthetic challenges.

Each resolution provides the opportunity to explore unique location/area specific cosmologies across a global spectrum. Such cosmologies may include, but would not be limited to, ancient Chacoan archeo-astronomical structures of Chaco Canyon (New Mexico), ancient Celtic and Druidic cosmologies (MERLIN -UK), Mātauranga Māori (NZ), and indigenous narratives of the Dream Time (Australia). SKA-LFG does not intend to speak for these cosmologies but rather seeks to provide a variable, developmental, scientific, and technological platform for engaging with indigenous cultures, to explore these unique traditions, knowledge, and understanding of the universe; a universe which inevitably we all inhabit.

REFERENCES

- Vesna, Victoria, ed. *Database Aesthetics; Art in the Age of Information Overflow*. Minneapolis: University of Minnesota. 2007. Print
- Barthes, Roland. "Introduction to the Structural Analysis of Narrative." *Image Music, Text*. Ed. Stephen Heath. Noonday Press. 1977. 79 - 124 Print
- Manovich, Lev. "Database as Symbolic Form." *Database Aesthetics; Art in the Age of Information Overflow*. Ed. Vesna, Victoria. Minneapolis: University of Minnesota. 2007. 39 - 60 Print
- Manovich, Lev. *The Anti-Sublime Ideal in Data Art*. August 2002. Web. Fri 18 December 2011. Web