

Institution: University of Plymouth		
Unit of Assessment: UoA32		
Title of case study: Quorum: Cultural Computation – Enhancing Audience Engagement.		
Period when the underpinning research was undertaken: 02/2013-05/2020		
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:
Professor Mike Phillips	Professor of Interdisciplinary Arts	1992 - present
Dr Birgitte Aga	i-DAT Director of Operations.	2012 - 2019
Dr Gianni Corino	Associate Head of School	2007 - present
Dr Mathew Emmett	Associate Professor in Architecture	2004 - present
Period when the claimed impact occurred: 06/2013-05/2020		
Is this case study continued from a case study submitted in 2014? N		
<p>1. Summary of the impact (indicative maximum 100 words)</p> <p>The Quorum project comprises research in the design, development and application of software and hardware that uniquely augments, evaluates and increases public engagement of cultural experiences. Working collaboratively with communities and not-for-profit, public and private organisations, impact includes: design of digital tools for cultural organisations to enhance cultural value metrics, increase engagement and financial value; digital curatorial techniques and audience engagement of the Tate; collaborative audience experiences in data driven immersive environments for the international Fulldome community; digitally enhancing school safe-guarding and pupil engagement through the use of Artificial Intelligence; Innovating social change and community engagement through the use of data.</p>		
<p>2. Underpinning research (indicative maximum 500 words)</p> <p>The deficit in meaningful methods and tools for data collection across the cultural sector, combined with the sector's limited acceptance of digital processes, provoked a research initiative to explore the challenges associated with measuring 'intrinsic' as opposed to 'instrumental' value. This also exposed the 'divide' between the motivations and requirements of the funder and the funded, and highlighted an 'innovation problem' across the cultural sector in respect of technology adoption. The Quorum project was developed to explore and provide innovative solutions for these problems.</p> <p>i-DAT, led by Prof Phillips, is a research group in the University of Plymouth's School of Art Design & Architecture. Quorum emerged following i-DAT's tenure as an Arts Council England (ACE) National Portfolio Organisation (NPO) (2012-2015). Our response to the sector problems was to develop research using collaborative design strategies and technological innovations that filled the gap between governmental pressures and organisational capabilities, creating mechanisms to enhance audience engagement and participation.</p> <p>This approach consisted of innovative participatory design processes coupled with digital prototyping, developing networked devices, apps and the incorporation of Artificial Intelligence and Machine Learning to augment, evaluate and increase public engagement of cultural experiences.</p> <p>i-DAT's partnership with Cheltenham Festivals and Dr Eric Jensen (University of Warwick), secured a NESTA Digital R&D Award for the Qualia Project (£127,000, 2013-2014). It developed digital alternatives, complementary enhancements and speculative innovations to exploit the potential of digital systems to deliver new mechanisms and metrics. Prof Mike Phillips, Dr Birgitte Aga and Chris Hunt (Research Assistant) employed a 'research-by-design' methodology to rapid prototype technologies for the four 2013 festivals which operated as a 'living laboratory' with the bulk of the research activity focused on the October Literature Festival, followed by system refinements and evaluation into February 2015.</p> <p>The research generated a platform with a sophisticated API for data capture, processing and analytics, powering smile detection, geofencing and tracking, and sentiment analysis to calculate the 'mood' of social media. Shared with users and festival organisers the system generated a real-time data model of audience activities.</p> <p>The Quorum project was established to provide a broader framework to support the development of the Open Source software and methodologies developed through the</p>		

Qualia project. The research was proactively shared across the sector through design workshops with Tate, BAFA Road Shows (including Cambridge Literary Festival and Theatres Trust), Cheltenham Festivals and the AHRC Creative Economy Showcase 2014.

Subsequently, Phillips was commissioned by Jensen, working for the AHRC Cultural Value Project (2014) and Culture Smile (£15960, 2016), to develop sentiment analysis software to extend this research into digital methods for measuring cultural value.

Three Quorum installations were commissioned by the Tate to develop the Artificial Intelligence elements of this research for the DataJam, Turbine Festival (2015) and This Is Where We Are (TIWWA) installation for the launch of the Tate Modern Blavatnik Building (Arts Council England £14885 and Tate Modern £12,500, 2016). These attracted significant audiences (25k in a single day for DataJam and 197k over four days for TIWWA), incorporated projection mapping, robotic objects and Internet of Things technologies (IoT) to create intimate networked relationships between audiences and the algorithms that they were 'playing' with. The third Tate commission developed a high-resolution interactive simulation for the St Ives Naum Gabo exhibition (£7,400, 2020). Phillips developed these IoT techniques into handheld devices for the *Murmuration* Fulldome performances at the Society for Arts and Technology, Montreal, Canada (Phillips, M. UK PI. 2014-2015. European Mobile Dome Labs, EU Culture Programme. Strand 1.3.5, Cultural Cooperation projects with Third Countries, €400k) deploying the audience metrics evaluation techniques within a Fulldome environment.

Further iterations of Quorum included: Artory (2015-2017), an incentivised 'What's-On' app, which was a city-wide collaborative pilot produced by i-DAT and Plymouth Arts Centre with the Plymouth Culture Guide Group; and Emoti-OS (£2,000, Plymouth City Council DataPlay award, 2017) led by Dr Aga, a conversational AI, developed with and for Children & Young People (CYP) at Plymouth School of Creative Arts (PSCA), which questions if artificial systems can generate increased levels of awareness and empathy within a School. Participatory design workshops were carried out with stakeholders across these projects as a methodology to explore ethical, design, pragmatic integration, and subsequent audience/institutional behaviours and values.

Underpinning this impact is the code that has facilitated the collaborations and design approach. Distributed as an open-source repository on GitHub, the original code base had 5 remote contributions, made forward contributions to 4 open-source projects and was interacted with by over 250k people. It also was instrumental to i-DAT's status as an ACE NPO (2012-2015) which engaged over 1.5 million audiences and 4,348 participants (of which over 3000 are Children & Young People).

These research activities have been developed, implemented and evaluated using iterative design processes which have included key stakeholders (institutions and their audiences) in a participatory process with research learnings being folded back into each new iteration or fork of the code, technology and specific research outcome and application.

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

- 3.1 Phillips, M. Bennett, J. 2014. Measuring Cultural Value and Cultural Impact using technology-enhanced methods. Research commissioned by Dr Eric Jensen, University of Warwick University, for the AHRC's Cultural Value Project. <https://doi.org/10.6084/m9.figshare.9775739.v1>, (<http://www.ahrc.ac.uk/research/fundedthemesandprogrammes/culturalvalueproject/>)
- 3.2 Aga, B. 2017. Capture the Rapture. Cloud and Molecular Aesthetics. Leonardo Electronic Almanac Book. Volume 22 Issue 1. Editors Lanfranco Aceti, Paul Thomas, Edward Colless. <https://contemporaryarts.mit.edu/pub/capturetherapture>
- 3.3 Aga, B. Melville, D. Phillips, M. et al. 2015. Artory <https://i-dat.org/artory/> 2015-2017.
- 3.4 Phillips, M. Aga, B. et al. 2016. This Is Where We Are. Installation. Tate Modern, Switch House Launch, 12-19/07/2016. <http://quorum.i-dat.org/tiwwa/> Unit 32 Portfolio Submission Phillips, M.
- 3.5 Aga, B. and Phillips, M. 2017. "This is where we are": collectively living, working and being, with and through predictive algorithms. In Proceedings of the conference on Electronic Visualisation and the Arts (EVA '17). BCS Learning & Development Ltd., Swindon, GBR, 198–201. <https://dl.acm.org/doi/abs/10.5555/3136628.3136689>

3.6 Phillips, M. et al. 2015. Murmuration. EMDL Productions, SAT (Society for Arts and Technology), Montreal, Canada. 26/05-12/06/ 2015. <https://i-dat.org/murmuration/>
Unit 32 Portfolio Submission Phillips, M.

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

Quorum is rooted in the research to generate meaningful digital tools to measure and enhance audience engagement for Cheltenham Festivals, funded by Nesta. It has grown through Artory and became threaded through the cultural fabric of the City of Plymouth, bringing arts organisations, their audiences and their funders together to release new funding and improve a cultural dialogue. The innovative methods and technical approach have helped to stitch together Plymouth City Council with their communities to enrich a civic dialogue about data and generated a new dialogue between teachers and pupils through Emoti-OS. The same approach and digital tools have provided inspiration and a technological infrastructure for a new Fulldome venue in an area of multiple deprivation in Plymouth, which has already significantly transformed its sense of civic pride. It is now providing a platform for the Cornish regional cultural sector, switching a model designed to measure cultural metrics in city venues to a region where there is significant geographical distribution of rural communities, many of which have been excluded from a cultural dialogue. The research has had national reach through its engagement with the Arts Council England, Tate, and internationally through applications within Planetariums and large-scale projection venues, such as the National Space Centre Leicester, the Société Des Arts Technologiques [SAT] Montreal, the Fulldome / VR & AR Lab University of Applied Arts Vienna, *The Zeiss-Planetarium Jena* and the Festspielhaus Hellerau in Dresden, all seeking to improve their audience metrics and increase audience engagement through innovative digital techniques.

Quorum research has engaged with the complex problems of measuring Cultural Value and Cultural Impact using technology-enhanced methods in response to Governmental agendas, and delivered by non-departmental public bodies such as the ACE. Quorum challenges traditional methods of measuring cultural impact and outcomes and supports the lack of capacity, especially within smaller arts organisations, to undertake the necessary measurements and data collection. The concern for the cultural sector is that artistic output is viewed only in economic terms using things that are easy to measure and ignoring those that are not. This presents a particular difficulty for the cultural sector, where value is considered to be 'intrinsic' and hard to quantify.

The digital tools (software and hardware) and participatory design approach developed through this research enabled us to develop a series of collaborations with organisations and communities of varying scale to create technological and methodological solutions that better fitted their unique ecologies and audiences, but that also generated new digital and data driven experiences, effectively turning the measuring of things into a form of creative participation.

Design of digital tools for cultural organisations: Through the NESTA Digital R&D funded Qualia Project (2013), we developed an experimental framework which enhanced the management of Cheltenham Festivals, developing more effective and real-time audience engagement and evaluation mechanisms, such as sentiment analysis of social media feeds, capturing smiles, mood, accurate attendance information, levels of participation, location and flow of audiences. All of this information was relayed to the event organisers through an online dashboard to inform the organisations' understanding of their events as they happened, allowing them to be more responsive in their engagement with audiences. This took the form of push notifications, more focused and demographically tailored information, sharing of captured information through visualisations and audio on the app and information booths, and the ability to make site-specific interventions where the audience was clustering. This knowledge also allowed Cheltenham Festivals to better plan future events based on accurate flow of people when linked to factors such as weather and traffic changes. *"I loved the fact that you could reflect on what your expectations of the event were before you went and why you chose the event and then record your actual feelings having attended. It really made you think about what you wanted to get out of the event and this will be a wonderful source of information for artists and organisations to gain a deeper understanding of their audiences."* [5.1].

Quorum research informed AHRC's Cultural Value Project [3.1] (2014) and the delivery and design of audience metrics strategies through collaborations with the British Arts

Festival Association and Tate (Digital, Learning, Tate Collective, Exchange and St Ives) to support their membership engaging with digital techniques. It was taken further with the development of Artory [3.2 & 3.3] (2015-2017). Artory enhanced the marketing strategies of its 25-organisation membership, significantly increasing customer reach. It secured increased funding by contributing to six of Plymouth's successful ACE NPO bids, enhancing audience engagement through innovative embedded micro-feedback techniques, real-time information and incentivisation, and coherent organisational metrics reporting. ACE identifies the critical role this research played in the cultural infrastructure of Plymouth City: "Artory was instrumental in bringing diverse Plymouth arts organisations together to allow them to engage with Arts Council England audience metrics. The research produced technical innovations but also created a strong 'social' platform for audiences and organisations to have a rich cultural dialogue. It brought together audiences, arts organisations and City Council stakeholders and was cited in a number of successful funding applications to Arts Council England." [5.2].

This design approach led to a partnership with Counting What Counts Ltd to "create a palpable sense of innovation and openness around the whole QEFP (quality evaluation framework project), and generate accelerating public value returns for ACE and all cultural organisations involved." [5.3], and their successful award of the ACE 'Impact & Insight Toolkit' (2018) contract which has been used since 2018 to support and report audience metrics for all ACE National Portfolio Organisations in receipt of £250k or more (256 organisations in total [5.10]).

ACE comments further "*Artory...continues to be cited as an example of best practice and digital innovation for the culture sector and has been influential in the current Audience Impact & Insight toolkit (led by John Knell) used by Arts Council's National Portfolio Organisations.*" [5.2]. This approach has recently been selected by Cornwall 365 (10/2020), Cornwall's Cultural Tourism Network, under the umbrella of the Creative Kernow network, as the data collection platform for Cornwall's diverse and geographically dispersed cultural audiences.

Digital curatorial techniques and audience engagement in galleries: Quorum was the basis for Phillip and Aga's collaboration with the Tate, which built on these digital methods and the design approach to deliver work for the Tate Turbine Hall festival and TIWWA [3.4 & 3.5] installation, the first interactive digital work to be exhibited in the Blavatnik Exchange, with an audience of 197,000 people over 4 days. This has enhanced Tate's digital curation approach: "The model of the 'collaborative interdisciplinary ecology' is one that Digital Learning has reproduced on subsequent occasions and is planned as the frame for future research". [5.4] Led by Phillips, i-DAT were further commissioned for an interactive volumetric scan of a Gabo sculpture, 'Bronze Spheric Theme' (1960) for the Tate St Ives 2020 exhibition. Co-produced with Tate Digital, the adoption of these algorithmic approaches has opened new curatorial approaches in traditionally conservative areas of conservation, exhibition and curation.

Collaborative audience experiences in data driven immersive environments: Quorum's networked devices and algorithmic designs for Fulldome environments were incorporated in performances at the Satosphere Fulldome in Montreal [3.6] (2015) to allow crowds to interact collaboratively with the projected virtual image, techniques which have enhanced the international Fulldome community by providing new digital tools for audience participation. "The ongoing work, as demonstrated in the EMDL production at IX at SAT, provides an innovative template for the use of real-time data for creating powerful audience interaction and engagement in Fulldome installations. The embedding of these initiatives into the fabric of the new Fulldome installation in the Plymouth Market Hall will mark a significant step forward for the community, offering new audience experiences and a new platform for creative production." [5.6]. This informed the commissioning and design of the £7.4 million New Devonport Market Hall in Plymouth by providing methods, digital tools and audience engagement techniques, and ACE commissioning of new work through Phillips' leadership of the ACE Montreal delegation (£20,000, 2019). The Real Ideas Organisation recognise the instrumental significance of Quorum: i-DAT's "*cutting edge Fulldome research is inspirational, opening up the potential for new content, work and economic growth. It is the reason we, at Real Ideas, decided to raise £7.4 Million and establish the Market Hall as a centre for Fulldome development and enterprise in Devonport, Plymouth. The research informed the design of the technology infrastructure, allowing us to*

create experimental interactive data driven productions for this unique environment. It is an important platform for artists and performers closely associated with i-DAT's network and for the many other makers, technologists, entrepreneurs, young people and families looking to explore this area." [5.6].

Digitally enhancing school safe-guarding and pupil engagement: Quorum underpins Emoti-OS 1.0 which was developed for Plymouth School of Creative Arts (11-12/2017) and exhibited in the Tate Exchange (01-02/2018): an emotive chatbot to engage 37,670 'emotional' user interactions and 1,372 unique conversations in the period it was live. It enhanced the School's safeguarding policy, enhanced social interactions and behaviours between pupils and staff and empowered pupils to express feelings and increase empathy. *"For students there was a palpable increase in engagement where the young people had the chance to review their emotions in a motivating manner. It raised a consideration of risk and emotions in an interesting manner. It is impossible to take responsibility without awareness, this project supported awareness of safeguarding and risk."* [5.7]. Nesta recognises the significance of Emoti-OS by using it as a case study in the use of AI in the education sector, which has informed the sector's engagement with its use as a tool to enhance learning: *"In this model, insights gained from data collected by AIEd are combined with insights from staff in the school to create a collective intelligence, to enable decision making that brings together the views of students and staff"* [5.8]. Emoti-OS was also presented at London EdTech Week by the Computing Lead at Plymouth School of Creative Arts as mechanism for empowering students, and as a viable alternative to a fear of the "mutant algorithm" often felt in the sector. *"It became apparent that, with Emoti-OS, we were empowering students to give voice to their feelings and, in many cases, giving them an opportunity for non-human, non-judgmental conversation."* [5.7].

Innovating social change and community engagement: "Following the Artory project i-DAT was a founding partner in Plymouth City Council's 'DataPlay' (2015) [5.9] and Quorum research contributed to the development of the city's open data strategy to generate collaborations, conversations and workshops between data providers and communities, SMEs and artists. The coupling of our participatory design methods and open technological innovation has allowed greater access for numerous community groups (such as Plymouth Tree Partnership), Schools (such as Plymouth School of Creative Arts), and SMEs (such as Elixel, Mutant Labs, and Controlled Frenzy) to engage with the City Council and their data, which was previously inaccessible and poorly curated. This strategy was extended through geospatial models to produce real-time urban simulations which have been used in participatory community conversations to inform civil decision making with councils in Cairo, Egypt, as part of i-DAT's partnership for the Cairotronica Festival (2016) and by invitation the University of Edinburgh Design Informatics Research Institute for the Edinburgh (Cityscope Project, 2016). As a result of the success of these techniques they were incorporated into the delivery of the Environmental Futures and Big Data Impact Lab (£6.4m, European Regional Development Fund, 2018), a collaboration with the Met Office and other partners, and part of the technical infrastructure of the Market Hall Fulldome installation in Plymouth as mechanisms to create greater civic engagement with the design of urban environments.

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

- 5.1 CEO of Cheltenham Festivals. NESTA Digital R&D Final Report. 02/2015.
- 5.2 Arts Council England (South West Director of Arts Council England, and Relationship Manager, Creative Media, Arts Council England South West).
- 5.3 Counting What Counts, extract from ACE 'Impact & Insight Toolkit' Application (2018).
- 5.4 Tate Learning and Tate Digital confirmation of the impact of TIWWA.
- 5.5 IMERSE.org, Impact this research has had on the international Fulldome community.
- 5.6 RIO (Real Ideas Organisation) on the design of the £7million Devonport Market Hall.
- 5.7 Plymouth School of Creative Arts confirming the impact Emoti-OS had on the Schools Safeguarding, wellbeing and pupil teacher relationships.
- 5.8 Baker, T. Smith, L. (2019). Nesta: Educ-AI-tion Rebooted? Exploring the future of artificial intelligence in schools and colleges.
- 5.9 Plymouth Data-Play Booklet. Plymouth City Council (2017).
- 5.10 Arts Council England 'Our National Portfolio in Numbers, 2018-22'.