

Impact case study (REF3)

Institution: University of Hertfordshire		
Unit of Assessment: 32 – Art and Design: History, Practice and Theory		
Title of case study: Connecting Art and Science in Sculpture, Light and Sound		
Period when the underpinning research was undertaken: 2010-2018		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Simeon Nelson	Professor of Sculpture	2001 – present
Rob Godman	Reader in Music	2004 – present
Samantha Jury	Senior Lecturer in Fine Art	2004 – present
Period when the claimed impact occurred: October 2013 - 2019		
Is this case study continued from a case study submitted in 2014? N		
1. Summary of the impact (indicative maximum 100 words)		
<p>Simeon Nelson and Rob Godman’s research at the University of Hertfordshire (UH) deploys large-scale sculpture, video and spatial sound performance to offer new insights into pattern, perception, and systemic connections between art and science. Working with a range of leading arts and funding organisations, their work has been shared with the public through exhibitions, public artworks, <i>lumières</i>, performances, publications, lectures and community outreach. Their public artworks have reached non-academic audiences in excess of 1.46 million, outreach work with 14 schools has reached over 1,100 students, and cumulative audiences of over 3,300 have attended concert performances. Feedback and evaluations demonstrate that the works have inspired audiences to think about scientific concepts, encouraging a greater understanding of our place in the world.</p>		
2. Underpinning research (indicative maximum 500 words)		
<p>Nelson and Godman have worked for over ten years on interdisciplinary art/science projects collaborating with scientists, engineers, programmers and producers to create visual art and sound installations which evoke natural phenomena, such as the cellular aberrations of cancer, and scientific concepts from fluid mechanics to models of the cosmos. Their projects explore the human response to pattern, change and decay. They provoke questions about scale and the relationship between disorder and order, including the relationship of the human scale to the very small and very large. The physical and sonic scale and structure of the works are organised around geometric and iterative systems – repeating forms into which some kind of anomaly is introduced. Three-dimensional multi-speaker spatialisation is an intrinsic aspect of the overall experience.</p> <p>Plenum (2010-2012) is a computer-generated architectural light projection, developed by Nelson and Godman with computer scientist/artist Nick Rothwell (Ravensbourne University London). It was shown at festivals in the UK and Europe, projected onto buildings including King's College Chapel, Cambridge and at KickArts (now NorthSite) Contemporary Arts gallery, Cairns, Australia. Based on textbook illustrations of crystal lattices, the light and sound projection runs on a 15-minute algorithmic loop; no two iterations are the same. Its custom code employs the physics of gravity and attraction: every point affects and is affected by every other point.</p> <p>This collaboration led to a residency and commission funded by the Wellcome Trust and University College London Hospital NHS Trust, Anarchy in the Organism (2012-2014), which challenged attitudes to cancer. By situating it within a wider context of complex evolving systems from cities to trees to landscapes, the work attempts to reconcile cancer as an inherent feature of being in the world. It consists of four 55-inch screens in portrait format embedded in a geometric vinyl pattern on which computer-generated organisms demonstrate growth, mutation and decay as systemic aspects of life. The sound features constantly changing tempi, creating a shifting accelerando/rallentando effect; any definitive pulse becomes difficult to ascertain and perceptually chaotic.</p> <p>This interdisciplinary collaborative practice was taken forward into Cosmoscope (2015-2018),</p>		

led by Nelson in collaboration with Godman, Rothwell and a team of physicists working on three scales: the very small, the human and the very large. It culminated in a monumental sound and light sculpture made of 52 laser-cut steel 3D Platonic elements bolted together into a spherical geometry. Sound and light patterns propagated through it via 2,000 integrated LEDs and 16 loudspeakers suggestive of time and length scales from the infinitesimal to the infinite. By situating humans at the midpoint of the quantum and the cosmological scales, *Cosmoscope* asked the viewer 'what is our place in the universe?'

Faraday Waves (2016-18), led by Godman, is a short audio-visual work written as a companion piece for a concert-hall performance of *Poème électronique* by Varese, and takes its source material from the classic 'Faraday Waves' undergraduate physics experiment. Michael Faraday (1831) discovered that the flat surface of a liquid undergoing vertical vibration, whose frequency exceeds a certain value, becomes unstable, forming non-linear standing waves. Godman collaborated with Professor Stephen Morris (Physics Department, University of Toronto), creating video documentation of the Faraday experiment using sound as the stimulus. The project's visualisation, created by Samantha Jury (UH), uses this documentation, and visualises vibration and sound as the starting point for the creation of the music. The musical composition uses speech rhythms found in the E.E. Cummings poem "[i carry your heart with me(i carry it in)]". Sounds are constructed from the resonance formed through the cross-synthesis of a child's voice and an English bell peal, symbolizing the creation and birth of a new life.

3. References to the research (indicative maximum of six references)

3.1 *Plenum, 2010-2012. Nelson, S., Godman, R. and Rothwell, N.*

- **Sound and light projection on iconic buildings:** Skyway Festival, August 2010, Collegium Maximum Façade, Toruń, Poland. Skyway Festival, August 2011, Church of the Holy Spirit, Toruń, Poland. Valgus Festival, Tallinna Raekoda, Tallinn, Estonia, September 2011. Lumiere (produced by Artichoke), St Oswald's Church, Durham, November 2011. Cambridge Music Festival, King's College Chapel, Cambridge, November 2012
- **Gallery presentation:** KickArts Centre of Contemporary Arts, Cairns, Australia, June-July 2012
- **Live concert performances with the Goldfield Ensemble:** Huddersfield Contemporary Music Festival, November 2013; Kings Place Festival, London, January 2014
- **Further performances:** Noisily Music Festival, 5-8 July 2018 & 11-15 July 2019; WOMAD, 25-28 July 2019

3.2 *Anarchy in the Organism, 2010-2014. Nelson, S. and Godman, R.*

- **Artist Residency and installation:** UCLH Macmillan Cancer Centre, London, March 2011 – July 2013.
- **Live performances with the Goldfield Ensemble:** Huddersfield Contemporary Music Festival, 18 November 2013; Kings Place, London, 12 January 2014; Frome Festival, July 2014; St Augustine's Church, Cambridge, February 2017; Guildhall School of Music and Drama clarinet and electronic workshop (Rob Godman and Kate Romano), July 2019. <https://wellcome.ac.uk/news/study-live-music-and-light-two-audiovisual-performances>
- **Book:** Nelson, S. *Anarchy in the Organism*. London: Black Dog Publishing, October 2013
- **Funding:** Commissioned by UCLH Arts. Supported by two competitive awards from the Wellcome Trust (£30,000 and later £22,000 for the concert-hall version).

3.3 *Cosmoscope, 2015-2018. Nelson, S. and Godman, R.*

- **Exhibitions:** Lumiere Durham November 2017; Lumiere London January 2018; *Moonscapes*, Watts Gallery Artists' Village, Surrey April-May 2019
- **Funding:** Large arts award of £150,000 from Wellcome Trust, competitively awarded to Artichoke (joint application with Nelson.) The Arts Council England, Durham Council, Durham University, University of Hertfordshire and in-kind support from industry. <https://www.lumiere-festival.com/programme-item/cosmoscope/>

3.4 *Faraday Waves / Ritual in transfigured time, 2016-2018. Godman, R, Jury, S.*

- **Live performances:** Art & Science Days Concerts, Concours de Bourges, France (3 June 2016); Diffrazioni Festival, Florence, Italy (November 2016); Sound-Image, Faculty of Architecture Computing and Humanities, University of Greenwich 2017; Seeing Sound, Bath Spa University 2018; Noisily Festival, 11-15 July 2019; WOMAD, 25-28 July 2019
- ***Ritual in Transfigured Time* tour** (with Kate Romano and the Goldfield Ensemble): Cheltenham Festival (July 2016); Oxford OVADA gallery (September 2016); University of York, Jack Lyons Concert Hall (October 2016); Cardiff University (November 2016); Cambridge Stapleford Granary (February 2017).

Evidence of Quality: 3.1 and 3.2 submitted to REF2014; 3.2 and 3.3 funded by competitive, peer-reviewed awards; exhibition and performance reviews included in section 4.

4. Details of the impact (indicative maximum 750 words)

Nelson and Godman's works have inspired a broad range of audiences – cultural audiences, school participants, teachers, patients, academics and practitioners – to engage with the connections between art and science. The projects have experimented with varied contexts, themes and media in which to allow this science/art relationship to unfold, sharing findings with both public-art and concert-hall environments.

Cumulative audiences for the public artworks are in excess of 1.46 million, and concert hall performances have reached over 3,400. Outreach activities have extended the impact to over 1,100 school children, students and family members. This has stimulated cultural tourism, contributed to the quality of the tourist experience, and to economic impact of over £7.6 million. Through engaging with diverse audiences as well as those who may not normally access such types of media or arts programmes, the research has increased cultural participation, and has led to reported benefits to individuals' wellbeing and impacts within education.

Cosmoscope

Cosmoscope, produced in partnership with arts production company Artichoke, aimed to “introduce questions about human biology and the context of life on earth to the widest possible audiences, through a large-scale light and sound sculpture incorporating molecular physics, biomedicine and cosmology” [5.1] – reaching beyond the traditional science audience. It has been experienced by substantial audiences across the country, principally as part of Lumiere, the UK's largest light festival. It was first presented at Lumiere Durham (16-19 November 2017), which attracted 245,000 visitors; it was then shown at Lumiere London (18-24 January 2018), with an audience of 1,200,000 [5.1]. *Cosmoscope* was 7th most cited, out of 29 light installations in total, when visitors were asked ‘which installations made you think about science?’ [5.2].

Artichoke delivered a schools outreach project in partnership with Durham County Council. 420 primary school pupils from 14 schools across County Durham took part in workshops related to *Cosmoscope* [5.1]. These contributed towards learning objectives in KS2 Science, Art and Maths [5.4]. Artichoke worked with schools at a measurable disadvantage (e.g. higher than average free school meals), and those who have limited or no access to arts or extracurricular activities [5.1]. The children investigated key questions posed by *Cosmoscope*; they then created their own artworks, which were exhibited as part of Lumiere – this encouraged further engagement with *Cosmoscope* by the children and their families, increasing cultural participation and providing “public recognition for their achievements, improving their self-esteem and wellbeing” [5.4]. Nearly all pupils – 99% – identified something they had learned from the experience, most commonly “the smallest things in the universe (quarks) and the biggest things in the universe (cosmic web)...the inside of human bodies/cells and space / the universe”. 72% said there was no aspect that they hadn't enjoyed [5.2]. Teachers praised the experience and the learning opportunities it provided: “a fantastic project which all the children were excited to take part in. Even though the topic is quite a difficult concept for Year 3 and 4 children, it was delivered brilliantly so the children were interested.”; “It provided fantastic art opportunities and opportunities for scientific exploration. The range of activities...engaged all pupils”. Teachers

also anticipated taking concepts from the project into the curriculum, and “including more art in relation to science” [5.2]. Activity packs and resources were made available to any school on request.

Cosmoscope had a workshop stand at *Celebrate Science* (24-26 October 2017), Durham University’s family science festival (c.8,500 attendees overall). The stand’s feedback wall reveals children engaged with learning about ‘galaxies’, ‘the stars’, ‘physics’, ‘cells’, and ‘light’ [5.4].

Durham County Council concluded: “the 2017 Lumiere Festival was a significant success in terms of both economic and social impact”, with a total net economic impact of £7.6m [5.3]; 91% of attendees reported visiting Durham specifically for Lumiere [5.2]. *Cosmoscope*’s inclusion is likely to have played a solid role in this stimulation to cultural tourism, having been identified by Artichoke as “a highlight for the audiences in both Durham and London” [5.1]. Images were shared on social media and featured in national and international press, with the *Daily Mail* identifying *Cosmoscope* as “one of the most moving sights” at Lumiere [5.5].

The New Scientist created a video showcasing *Cosmoscope*, the team and concepts behind it and how it was made (‘*See inside the universe in this stunning light sculpture*’, 18 January 2018); the video had received c.4,800 views on YouTube by the end of 2020. It was also discussed in *The Psychologist*, the official organ of the British Psychological Society, read by more than 50,000 members [5.5].

Cosmoscope continued to reach further audiences, with an installation at the Watts Gallery’s *Moonscapes* exhibition (9 April – 23 June 2019), which coincided with the 50th anniversary of the moon landing. *Cosmoscope* was one of four ‘contemporary art interventions’ installed in the grounds of the gallery (c.10,000 visitors). Reviews of *Moonscapes* – covered in local and national press as well as specialist publications – demonstrate how the dramatic appearance of *Cosmoscope*, at this gallery known principally for Victorian art, prompted viewers to engage with its scientific concepts: “startling...an extraordinary construction in the gardens as you arrive” (Fortean Times, 1 June 2019); “spectacular...a splendid attempt to conjure an inter-galactic sense of awe and wonder” (Farnham Herald, 4 April 2019). Nelson and Godman gave a talk at the Gallery about *Cosmoscope* and the themes of science, myth and the visual arts – an attendee stated: “the whole course put ‘Moonscapes’ in a historical and scientific context”. [5.6]

Anarchy in the Organism

Originally conceived as a public artwork with the aim of challenging attitudes to cancer, installed at UCLH Macmillan Cancer Centre, London (2011-2013), Godman later created a scored algorithmic concert-hall version for Eb Clarinet, responsive electronics and video (a collaboration with Dr Kate Romano and the Goldfield Ensemble). This migration from public art to concert hall introduced the research to a second, distinct audience thus increasing and diversifying its reach. Two high-profile concert performances for this chamber version were achieved:

- Huddersfield International Music Festival (October 2013) – audience c. 400 (capacity)
- Kings Place, London (January 2014) – audience c. 120 (75% capacity) [5.7]

A focus group conducted after a small-scale, intimate performance at the Frome Festival (July 2015, c.40 attendees) revealed a profound personal effect on audience members’ understanding of cancer, with reported benefits to their wellbeing: “*I am a cancer sufferer and people were saying to me ‘are you sure you want to go to this?’ I’m so glad I did. It has taught me so much and put my illness into context. It has made me feel a lot better about this illness.*” “*Thank you for tonight, very helpful to someone recovering from cancer.*” “*Personally, the whole project has opened up whole new understanding, information and emotions towards the subject of cancer. Artistically and creatively, it has stimulated my own further exploration into the subject.*” [5.8]

Public talks further extended the project’s reach: *Art and Cancer* at the ONCA Centre for Art and Ecology (July 2016) where Nelson discussed the human implications of *Anarchy in The Organism* for an audience of 50 health workers and artists; a public lecture at the London Laser Talks (November 2016) where Nelson and one of the scientific collaborators on the team, Dr

Simon Walker-Samuel (UCL Centre for Advanced Biomedical Imaging) discussed the project's intersection of art, science and technology. This attracted an audience of c.65 artists, academics, students and public; feedback indicated they found the talks engaging, with all responses rating them very good or excellent [5.9].

The *Anarchy in the Organism* collaboration had a lasting influence on the ensemble's creative practice; Romano states: "the process of working with Rob enabled all Goldfield musicians to fully understand the role of a sound projectionist; we consider Rob a fellow chamber musician, not a technician." It has become part of the established repertoire for Godman and Romano, and has been used as a workshop composition for the Guildhall School of Music and Drama [5.7].

Faraday Waves

This project brought the sheer beauty of this classic physics experiment to broad, non-specialist audiences, with figures in excess of 3,000 people. The first performance was at the prestigious Art & Science Days 2016 Concerts, Concours Bourges, a leading centre for the performance of electroacoustic music. Faraday Waves later toured five UK venues in 2016/17 as part of the 'Ritual in Transfigured Time' tour (Kate Romano and the Goldfield Ensemble), for which Godman designed and coded a unique performance system (total audience 735; funded by the Arts Council of England, RVW Trust and the Britten-Peers Trust). Audience feedback described "an extraordinary and powerful work...it makes so much more sense to hear and watch it live"; "I have never really understood Varese until I heard it in this context..." [5.10]. After initial performances at these niche, prestigious electroacoustic venues, *Faraday Waves* reached entirely different audiences through festival appearances in Italy, Greenwich and Bath (2017-2018), and more 'mainstream' music crowds in 2019 at the Noisily and WOMAD festivals (physics pavilion, c.2,100 visitors).

Educational impact was achieved through a tour of Cambridgeshire schools (720 pupils), which again went some way to removing the art/science division within learning and understanding. In this workshop, polyrhythms were demonstrated to children in KS1 and KS2 using hackable Scratch coding templates developed by Godman. Schools feedback stated: "the children and adults all absolutely loved the show and learnt so much too... [it] exceeded all expectations"; "the children were buzzing...I've never seen them so animated..." The Scratch template is available freely online; estimated take-up 200 [5.10].

5. Sources to corroborate the impact (indicative maximum of 10 references)

- 5.1 Cosmoscope End-of-Grant Report for Wellcome Trust (prepared by Artichoke)
- 5.2 Lumiere Durham Festival 2017 independent evaluation report (and school feedback)
- 5.3 Durham County Council report on Lumiere 2017
- 5.4 Short report produced by Artichoke for Durham University (& Celebrate Science feedback)
- 5.5 Cosmoscope press and social media file
- 5.6 Moonscapes evaluation from Watts Gallery; media coverage
- 5.7 Report from Dr Kate Romano, Artistic Director of Goldfield Productions
- 5.8 Wellcome Trust Engaging Science end-of-grant report for *Anarchy in the Organism*
- 5.9 Laser London Talks email; ONCA details
- 5.10 Ritual in Transfigured Time evaluation report + WOMAD performance data