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Material Sight: A Sensorium for Fundamental Physics

Fiona Crisp

Northumbria University Newcastle

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Abstract

Often our attempts to connect to the spatial and temporal scales of fundamental physics - from the subatomic to the multiverse - provoke a form of perceptual vertigo, especially for non-scientists. When we approach ideas of paralysing abstraction through the perceptual range of our sensing bodies, a 'phenomenological dissonance' can be said to be invoked, between material presence and radical remoteness. This relational dynamic, between materiality and remoteness, formed the conceptual springboard for 'Material Sight' (2016-2018), a research project based at three world-leading facilities for fundamental physics, that brought to fruition a body of photographic objects, film works and immersive soundscape that re-presented the spaces of fundamental physics as sites of material encounter. The research was premised on a paradoxical desire to create a sensorium for fundamental physics, asking if photography, film and sound can embody the spaces of experimental science and present them back to scientists and non-scientists alike, not as illustrations of the technical sublime but as sites of phenomenological encounter. This article plots the key conceptual coordinates of 'Material Sight' and looks at how the project's methodological design – essentially the production of knowledge through the 'act of looking' – emphatically resisted the gravitational pull of art to be instrumentalised as an illustrative device within scientific contexts.

Keywords

materiality, encounter, art-science, phenomenology, cross-discipline, fundamental physics, non-documentary photography

Material Sight: Un sensorium para la física fundamental**Resumen**

A menudo, nuestros intentos de conectarnos con las escalas espaciales y temporales de la física fundamental, desde la subatómica hasta el multiverso, provocan una forma de vértigo perceptivo, especialmente para los no científicos. Cuando abordamos ideas de abstracción paralizante a través del rango perceptual de nuestros cuerpos sensoriales, se puede decir que se invoca una “disonancia fenomenológica” entre la presencia material y la lejanía radical. Esta dinámica relacional entre materialidad y lejanía representa el trampolín conceptual de “Material Sight” (2016-2018), un proyecto de investigación realizado en tres de los principales centros internacionales de física fundamental, que presenta un corpus de objetos fotográficos, trabajos audiovisuales y un paisaje sonoro inmersivo que representa los espacios de la física fundamental como lugares de encuentro material. La investigación se basa en el deseo paradójico de crear un sensorium para la física fundamental, preguntándose si la fotografía, el cine y el sonido pueden encarnar los espacios de la ciencia experimental y presentarlos a científicos y no científicos por igual, no como ilustraciones de lo sublime técnico sino como lugares de encuentro fenomenológico. Este artículo traza las coordenadas conceptuales clave de “Material Sight” y analiza cómo el diseño metodológico del proyecto –básicamente la producción de conocimiento a través del “acto de mirar”– ha resistido enfáticamente la atracción gravitacional del arte para ser instrumentalizado como un dispositivo ilustrativo dentro de un contexto científico.

Palabras clave

materialidad, encuentro, arte, ciencia, Fenomenología, interdisciplina, Física fundamental, fotografía no documental

Introduction

Figure 1. Material Sight 2018. Northern Gallery for Contemporary Art, Sunderland, UK. Installation Detail. ©Fiona Crisp

Our attempts to connect to the spatial and temporal scales of fundamental physics - from the subatomic to the multiverse - often provoke a form of perceptual vertigo, especially for non-scientists. When we approach ideas of paralysing abstraction through the perceptual range of our sensing bodies, a ‘phenomenological dissonance’ can be said to be invoked, between material presence and radical remoteness. This relational dynamic, between materiality and remoteness, formed the conceptual springboard for *Material Sight* (Crisp 2018),¹ a research project based at three world-leading facilities for fundamental physics, that brought to fruition a body of photographic objects, film works and immersive soundscape that ‘re-presented’ the spaces of fundamental physics as sites of material encounter [Figure 1].

The research was premised on what could be seen as a paradoxical desire to create a sensorium for fundamental physics, asking if photography, film and sound can embody the spaces of experimental science and present them back to scientists and non-scientists alike, not as illustrations of the technical sublime but as sites of phenome-

1. See www.materialsight.wordpress.com

nological encounter. This article plots the key conceptual coordinates of *Material Sight* and looks at how the project's methodological design – essentially the production of knowledge through the *act of looking* – emphatically resisted the tendency of art to be instrumentalised as an illustrative device within scientific contexts.



Figure 2. *Joy 3 Continuous Miner* from *Material Sight* 2018. Giclée print from colour transparency. ©Fiona Crisp

The project partners for *Material Sight* were: The Centre for Advanced Instrumentation (CfAI) and The Institute of Computational Cosmology (ICC) at Durham University, UK; Laboratori Nazionali del Gran Sasso (LNGS) in Italy; and Boulby Underground Laboratory, UK. Funded via a Fellowship from the Leverhulme Trust (UK), it was a practice-based research project premised on the lead artist/researcher's long-term engagement with the ontology and phenomenology of photography. In this context the project was positioned to explore photography's limits, as much as its capabilities, based on the photograph's inability to adequately embody presence – its 'phenomenological failure' (Crisp 2015) – that has formed one of the key conceptual conduits by which the researcher has interacted

with physicists and the environments of fundamental science for the last decade.

The project was hosted by the UK-based organisation, Arts Catalyst,² who have a laudable history of supporting artists, scientists and technologists to establish innovative interdisciplinary practices. As part of *Material Sight*, a co-enquiry was developed with Arts Catalyst's then Artistic Director, Nicola Triscott,³ to bring together a network of artists, physicists, curators and writers and ask how fundamental physics might be brought into the human experience or, as astronomer Roger Malina has asked, how big science might be made 'intimate' (Malina 2018). These questions were approached throughout the project, notably in a season of public workshops and performances programmed to coincide with the *Material Sight* exhibitions.⁴ Ideas of intimacy and agency also framed a one-day workshop held at the Institute of Physics in London in 2017 where two distinct but closely related themes began to emerge concerning 'physics in culture' and 'the culture of physics'. These themes subsequently became the twin foci for the book *The Live Creature and Ethereal Things: Physics in Culture* (Eds Crisp & Triscott 2018), a collection of essays, images and short texts that present fundamental physics and the physics of the universe as human activities and cultural endeavours.

The Conceptual and Socio-political background of *Material Sight*

The conceptual genesis of *Material Sight* can be traced back over a decade to when research was being undertaken for the project *Subterranea*. (Crisp, 2009-2010). At this point permission was gained to access Boulby Mine, a facility on the North East coast of England where potash, polyhalite and rock salt are extracted from tunnels stretching several kilometres out underneath the bed of the North Sea [Figure 2]. At over a kilometre beneath the ground, Boulby is the UK's deepest working mine as well as being the home for Boulby Underground Laboratory, a facility that is engaged in a broad range of science - astrophysics, ultra-low background material screening, studies in geology/geophysics, climate and life in extreme environments - but in 2009 was primarily involved in experiments searching for Weakly Interacting Massive Particles (WIMPs). At this time it was the phenomenology of the mine itself that was central to the research being undertaken for *Subterranea* [Figure 3] but this body of work is

2. See www.artscatalyst.org

3. Dr Nicola Triscott, Founder and Artistic Director/CEO of Arts Catalyst 1994-2019 is now CEO of FACT, Foundation for Art and Creative Technology, Liverpool, UK.

4. The Live Creature and Ethereal Things was a season of discussions, talks, workshops, films, live experiments, performance/readings based around the *Material Sight* exhibitions. KOSMICA Ethereal Things formed part of the season gathering physicists, artists, educationists and publics together for two, weekend-long events, one in London and one in Sunderland. Through live events, performances and workshops participants worked towards a re-imagining of the non-expert's encounter with fundamental physics and the physics of the universe including the physicist and rap artist Consensus performing from his album ConCERNed and the artist Annie Carpenter's demonstration of DIY cosmology using household items.

a vital antecedent to *Material Sight* in two important respects: First, it is here that some of the key questions regarding the ontology of photography that underpin *Material Sight* were formulated; and second, it is the relationship between the conceptual and visual imperatives of this body of work, combined with what was to become a longitudinal research relationship with the science and scientists of the underground laboratory, that can be seen, retrospectively, to form the basis of the idea of phenomenological dissonance that *Material Sight* is premised on; it is therefore productive to discuss the conceptual, visual and methodological aspects of *Subterranea* in some detail given that it formed the paradigm from within which subsequent research with fundamental science has been evolved.



Figure 3. *Pump Lodge* from *Subterranea* 2009. Giclée print from colour transparency.
©Fiona Crisp

Subterranea was a touring exhibition comprising several groups of large-scale photographic works made within underground locations across the UK and mainland Europe. The sites ranged from a German military hospital in the Channel Islands to the Early Christian catacombs of Rome, spanning across geographies, histories and timeframes, but the spaces shared a common ontological root inasmuch as they were all interior architectures, formed through excavation and with no exterior. Within these hermetic environments, many of the 'rhetorical forms' (Townsend 2009) of photography, such as light,

time or space, were either destabilised or suspended altogether. The *Catacombe* Series [Figure 4], for example, were taken using pinhole cameras with large-format analogue film; apart from the anachronistic presence of modern safety lighting, these particular catacombs have been in a state of stasis for hundreds of years and the stability of light and climate are absolute. In many ways the resultant photographs represent a tautology, inasmuch as they are still images captured of spaces that are, essentially, already still, already 'dead.' Within the three hours taken to expose the large-format film of the pinhole negative, an indeterminate time is opened up between "sometime" and 'no-time,' and, similarly, in the suspended identity of place, a space is created between 'somewhere' and 'nowhere'; an *impossible* space.



Figure 4. *Catacombe #13* 2001/2. Archival pigment print on cotton rag from black-and-white pinhole negative.
©Fiona Crisp

It was the collective sense of suspension, of the spaces as somehow aporetic or impossible, that formed the locus of enquiry within *Subterranea*; by contrast, the documentary histories of the individual sites themselves remained un-narrated, being left to linger beyond the frame. The research enquiry within *Material Sight* continued to be led by ontological questions about photography and film, particularly regarding how the construction of 'impossible' space established in *Subterranea* might map over the idea of 'radical remoteness' in fundamental science.⁵ Likewise, the use of both photography and film within *Material Sight* remained non-narrative and it was the photographic/film object as an embodied, non-documentary phenomenon that was used to illicit a visceral response in the viewer, ahead of an intellectual reading, when trying to approach the idea of phenomenological dissonance.

5. A key aspect of extreme remoteness within cosmology and fundamental physics is that spaces, places and timescales can only be experienced indirectly or vicariously, for example through data or simulations, or via remote landing crafts, mathematical constructs or thought experiments.

These are complex ideas to communicate, not least because, in many contexts, there can be an expectation that working with a film or a stills camera equates to making documentary footage/images. This assumption of narrative purpose (both in the making-of but also in the reading-of photography) can create what could be thought of as a ‘documentary burden’ – a pressure that can often be exacerbated when artists work in scientific contexts where art can be seen as an illustrative tool for the purposes of communication, impact or public outreach. The co-option of art by science is frequently premised on the idea that “science is understood as complete, and needing only to be communicated or applied, while art provides the means through which the public can be assembled and mobilised on behalf of science”. (Born and Barry, 2010, 103) Of course there are equal problems created by artists treating science as an undifferentiated repository of visually and/or conceptually compelling content that can be ‘cherry-picked’ without contextualisation but whilst much critical theory has moved beyond this instrumentalized relationship, it is a model that can still be found to exist in the field and, even more worryingly, can sometimes be seen to be actively supported by funding bodies. So how can we avoid the ideals of cross-disciplinary collaboration turning out to be no more than a mutual exchange of services where access and content get traded for impact and outreach?

Experience shows that it takes patience and tenacity to nurture trust and communicate intentionality and it is sometimes only after several years that a reciprocal relationship is established that could genuinely be defined as collaborative or cross-disciplinary. Asking busy scientists who work in complex and/or dangerous laboratory environments to engage with an artist, can be construed as a potentially onerous request but this can be in part mitigated by working incrementally in order to build trust whilst building mutual research interests through iterative visits. For *Material Sight* the request was for individual scientists as well as collective institutions: to trust an artist-researcher to be in their environment; to give access to ideas, spaces, and equipment; to take part in activities that might take everyone outside of their respective comfort zones;⁶ and to take a risk in what is a speculative process that posits the role of film and photography as non-documentary and non-interpretive while (probably most controversially) proposing the production of knowledge through *looking*. In this respect the approach was premised on visual arts practice as a producer rather than an illustrator of knowledge, placing artistic production in the spaces where experimental and theoretical science is performed and foregrounding the ‘site’ or laboratory as a social, cultural, and political space where meaning is shaped and constructed rather than received or observed (Doubleday 2007).

Equally, it was important to communicate in this process that the role of the artist-researcher was not to impart subject-specific knowledge. Just as there was an avoidance of claiming a documentary ‘subject’, the research eschewed any notion that art practice demonstrates ideas within science and technology; in other words, although there was a focus on how lay-publics assimilate areas of ‘extreme’ science, this did not mean that the science itself was being illustrated. Instead, the research sought to contribute to the potential heterogeneity of science; that is to say, to a hybrid mix of the technological, the socio-political and the cultural.

The Fieldwork

Boulby Underground Laboratory, UK.

When Boulby Mine was first accessed for the purposes of the *Subterranea* project in 2009, the Underground Laboratory was assembling Zeplin-III, a third-generation liquid xenon detector, designed and run by an international team to detect WIMPs. Unlike the high-energy physics of particle accelerators such as the Large Hadron Collider at CERN, the astrophysics undertaken at Boulby was based on detectors that provide a still ‘target’ (in this case, liquid xenon) for particles to interact with. The depth of rock shields against cosmic rays⁷, creating the ‘quiet’ conditions that the experiments rely on, whilst inside the dust-free, temperature-controlled environment of the laboratory, technical apparatus mediates signals wholly outside of the body’s perceptual scope. Despite the fact that the scientific research at Boulby was not the central focus of the *Subterranea* project, these early encounters where the perceptual remoteness of the science being performed in the underground laboratory was juxtaposed with the extreme physical presence of the mine itself, were highly formative creating the conceptual paradigm for what, several years later, evolved into the project *Material Sight*. Crucial to this development was attending to the visceral and haptic *experience* of undertaking science in extreme physical environments as these phenomenological aspects of experimental science are rarely the focus of the research process.

At the outset, *Material Sight* sought to question whether photography, film and sound could *embody* the spaces of experimental science and present them back to scientists and non-scientists

6. A good example is *The Blackboard*, a filmed conversation with Dr Massimo Mannarelli, a theoretical physicist at LNGS, which starts with approaching his blackboard as a conceptual object and then goes on to discuss exploring ‘impossible’ spaces through both mathematics and photography. The conversation can be accessed at: <https://materialsight.wordpress.com/2017/09/18/the-blackboard/>

7. These cosmic rays consist of a storm of charged particles that constantly hit our soil. Without the protection of rock, the “noise” from cosmic rays would drown out the very weak signal of the few interactions of neutrinos in the detectors.

alike, not as illustrations of the technical sublime, that distance and remove the viewer, but as sites of phenomenological encounter that an audience experience physically as well as intellectually. Accessing Boulby Underground Laboratory is above all else a physical experience. After donning full protective clothing there is the long descent into the mine via a lift cage shared with the mine workers. The rapid descent creates intense noise and air-pressure and on disembarking at the shaft base the dust and oppressive heat of the mine tunnel system is striking. It is, in effect, a journey to another world and indeed the extraordinary geology and environment of Boulby is close enough to that of Mars for the laboratory to be established as an international 'analogue site' for testing instrumentation such as remote landing vehicles for the future exploration of other planets.

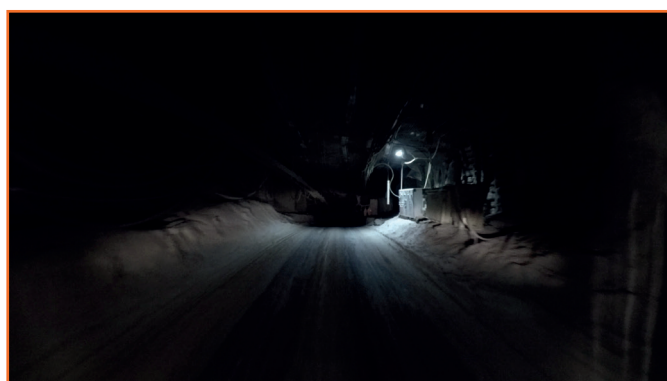


Figure 5. *Boulby* 2017. Film Still, single-channel digital video.
©Fiona Crisp

The film *Boulby* (Crisp 2013 & 2017)⁸ was one of the key outcomes of the practice-based research at Boulby Mine and Underground Laboratory, forming a central component of the final *Material Sight* exhibitions. Within the film the camera is embodied by a truck that moves in a single tracking shot from the base of the mine shaft and travels twelve kilometres out underneath the sea bed towards the mining face [Figure 5]. The vehicle advances inexorably into the enveloping darkness producing a relentless soundscape as the truck's engine reverberates off the confined tunnel walls. When installed within the *Material Sight* exhibitions, *Boulby's* hypnotic visuals and assaulting soundscape viscerally 'situated' itself within the viewer's body, establishing a literal connection to the extreme and remote landscape. At the same

time, the film formed a spatial and temporal feedback loop, like the *Catacombe* works of a decade earlier, simultaneously evoking somewhere and nowhere, sometime and no-time: an impossible space.

Laboratori Nazionali del Gran Sasso, IT.

The Laboratori Nazionali del Gran Sasso (LNGS) is one of the largest international research facilities for particle physics. The three vast underground Halls that make up the subterranean laboratories of LNGS were mined in the 1980s when the autostrade tunnel passing underneath the Gran Sasso mountain range was constructed and are shielded by a similar depth of rock to the laboratory at Boulby. Like a megalithic tomb built in relation to the sun, the halls of LNGS were excavated in alignment to CERN, the world's most well-known facility for high-energy physics, in an uncanny anticipation of the famous 'CERN Neutrinos to Gran Sasso' (CNGS) beam sent from the Super Proton Synchrotron at CERN to Gran Sasso to test neutrino oscillation.⁹

The huge OPERA experiment at LNGS (2003-2012) was built to detect the CNGS beam using a target of 156,000 'bricks', each made from large-format photographic film (nuclear emulsion) interleaved with lead sheets and weighing approximately 9kg. Now disassembled, LNGS retains an archive of a fraction of the OPERA bricks for future research [Figure 6] but, in the generous spirit of cross-disciplinary research, three of the bricks were gifted to the *Material Sight* project. In a non-laboratory context there is, of course, no advanced scanning technology to 'read' the emulsion plates but the sealed contents of each brick hold the *potential* (albeit highly unlikely) trace of a tau-neutrino 'event' that has travelled 732 kilometres through the rock of central Europe in 2.5 milliseconds. Getting workshop participants to hold the incontrovertible mass of the brick whilst contemplating the paralyzing abstraction of the beam allowed for an intimate, performative encounter with the apparatus of fundamental science whilst at the same time providing a beautifully simple but concrete example of the idea of phenomenological dissonance that the research was proposing.

8. An early iteration of the film, *Boulby* 2013, was made for the exhibition and symposium *Extraordinary Renditions: The Cultural Negotiation of Science* at BALTIC Centre for Contemporary Art, Gateshead: <http://fionacrisp.com/Website%20update/EXTRAORDINARYRENDITIONS.html> The event inaugurated the research group, *The Cultural Negotiation of Science* (CNoS): <https://www.cnos.org.uk/>

9. The Oscillation Project with Emulsion-tRacking Apparatus (OPERA) was an instrument used in a scientific experiment for detecting tau neutrinos from muon neutrino oscillations. The experiment was a collaboration between CERN and LNGS and uses the CERN Neutrinos to Gran Sasso (CNGS) neutrino beam.



Figure 6. *LNGS: Opera Archive* from *Material Sight* 2018. Giclée print from colour transparency. ©Fiona Crisp

OPERA is only one in a number of large-scale international projects housed in the underground halls of LNGS and during iterative research visits to Gran Sasso, there was an exploration of how, like the OPERA bricks, other experiments might ‘perform’ their conceptual and philosophical potentialities using methodologies taken from other cultural, rather than scientific spheres. The Large Volume Detector (LVD) is one of the oldest experiments at LNGS; essentially an underground observatory designed to study neutrinos from core-collapse supernovae, the LVD has been monitoring our galaxy since 1992. It is built on a modular system of blocks like a multi-storey cityscape and, unlike most other detectors that have sealed and inaccessible cores encased in various forms of lead, copper and purified water shields, the LVD has an open structure so as to allow access to its hundreds of surface-mounted photo-multiplier tubes. The unusual permeability of the LVD allowed for an active exploration of the apparatus, moving through, around and within the architecture with a film camera, creating a performative enactment of the experiment’s interior. Thus here, as elsewhere in the project, material encounters (geological, mechanical and technical) experienced by sentient bodies were conflated with bodies of knowledge, placing us inside of, and indivisible from, the knowledge-making process itself because, as the feminist theorist Karen Barad reminds us, knowledge-making practices are “social-material enactments that contribute to, and are part of, the phenomena we describe”¹⁰(Barad, 2007, 26)

10. An idea acknowledged by Barad as being developed from the philosophical writings of physicist Niels Bohr (1885-1962).

11. The Millennium simulation is an extremely large N-body simulation carried out by the Virgo Consortium. It simulates the gravitational evolution of a section of universe 500Mpc/h across using approximately ten billion particles.

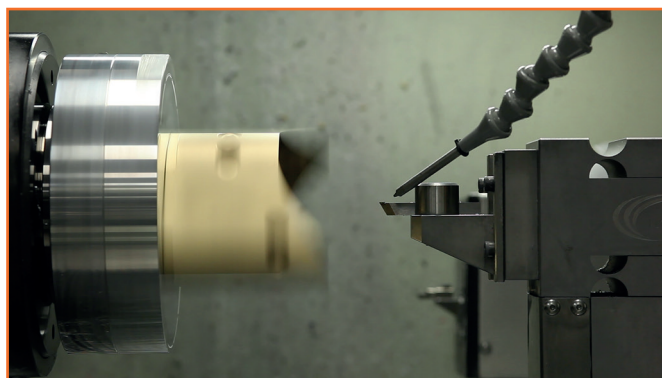


Figure 7. *Precision Optics* from *Material Sight Screen Two* 2018. Film Still, single-channel digital video. ©Fiona Crisp

The Centre for Advanced Instrumentation and The Institute of Computational Cosmology, Durham University, UK.

The third project partner for *Material Sight* was the combined facilities at Durham University, UK that include The Centre for Advanced Instrumentation (CfAI) and The Institute of Computational Cosmology (ICC). Many of the instruments made by the CfAI, such as spectrometers and telescopes, provide the data used by the ICC for researching the origins and evolution of the universe and for constructing visualizations such as The Millennium Simulation, a digital doppelgänger of a section of the universe made using an international consortium of super-computers, including Durham’s COSMA.¹¹ The ICC provided rich territory for the project to engage scientists (theorists, phenomenologists and experimentalists) in conversations about the ontology and phenomenology of photography from the relative perspectives of science and art. Given that the researchers at the ICC are working between observed, enhanced and constructed imagery the question of how the scientists thought about photography’s indexical relationship to the world was particularly pertinent, as demonstrated by Professor Richard Bower’s statement during a recorded discussion at the ICC: “I’m trying to make a universe, and then be part of that universe, even though it doesn’t exist”. (Bower, Crisp, Swinbank 2016)

The research also sought to ask how such models and simulations are culturally received; for example, some visualisations retain an indexical link to the observed cosmos whilst other simulations are built entirely from numerical data and therefore have parallels with virtual reality. Often visualisations conflate

observed and constructed imagery as with the ‘fly-through’ animation that Professor Mark Swinbank’s team produced of the famous Hubble Ultra Deep Field image; the film starts with the original (still) Hubble image, densely-packed with ten thousand galaxies and then animates the image back through time, with the galaxies reducing in number as we move back toward the origins of the universe.¹² The film formed a compelling point of exchange within the *Material Sight* project because it took an image that was directly observed, albeit remotely and in a composite of several hundred exposures,¹³ and expanded it through imaginative conjecture into temporal and spatial dimensions that we cannot observe or experience directly. The ICC generously gave permission for the fly-through animation to be edited together with the film *Boulby* to form one of the four moving image screens within the *Material Sight* exhibitions, allowing for the two radically remote ‘environments’ to be juxtaposed – the aurally assaulting, embodied presence of *Boulby* being cut-edited with the suspended, silent abstraction of the Hubble animation, travelling back to the origins of the universe.

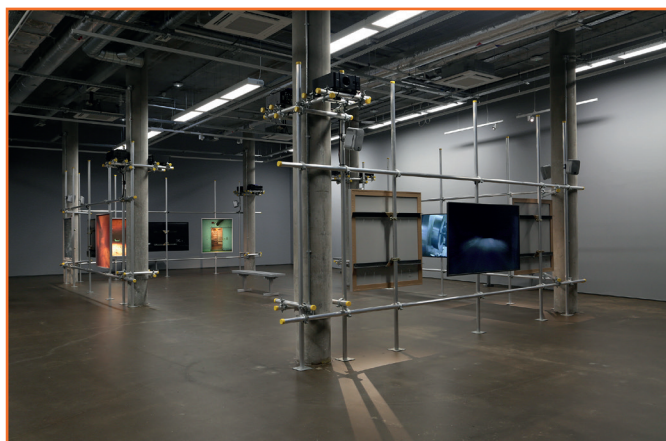


Figure 8. *Material Sight* 2018. Northern Gallery for Contemporary Art, Sunderland, UK. ©Fiona Crisp

The Exhibitions

In the production of imagery for *Material Sight*, the creation of knowledge through *how* a film or stills camera is used for the act of looking, as opposed to the illustration of meaning through *what* is looked at, was key to the visual and conceptual methodology of the project. Within this practice-based research process, two tropes emerged; the first was a performative form of looking where the

embodied camera traverses the sites, moving around, across and through environments or apparatus via, for example, bodies, cars, trucks and cable cars. The second trope of looking was where the camera is, by contrast, still in front of moving instruments or equipment, exemplified by the films and images produced within the over-ground laboratories at LNGS as well as in the CfAI’s Precision Optics Laboratory [Figure 7] or within the ICC’s super computer, COSMA. In this trope, durational witness is paid variously to the engineering, computing and technical processes involved in building instruments for remote sensing and vision or processing data, producing some of the most detailed, closely shot imagery within the project.

Whereas the production of imagery in *Material Sight* was premised on knowledge built through the camera’s act of looking, the exhibitions themselves sought to foreground the visitor’s experience of phenomenological encounter. The first exhibition was designed and built for the cavernous, hermetic space of the Northern Gallery for Contemporary Art (NGCA) in Sunderland, UK [Figures 1 & 8] and the second installation created a completely re-configured set of structures for the permeable, street-side galleries of Arts Catalyst Centre for Art, Science and Technology in London [Figures 9 & 10]. At both sites, scaffolding structures were built into the architecture of the spaces, wrapping round pillars (NGCA) or bracing floor to ceiling (Arts Catalyst) to support film screens, photographic works, speakers, wiring, media players and amps. Within this integrated sculptural apparatus, all elements were considered as an entity, resulting in the scaffolding structure and technical equipment being presented together with the photographs and



Figure 9. *Material Sight* 2018. Arts Catalyst Centre for Art, Science and Technology, London, UK. ©Fiona Crisp

12. The fly-through animation can be accessed at: <http://astro.dur.ac.uk/~ams/UDFmovie/HST.html>

13. The Hubble Ultra Deep Field image required 800 exposures taken over the course of 400 orbits by the Hubble Telescope around Earth between 24/09/03 and 16/01/04

films as undifferentiated material objects. The configuration of the work was as much conceptual as it was formal: the backs of the screens and images were presented as having equal status to the face, turning us away from the reading of the photograph or film as primarily image and instead encouraging a relationship through our bodily, spatial senses as much as with our intellectual, interpretive faculties.

The core question of how the radical remoteness of fundamental physics could be countered through an experience of embodied encounter – how big science can be made intimate – was central to the public manifestation of *Material Sight*. To this end the exhibitions sought to create a sensorium, not only through visual and formal means but via a combination of haptic connection and intense aural experience: within the installations the individual soundtracks from the four separate films were synchronized to form an immersive, spatial soundscape that served to ‘choreograph’ the visitor’s movements around the scaffolding screens and towers, sometimes building to pitches that overwhelmed the body, sometimes stopping abruptly and producing an equally intense feeling of ringing silence. A series of seven benches, designed and fabricated for the exhibitions, became points of stillness and focus, affording the visitor a haptic encounter with the temperature of the seating’s steel surface, provoking a simultaneous sense of distance and intimacy¹⁴.



Figure 10. *Material Sight* 2018. Arts Catalyst Centre for Art, Science and Technology, London, UK. ©Fiona Crisp

Beyond *Material Sight*

Material Sight is one of a number of projects associated with The Cultural Negotiation of Science¹⁵ (CNoS), a research group that brings together artists, academics and research students whose practices engage with expert cultures across a broad spectrum of science and technology. Collectively, CNoS challenges the use of art as an instrumental or illustrative device to interpret science and is characterised by a performative approach to cross-disciplinary working. One of the fascinations, working in this particular sphere with fundamental science and scientists, is the relationship between individual intentionality and collective knowledge, or collective intelligence as it is sometimes termed. The latter can be seen as offering advantage within the scientific method where open, democratic endeavour crosses both personal and national boundaries, leaving no place for (potentially subjective) individualism; however, this outlook does little to acknowledge the nuanced complexity that does (and *should*) exist within the culture of physics, or indeed in the culture of arts. As Karen Barad helpfully observes:

«Perhaps intentionality might better be understood as attributable to a complex network of human and nonhuman agents, including historically specific sets of material conditions that exceed the traditional notion of the individual. Or perhaps it is less that there is an assemblage of agents than there is an entangled state of agencies.» (Barad, 2007, 23)

So, how do we respond to the challenge of existing *within* an entangled state of agencies? Although being premised on international cooperation, fundamental physics is one of the branches of the natural sciences that, historically, has self-identified as politically and/or culturally neutral. There are, however, increasing numbers of physicists who perceive their areas of activity as, necessarily, heterogeneous and, like elsewhere in contemporary culture, this is being opened up via wider debates concerning ethics, diversity, class and gender that recognize the roles of the socio-political and the cultural; in this context, the intention is to expand the networks evolved through *Material Sight*. There are also very real questions about who is responsible for science literacy – surely not just the science community? And what would a radical form of artist’s residency look like in the context of these questions? So, looking beyond *Material Sight*, it is important to think how the concepts developed through the project – of a sensorium for fundamental physics, of phenomenological dissonance, of radical remoteness – could continue to develop through embedding photographic and film practice within the physical and conceptual sites and sights of science, thus contributing to a productively entangled relation of research fields.

14. At Arts Catalyst three of the seven benches were installed on the busy, central London street outside the gallery spaces. (Figure.9)

15. <https://www.cnos.org.uk/>

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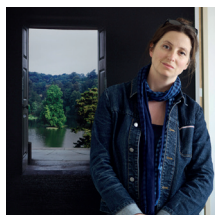
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Links

- www.materialsight.wordpress.com
www.fionacrisp.com
www.cnos.org.uk

CV

**Fiona Crisp**

fiona.crisp@northumbria.ac.uk

Northumbria University Newcastle

Fiona Crisp is Professor of Fine Art at Northumbria University, Newcastle, UK where she is a founder member of 'The Cultural Negotiation of Science', a research group that brings together artists, academics and research students whose practices engage with expert cultures across a broad spectrum of science and technology. Crisp's practice resides at the intersection of photography, sculpture and architecture where the limits and capabilities of both photography and video are explored through the making of large-scale installations. For the past decade she has been working with institutions and individuals involved in fundamental science, most recently via the research project 'Material Sight'. Crisp's work is represented by Matt's Gallery London and is held in several national permanent collections in the UK including Tate, the British Council, Arts Council and the Government Art Collection.