

Section A		
The fields in this section are mandatory.		
Institution: Durham University		
Unit of Assessment: 28 - History		
Title of case study: Ordered Universe		
Period when the underpinning research was undertaken: Between 2009 and 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:
Giles E. M. Gasper	Professor in High Medieval History	2004 – present
Period when the claimed impact occurred: Between August 2013 to December 2020		
Is this case study continued from a case study submitted in 2014? N		
Section B		
1. Summary of the impact:		
<p>Gasper's research insights within the context of the Ordered Universe project have impacted upon:</p> <ul style="list-style-type: none"> • The artistic and commercial direction of a major UK creative arts company, <i>The Projection Studio</i> - prize-winning outputs have emerged, as well as significant increase in UK and international profiles, and measurable economic benefit to specific UK and US communities. • the establishment of a path-breaking Access to University scheme (OxNet) in the North-East, involving ten regional schools, and recognised by a National Social Mobility Award (2019). • the career and development of Alexandra Carr, multi-media sculptor, which has been transformed by engagement with the Ordered Universe project, and artists at the National Glass Centre, UK. • A wider public education programme in the UK, Europe, Canada and the USA. <p>Gasper led on all impact activities below, in the context of a large-scale interdisciplinary collaboration.</p>		
2. Underpinning research:		
<p>The principal research insights from the Ordered Universe concern the nature, practice, and sources of medieval science, and the development of a path-breaking collaborative methodology across arts and science. From its inception in 2009, the Ordered Universe project has taken a single point of focus, the scientific works of the English polymath Robert Grosseteste (c. 1170-1253), and developed a novel interdisciplinary methodology engaging medieval specialists and modern scientists. Supported by an AHRC Network Grant 2012-14, and an AHRC Standard Grant 2015-19 (GBP1,000,000), over 165 scholars have engaged with the project since its inception, from medieval history, philosophy, and Arabic studies, to modern physics, engineering and vision science; the core team is 30. The project has significant international reach with partners in the UK (Durham-York-Oxford act as hubs), Italy, Ireland, Lebanon, Canada and the US (with additional financial resource from Georgetown University). Shortlisted for the THE Research Project of the Year in 2014, Ordered Universe informed the AHRC 2019 Delivery Strategy for arts engagement with scientific disciplines. Impact from the project emerges from a collaborative background, directed by Gasper, with Durham colleagues (Tanner, Bower, Sønnesyn, Gilbert) playing leading roles in its production and measurement.</p> <p>Grosseteste was one of the most dazzling minds of his generation, and the project presents his 13 treatises on natural phenomena, in critical editions together with English translation (in most cases for the first time), and extensive multi-disciplinary analyses. These will be published by OUP in 6 volumes, the first published in 2019, the rest to follow on an annual basis (R1). As a result, Grosseteste's scientific thought is now authoritatively accessible to medieval studies,</p>		

histories of science and a wider disciplinary audience in modern science; the implications of this remarkable corpus can now be analysed fully (R5). The impact of the interdisciplinary methodology has been considerable, not least in the disciplinary areas represented in the project. In its course new interpretations have been developed for the historical data of Grosseteste's life and career and transformed the ways in which medieval scientific thinking can be elucidated through collaborative disciplinary research (R4). New science has resulted from the investigation of past science (R3). The collaborative methodology of the project has produced interdisciplinary outputs in leading science and humanities journals, and edited volumes as well as the monograph series (R2, R3, R5, R6). The flexible, new way of working across disciplines made engagement with non-HEI partners a natural part of the Ordered Universe, as shown in the diversity of impact generated.

3. References to the research:

- R1. **Giles E. M. Gasper et al**, *Knowing and Speaking: Robert Grosseteste's De artibus liberalibus 'On the Liberal Arts' and De generatione sonorum 'On the Generation of Sounds'* (Oxford: Oxford University Press, 2019).
- R2. Joshua, Harvey, Hannah E. Smithson, Clive Siviour, **Giles E. M. Gasper**, Sigbjorn O. Sonnesyn, Brian K. Tanner, & Tom C. B. McLeish, 'Bow-shaped Caustics from Conical Prisms: a 13th Century Account of Rainbow Formation from Robert Grosseteste's *De iride*', *Applied Optics* 56(19) (2017): G197-G204. <https://doi.org/10.1364/AO.56.00G197>
- R3. **Giles E. M. Gasper**, Tom C. B. McLeish, & Hannah E. Smithson, 'Listening Between the Lines: Medieval and Modern Science', *Palgrave Communications* 2, (2016), 16062. <https://doi.org/10.1057/palcomms.2016.62>
- R4. Richard G. Bower, Tom C.B. McLeish, Brian K. Tanner, Hannah E. Smithson, Cecilia Panti, Neil Lewis, & **Giles E.M. Gasper**, 'A medieval multiverse?: Mathematical modelling of the thirteenth century universe of Robert Grosseteste', *Proc. Roy. Soc. A* 470(2167) (2014), 40025. <https://doi.org/10.1098/rspa.2014.0025>
- R5. Tom McLeish, Richard G., Bower, Brian K. Tanner, Hannah E. Smithson, Cecilia Panti, Neil Lewis, & **Giles E. M. Gasper**, 'History: A medieval multiverse', *Nature* 507 (2014), pp. 161-163. doi:10.1038/507161a
- R6. **Giles E. M. Gasper**, 'The Fulfillment of Science: Nature, Creation and Man in the Hexameron of Robert Grosseteste', in J. P. Cunningham & M. Hocknull, eds. *Robert Grosseteste and the pursuit of Religious and Scientific learning in the Middle-Ages* (Cham: Springer, 2016), 221-242.

Evidence of quality:

The underpinning research resulted from 6 awards, as evidence of quality: 2 from the AHRC (Project Reference: AH/N001222/1 and AH/K003658/1), 1 from the Leverhulme Trust, 1 from the Andrew W. Mellon Foundation, 1 from the Mahfouz Foundation for Interdisciplinary Research, 1 from Georgetown University. Total value of awards was GBP1,260,511. PI for the AHRC and Leverhulme was Gasper (2013 -14; 2015 - 20; 2017-18). Lead applicants for Mellon were Siviour, Smithson and Harrison (University of Oxford) with Gasper; for Mahfouz, Smithson, with Gasper; and for Georgetown, Lewis. In addition the Ordered Universe project has featured in, and secured funding from, the Being Human Festival, 2014, 2015 and 2016; it was also featured as the AHRC nomination for the Cheltenham Science Festival 2015. In 2017, Gasper was awarded an honorary doctorate for leadership of the Ordered Universe project.

All of the outputs are peer-reviewed and in leading journals, humanities- and science-based, or leading presses.

4. Details of the impact:

The Projection Studio: Gasper (with input from other Durham and project colleagues) has developed 6 sound and light shows with *The Projection Studio* (2015-2020), playing in the UK, Germany, and the USA, to a total of 1,000,000 people, and advised on 3 other projects in incubation stages (E1). All 6 shows are based on material from Ordered Universe research: historical, textual, and scientific. Starting with Durham Lumiere 2015, interaction with the company has been regular and consistent. Ross Ashton and Karen Monid, co-Directors of the company, have attended project symposia to work first-hand with the material and collaborative

methodology of Ordered Universe. The transformative effect of using academic research for projection art is noted in Ashton's testimonial (E1): 'Being part of a project with such a wide scope of topics and contributors has fed back into my work and has stimulated a new interest in medieval history and cosmology. This led to a series of ideas that were developed directly into major works.'

The 6 shows draw on different aspects of Ordered Universe research: *World Machine* (2015) focused on cosmology (R4 and R5), *Spiritus* (2016) worked through ideas of body and form, *I-See* on visual perception (2018), *Horizon* (also involving research from NASA) and *Zenith* on the history of astronomy (2018/19), and *Northern Lights* on light (2019/20) (R1).

All shows played to diverse audiences, with multiple impacts on *The Projection Studio's* business model and creative processes. *World Machine* and *Spiritus* were produced for major international festivals, the former the centrepiece for Durham Lumiere (the UK's largest sound and light festival), the latter for the Berlin Light Festival. *World Machine* was identified as the most popular installation in visitor surveys and contributed approximately GBP8,000,000 uplift to the local economy, with audiences of approximately 250,000 people, as calculated in the Durham County Council commissioned report (E2). *Spiritus* took *The Projection Studio* to the Berlin Light Festival for the first time (2016), viewed by approximately 600,000 people, and facilitated contact from the US City of Baltimore as part of its plans to establish a new Light Festival.

During the course of collaboration with Ordered Universe research *The Projection Studio* took on major roles with fledgling festivals, bringing the experience of light and sound installations to non-traditional audiences and with international exposure. These not only featured co-created projections but also a sequence of Ordered Universe talks and interactive activities on the history and science behind the show: a novel and innovative development for the industry. *Spiritus*, together with a day of talks and activities, featured as the showpiece in the second Cambridge e-Luminate Festival (2017) helping to double the audience from the previous year (E2). This model was repeated in 2018 with *I-See*, and a broader series of supporting talks.

The model of co-created shows and supporting events curated by Gasper was adopted wholesale by Ashton and Monid for the new Festivals at Napa, California and Poole in the UK, for which they act as artistic directors (E1). Their links with university researchers were important aspects in their appointments. For the 2nd Napa Lighted Art Festival 2019, which co-commissioned *Horizon* with the Light Up Poole Festival, Gasper and colleagues presented 3 days of talks, reading groups, and demonstrations. Light Up Poole commissioned *Zenith*, and, on Ashton and Monid's recommendation, a series of public talks across the whole Festival from artists and academics: Gasper and colleagues participated in 2019 and 2020. The positive effect on Napa businesses features strongly in the evaluations of 2019, with an audience of approximately 40,000 people; Poole 2019 also witnessed a substantial increase in numbers and regional and national profile (E2).

Project research also contributed to a ground-breaking internal projection at York Minster, *Northern Lights*, in 2018, a commission attributed by Ashton in no small part to the association with academic researchers: 'Having their names associated with our company has helped us to secure work in Heritage Interpretation projects' (E1). Commissioned as part of a fund-raiser to preserve the Minster's medieval stained-glass, *Northern Lights* proved so popular it was re-commissioned in 2019, with supporting talks by Gasper and Durham colleagues. Short-listed for awards in 2018 and in 2019, *Northern Lights* won 'Best Use of AV Technology' at the Event Technology Awards, and Ashton the 'AV Professional of the Year Award' at the AV Awards. According to Ashton: 'Working with the Ordered Universe has had a major impact in my work leading to new projects, new ways of working and new business ideas for the future.' (E1)

Engagement with Ordered Universe research has had second and third levels of impact for *The Projection Studio*. An excellent example is a 2016 commission, *Chasing Stars*, for Blackpool Illuminations, with Oscar-winning composer Vangelis, and astronaut Tim Peake. This came about as a result of Ordered Universe collaboration with colleagues from the European Space Agency, who contacted Ashton and Monid. *Chasing Stars* has been viewed by approximately 12,000,000 people (E1).

Access to University: OxNet and OxNet North-East: OxNet (a University Widening Participation Scheme) was established in Pembroke College, Oxford, in 2008 and adopted by a larger consortium of colleges in 2018. Ordered Universe's engagement with schools dates back to its AHRC Network Grant (2012-14), which included a network of teachers in the North-East.

Involvement in the OxNet scheme flowed naturally from this initial activity and was framed and resourced as a pathway to impact within the principal grant. OxNet operates a hub school model, where the hub forms the administrative centre and typically engages between 5 and 6 schools in the locality to form a coherent body for widening participation. As of 2015 hub schools existed in London, Greater Manchester and Crewe. The North East hub at Southmoor Academy, Sunderland, was established in 2016 as part of the Ordered Universe impact strategy. Three complete cohorts of between 18 and 23 students have been through the programme (between 2017 and 2020). The Southmoor hub now involves between 11 and 17 schools, demonstrating the success of the programme within the region.

Gaspar designed the Ordered Universe Access Programme, adapting the OxNet template to showcase interdisciplinary work: a taster event for students, teachers and parents; a selection process with account for indicators of deprivation; a one-day learning skills workshop; a 6-week seminar programme exploring the science and humanities subjects and the collaborative ethos of the project; a residential Easter School on medieval manuscripts and modern physics; a summer school in Oxford (involving all participating hubs) in which students adopt Ordered Universe practice in collaborative study of Grosseteste's scientific works.

The impact of this challenging curriculum is shown in 3 ways: on the pupil participants (E7); on the Aspirations Programme spearheaded by Southmoor Academy embedding access to university from primary to sixth form (E8); and on the broader OxNet programme (E8).

Impact on pupils was measured by iterative surveys throughout the programme. The effect of student aspiration has been marked. Comments from the 2018 cohort are emblematic: 'the programme in general has made me more confident, it's made me feel like I've got more skills and more to say about myself'; 'it's raised my aspirations for university'; 'it's let me do something I wouldn't normally do in my a-levels'; 'it's really helped me understand what to look for'; 'learning is such a collaborative process' (E7). This aspiration can be tracked into applications and places at Russell Group universities: of the 2017/18 cohort, 13 gained places across 8 universities, and in subjects ranging from History to Pharmacology; the 2018/19 cohort made applications to 11 universities. Contact with the 2018 cohort includes Ordered Universe research singled out as a factor in their applications (E7).

Over the last 3 years, Gaspar has advised the Vice-Principal at Southmoor, Dr Sammy Wright, in the construction of a deeper programme of educational aspiration in the North-East region with university access as the final aim. The Aspirations Programme runs from Primary to Year 13, and includes a wider range of schools, with the Ordered Universe programme as core activity for the sixth-form element. Embedding university at earlier levels is crucial to the ethos of the programme (E7). The Aspirations Programme draws in part on Ordered Universe work, which was conducted with primary-level teachers in 2013 as part of the AHRC Network Grant. The considerable, and effective, difference that the Southmoor Academy programmes are generating in terms of access to university were recognised by a National Social Mobility Award for School/College of the Year in 2019, as part of which the OxNet-Ordered Universe programme was identified as a significant element.

The Ordered Universe programme has generated impact on the wider OxNet offer. First, the new model of using a research project to showcase university life to sixth form students from non-traditional access backgrounds has been adopted as best practice within the wider OxNet group (E8). Second, in response to Covid-19, the Ordered Universe strand moved its activities completely online for the Easter and Summer schools. The way in which this was done became a model for the whole OxNet offer, and went, as the Director noted 'a long way in reinventing OxNet' (E8).

Alexandra Carr/National Glass Centre: A third line of impact focuses on multi-media and glass sculpture. The association with Alexandra Carr dates from a public talk given in 2015 by Gaspar and Tanner at the Royal Society for Open House London. This prompted Carr, an upcoming multi-media sculptor with particular interest in scientific process, to make contact. At the initial

meeting she produced a portfolio of ideas for artistic outputs drawing on material from the project website, which mapped out a sustained engagement with its research. A series of line drawings were the first outputs to emerge in 2016; Carr attended project symposia over this period.

Her engagement with the research led to a successful application by Gasper for a Leverhulme Trust Artist in Residence Fellowship (2017): *Sculpting with Light*, which focused on medieval and modern cosmology. The residency created the environment for a more intensive response to Ordered Universe research and involved a wider range of outputs, including an increasing number of external commissions (E5, E6). An experimental temporary installation at Ushaw College (Durham), *Lux Obscura*, led to three commissions for similar work at The Bowes Museum, and Pembroke College, University of Oxford. A body of long-exposure light photographs captured in 2017 was exhibited at Outstanding Art, Durham, from 2019 to 2020.

The centrepiece of the residency was a significant sculpture, *Empyrean*, which models the medieval cosmos (E6). Made for a Durham Palace Green Library exhibition on Dante (open between 2017 and 2018), and exhibited subsequently at Ushaw College between 2018 and 2019, it is in early-stage negotiation with a private buyer for approximately GBP20,000. In 2019 *Empyrean* was longlisted for the Aesthetica Art Prize. Carr's association with Durham was extended with her appointment as Artist in Residence at Josephine Butler College for the academic year 2018-19, and an Institute of Advanced Study Fellowship for 2020. All of these connections have expanded Carr's profile and practice, particularly in engagement with science and history of science, culminating in her recruitment by Renee Pfister, London- and New York-based Art and Gallery Consultant, in 2019, with high-status commissions following. In Carr's words she has 'exciting, high profile potential projects in the offing as a result. I think this is in no small part due to the work I have done with Ordered Universe' (E5).

In a similar vein, Ordered Universe research inspired glass artists based at the National Glass Centre (NGC), University of Sunderland, which resulted in a major exhibition of new work at the NGC in 2018 (E4). Cate Watkinson and Colin Rennie led the collaboration, with impact upon their own artistic practice (E3), and on the work of Angela Thwaites, who used Ordered Universe research as the basis for her PhD in Glass Art (E3). Smaller pieces from the main exhibition and Thwaites's PhD portfolio were exhibited in Oxford, giving wider exposure to the NGC. One of Rennie's pieces was longlisted for the Toyama International Glass prize.

Public Education: The 3 areas of impact highlighted above show the reach and significance of Ordered Universe's research impact. This is supported by a wider programme of public education, with over 55 talks and workshops by team members, in the US, Canada, Europe, and the UK, from Cathedrals to Shopping Centres, and as part of the Light Festivals listed above. 16 of these have been surveyed, pre- and post-event, and show demonstrable change in audience perception of medieval science (E9 for representative examples). In addition, the project research, and its collaborative ethos, has enjoyed popular appeal. Topics such as 'The Medieval Big Bang' and 'The Greatest Scientist You've Never Heard Of' have been covered in magazines (e.g. *New Scientist*, *Sky at Night Magazine*, *New Statesman*), in broadsheet press in the USA, Europe and the UK, and in a wide range of podcasts (*Travels Through Time*) and other web-based media (E10).

5. Sources to corroborate the impact

- E1. Projection Studio: Testimonials from Ashton
- E2. Projection Studio: Lumiere, Napa, and Poole Impact Reports
- E3. National Glass Centre: testimonials from Rennie, Watkinson and doctoral students
- E4. National Glass Centre: artwork produced 2016-18
- E5. Alexandra Carr: Testimonial from artist
- E6. Alexandra Carr: Artwork produced during 2018 residency including *Empyrean*
- E7. OxNet Access: Student Testimonials from 2018-now
- E8. Southmoor and OxNet Directors with cohort analysis of university, with Aspirations Programme and report from Southmoor Academy
- E9. Public Talks: public questionnaire reports Cambridge 2017, 2018; Napa 2019.
- E10. Media evidence, including *New Scientist*, *Sky at Night Magazine*, *New Statesman*