



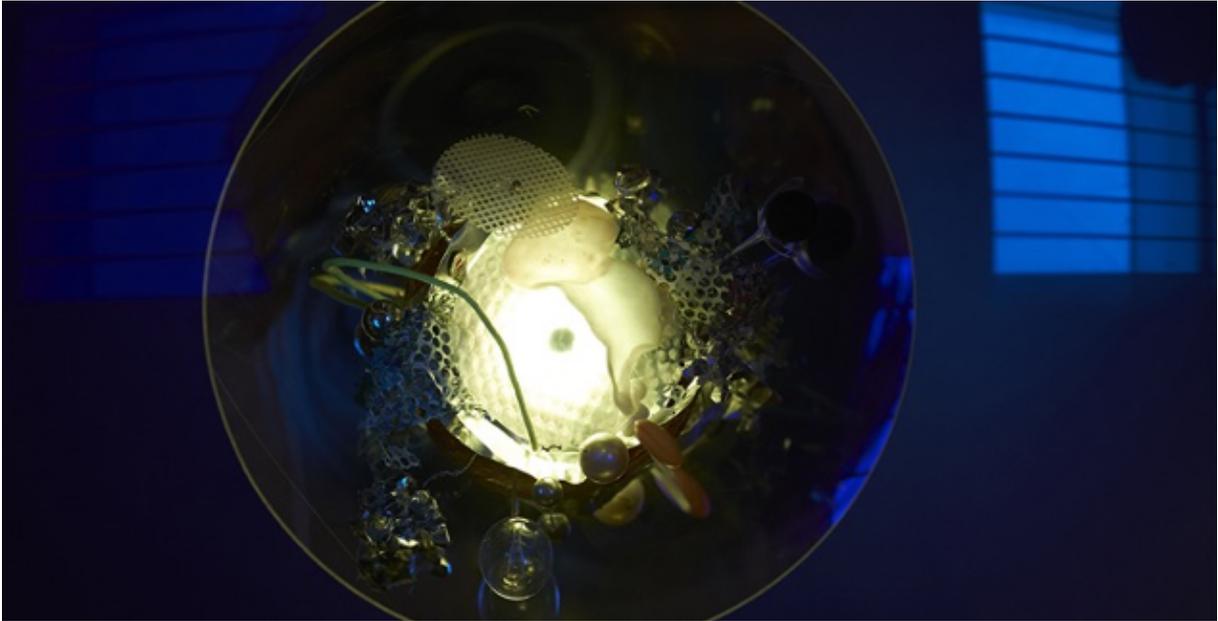
University of Brighton

**DAVID CHEESEMAN,
OLE HAGEN AND
ROBERTO TROTTA**

ALL THERE WAS

Examining speculative theory and visual thinking
in art and science through a post-Newtonian
orrery of sculptures

RESEARCH OUTPUT



Hologram
Aluminium, perspex and
mixed media

All There Was comprised an exhibition featuring five original sculptural art works, a co-written publication and a gallery performance. It investigated the difficulties of conceptualising cosmological theory and the ways in which contemporary artworks might help a general public towards greater understanding.

The sculptures were individual and collaborative works by Ole Hagen and David Cheeseman in response to the work of cosmologist Professor Roberto Trotta. They included a concertina black board that was used in a live conversation and drawing performance between Hagen and Trotta on the opening night. To explain newly discovered features of the universe, Hagen used figurative and artistic imagery to interpret Trotta's language of scientific equations and diagrams.

The work was framed as a post-Newtonian orrery of sculptures examining the overlapping fields of speculative theory and visual thinking in art and science. The exhibition and performance featured as part of the curatorial project *fig2* at the Institute of Contemporary Arts, London (ICA). It was accompanied by a publication *fig-2: 50 projects in 50 weeks*, published by Black Dog Press in 2018. The editor was the main curator of *fig-2*, Fatoş Üstek. The research was further disseminated during the exhibition through artists' talks and an online interview.

Four of the pieces were called 'Non-Euclidean Blackboard 1-4'. The fifth was a 'Black Dodecahedron' and 'Hologram' piece, with which the audience interacted through a light sensor. The exhibition also included Spectrum Skylights, which consisted of filters covering the windows of the exhibition space, revealing the spectrum hidden in white light.

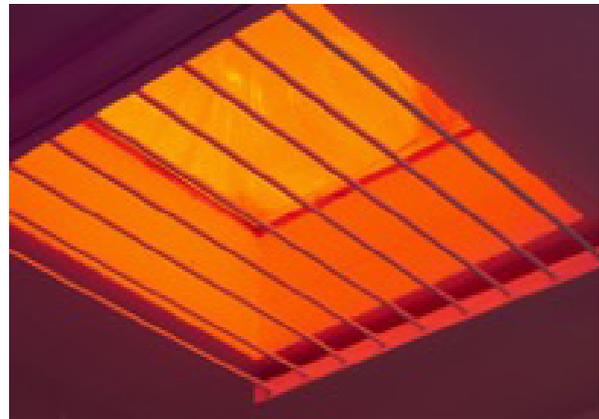
All There Was

Spectrum Skylights
Coloured light filter over window

Among the absorbing darkness of the blackboards, coloured filters were placed over the skylights of the ICA studio. These films filtered sunlight to reveal the hidden spectrum in the multiplicity of white light. Pools of light created by the filters reflected on other objects and changed with the time of day and the weather. In this sense this feature of the exhibition bridged the work in the show with the architecture of the building and the world outside the gallery space.



Spectrum Skylights
Coloured light filter over window



Non-Euclidean Blackboard 1
showing logo design for All There Was
Foam, wood, blackboard paint

In this blackboard piece, space-time is considered as a profiled, three-dimensional surface rather than as a vertical/horizontal graph. The marks left on the surface appear different from diverse angles.



All There Was

Non-Euclidean Blackboard 2

Wood, blackboard-paint,
pillow, chalk

This piece is a reference to Le Corbusier's recliner. The large waveform extends the body represented by the recliner from an anthropocentric reference point into a landscape that breaks with modernism. Drawn and wiped out, visions of creation mix with wiped out black spots, representing the emergence of the unknown.



Non-Euclidean Blackboard 3

Wood, wheels,
blackboard-paint, chalk

This concertina fold-out blackboard was used on the opening night as the site of a performative conversation between Trotta and Hagen.

Pipes mimicking the pipes of the ICA space linked two separate panels used by the artist and the scientist during their talk. The talk focused on the differences and overlaps between science and art in describing new cosmic phenomena, and hence also the differences between mathematical representation and visual or figurative thinking.



All There Was

Non-Euclidean Blackboard 4

Foam, blackboard-paint, aluminium ball, chalk

The exhibition presented a series of blackboards that were not flat. All the blackboards broke with the idea of an ideal abstract surface for mark making, by bringing in a notion of dimensionality and multiple perspectives. The blackboards support human signs, traces and speculations, that which is rubbed out, and that which is left contemporary with the present, representing thought and perception as non-static aspects of a changing cosmology. The globe is a reference to the idea of the celestial object, but also incorporates reflections of the viewer.



All There Was

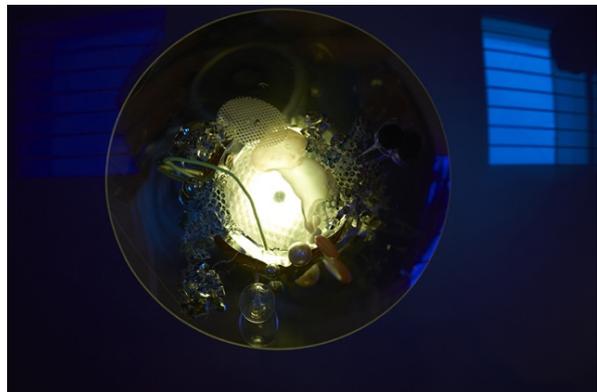
Hologram

Aluminium, perspex and mixed media

The concave-convex forms of the disc creates a hologram of this model, when seen from a certain distance, seemingly floating above the model.

Appearing as an illusion it questions the idea of first-hand direct perception as evidence of something concrete, and hints instead at the idea that the visible can sometimes be a reflection of the invisible.

The light inside the model is activated when viewers pass or observe the Black Dodecahedron nearby, toying with the idea that light has to travel, that phenomena appear in contingency with distant phenomena and in contingency upon observation.



Black Dodecahedron

Wood paint, fake diamonds, sensor

The sensor for turning on the light in Hologram is located in this piece.

The dodecahedron is the most mysterious of the Platonic solids, the embodiment of what, by analogy, has been referred to as the fifth element, the aether or perhaps the x of some ultimate equation.

In the post-Newtonian orrery, this could be dark matter, a hypothetical form of matter that is inferred to exist only through its gravitational effect on visible matter.



RESEARCH QUESTIONS



All There Was
Installation overview

Whereas classical Newtonian orreries map the planets' trajectory around the sun, this exhibition questioned what features an orrery might have in order to show the invisible elements of the universe and to help wider audiences understand recent cosmological theories.

The exhibition and performance sought not to illustrate science, but examine whether art forms might allude to such phenomena, examining the difficulties of grasping complex ideas about the universe.

Cheeseman and Hagen posed the following questions:

1. Given that post-Newtonian features of the universe are often invisible, how can three-dimensional models as artwork represent such ideas?
2. What is the relationship between visual thinking and theoretical speculation in science and art, taking cosmology as an example?
3. Can a post-Newtonian orrery function as research laboratory for a dialogue between artists and scientists that includes the audience?

RESEARCH CONTEXT

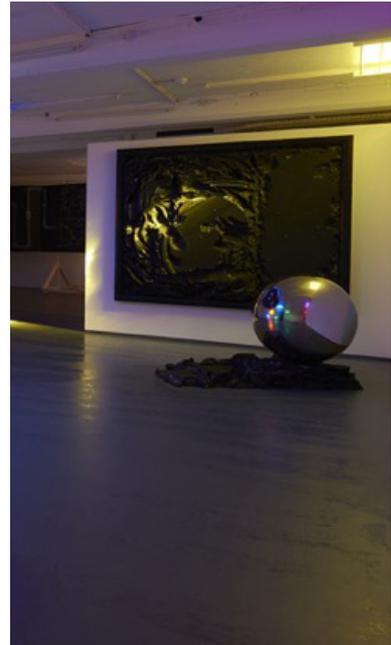
The output was the culmination of a collaborative research project between Dr Ole Hagen, late sculptor David Cheeseman of Birmingham City University and astrophysicist Professor Roberto Trotta of the Astrophysics Group at Imperial College, London, a specialist in dark matter, dark energy and the Big Bang. The exhibition is named in reference to Trotta's book *The Edge of the Sky, All You Need to Know About the All-There-Is* (2014).

It also expands on an earlier research paper by Hagen (2011), which asks how a fine art project can address problems such as whether visual ideas can give rise to new scientific theory or whether visual ideas are rooted in habitual human perception to such a degree that they cannot address phenomena beyond direct perception.

The underpinning research examined how new discoveries in cosmology can be visualised in a way that increases understanding and questions the overlap between science and art and the dynamics between visual and theoretical thinking. The problem of how visualisation influences thought poses fundamental questions regarding the correspondence between models and reality, highlighting the ongoing debate between physicalism and non-reductionist approaches with regard to the status of the role of the observer.

A model is by definition a representation of 'something else' by virtue of which it makes sense (Chadarevian and Hopwood, 2004). The status of this 'something else' has long been a matter for debate in the crossover between science and humanities. In a debated recent work, Quentin Meillassoux (2008) has argued that the humanities have been guilty of a type of idealism, where the 'great outdoors' has been subjected to 'correlationism', the idea that we can only say something about the way the world appears to us. For Meillassoux the preoccupation with discourse established by Foucault (1972) and others has reduced science to an idea of historical consensus that does not properly acknowledge the mathematical possibility of thinking a world without humans.

In the light of this debate, using cosmology as an example, examining the status of the visual model is about more than the pragmatic problem of how to communicate the invisible. It can be about the more fundamental relationship between visual thinking and abstract theory. In this respect, making the invisible visible is more about examining the 'hidden' ideas embedded in this relationship. A correlationist position would be to claim that all our ideas about the world can be understood to be models of the unknown. Hence, looking at the way visual models have influenced the bigger models or ideas about the cosmos would be best studied as a history of how visual languages are rooted in cultural paradigms.



All There Was
Installation view showing
arrangement of
Non-Euclidean Blackboards
1 and 4

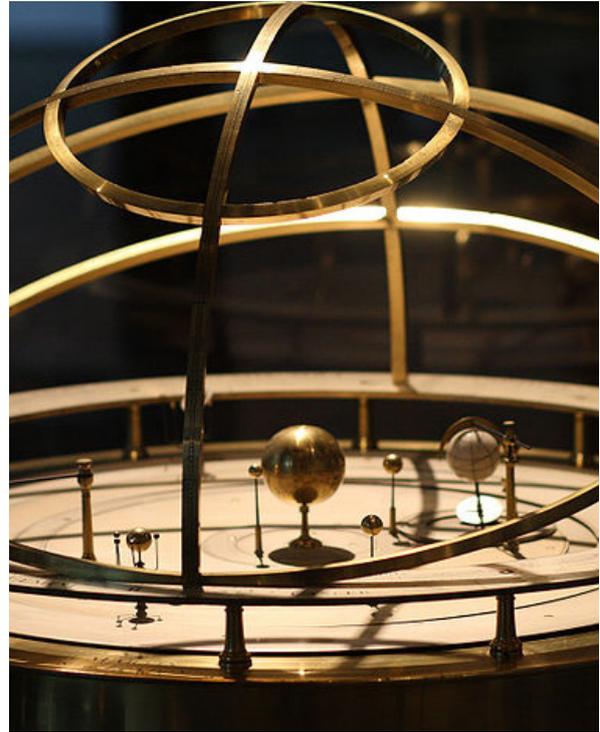
The mechanical orrery, a simple device to illustrate Copernican principles, showing the planets rotating around the sun, arose from an interest in Newtonian natural history in the eighteenth century. But there is also a history that links the orrery to adult science education as spectacle in a way that functions as a forerunner to cinema (King, 1978).

Theatrical orreries such as R.E. Lloyd's Dioatrodixon and Adam Walker's Eidouranion, were like 'Gesamtkunstwerk' in their inclusion of lights, music, mirrors and so forth. Later versions of this type of installation included rear screen projections that can be seen as forerunners of magical lanterns and eventually cinema. Sergei Eisenstein thought of cinema as a 'fourth dimension', in terms of art, because of its temporality (Gammel, 2002). These days virtual modelling might in many ways have replaced three-dimensional modelling in science. But screen-based representations are very much embedded in cinematic language.

This research explored the idea that a visual model, such as schoolbook representations of the molecule, can be misleading when taken in the context of a quantum understanding of hidden realities that coexist beyond the direct observation of objects. From this perspective, the celestial objects represented by a Newtonian orrery belong to an outdated mechanical cosmology.

On the other hand, visual metaphors, such as the DNA helix or the string, can provoke new thought and ideas. Dialogue between science and art shows that visual models can be both useful and misleading and a constant process of adjustment is necessary between mathematical knowledge and whatever understanding we are capable of assimilating into common perceptual schemes.

By the time new knowledge is absorbed into a shared culture, the forefront of knowledge has often moved on. There is also a deeper ontological question informing this exploration of visual representation in that commonsense realism is related to the sensory, while many new cosmological phenomena are inferred by data that sit within a mathematical understanding and may never be directly observable.



Mechanical Orrery
Benjamin Martin, London, 1767



Adam Walker, Eidouranion
Display within the proscenium arch of
the English Opera House,
Strand, 1817

RESEARCH PROCESS



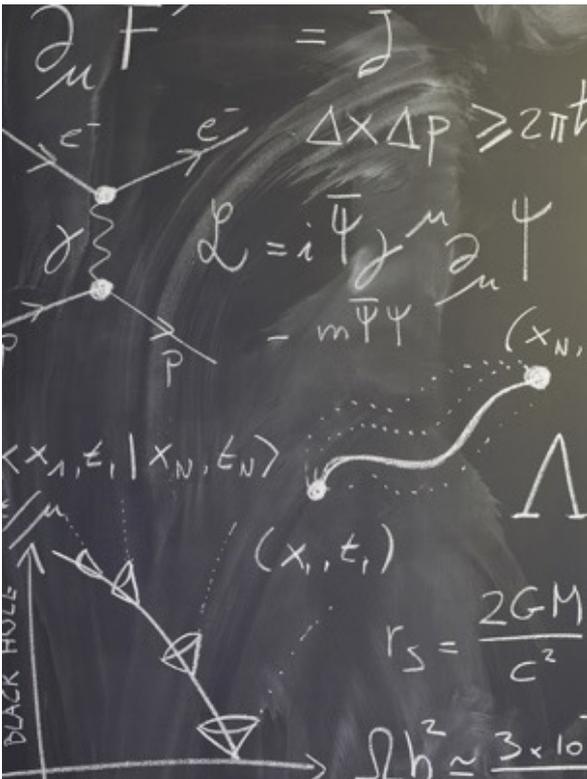
Over four years prior to the exhibition, the collaborative artists, Hagen and Cheeseman, and the scientist Troтта, conducted an extensive dialogue through which they aimed to find a way to communicate fundamental problems encountered in cosmology to a diverse audience.

Prototypes were developed for sculptures which expressed problems based on seven of the most radical new cosmological phenomena in post-Newtonian science. With this as a starting point, Hagen and Cheeseman used their artist studios as laboratories for developing models that referenced these seven phenomena, and discussed their models with Troтта, who then contributed new ideas from the astrophysicist's perspective.

It became evident that these sculptures could not serve as a straightforward visual illustration of scientific data related to very precisely defined phenomena. Rather, Hagen and Cheeseman aimed to convey how the unknown, the sphere of wonder as it were, surfaces as a site for human understanding.

Focusing on the blackboard in particular as a traditional surface of communication, they deliberately warped this surface to show how the strange and alien continuously shift the horizon of our understanding. These displayed signs of the process of thought in the form of chalk marks that had been added and rubbed out, embodying the idea that the very foundation or surface against which these signs can be understood, i.e. the ruling paradigm of a given time, is itself shifting.

The collaboration sought to communicate an atmosphere where the factual itself is seen to be subject to change and revision, and where communication is seen as equally open to changing perspectives.



(top) Performative drawing-dialogue, Troтта and Hagen opening night

(bottom) Close up of Troтта's equations from concertina blackboard performance

RESEARCH INSIGHTS



All There Was
Installation overview

The sculptures are not literal interpretations of scientific data. Rather the blackboards demonstrated how an ideal neutral surface or 'clean knowledge' is a hypothetical scenario (as in represented by flatness); how the process behind knowledge is often excluded from the final object of knowledge (the traces of thought can be excluded from the final mathematical equation).

The models also allowed the audience to think about how our three-dimensional perceptual understanding filters ideas. Some models, such as Hologram also demonstrated how the visible can be contingent on the invisible. The models represented a provocation, encouraging the audience to think critically beyond the ideas of scientific explanations, but they were also a way of introducing the territory of new cosmology to an expanded audience and to stimulate a questioning attitude at a fundamental perceptual level through the dialogue between the scientist and the artists.

Through dialogue, the researchers discovered that visual thinking can sometimes be a limiting scheme related to the naïve realism of common sense and sensory perception. On the other hand, they also discovered that visual ideas can sometimes trigger speculative new thought.

They found that visual representation of ideas, such as through a post-Newtonian orrery, can make these ideas more accessible to a larger audience; by translating complex theoretical ideas into a familiar visual model, and stimulating the imagination of the viewer yet leaving the interpretation open to speculation and discussion, the artwork opened up a conversation about the invisible and theoretical, allowing the science to be communicated in a broader, more inclusive way.

DISSEMINATION

The exhibition was held at the studio of the Institute of Contemporary Arts (ICA), London, 18-24 May 2015, as the twentieth of fig-2's '50 projects in 50 weeks'. The opening night, 18 May 2015, included a performance by Hagen and Trotta and was attended by 90 people.

It was promoted through fig-2 web, Facebook, Twitter and Instagram, the ICA website and numerous listings, such as artrabbit and artmap. It was also promoted online by Outset Contemporary Art Fund who sponsored fig-2.

The publication *fig-2: 50 projects in 50 weeks* was launched at a city event on 22 January 2018. It contains commissioned essays by Louisa Buck, Caroline Douglas, Gilda Williams, Catherine Wood and Hans Ulrich Obrist. It was widely promoted through the UK-wide fig-futures exhibitions in 2018/2019 with fig-2 alumni across UK galleries, and is available online and in major art bookshops.

An audio interview with Hagen, Cheeseman and Trotta was posted on fig-2's own website and is still [available through mixcloud](#).

All There Was was reviewed by [Alex Mortimer at Artlyst](#) and at the fig-2 website/ICA Bulletin. It was promoted by the Hands-On-Universe outreach program that Trotta is engaged with, which is sponsored by a Public Engagement Fellowship. In addition, Hagen and Trotta's conversation and the fig-2 breakfast talk aided in communicating the content of the exhibition.

All There Was, 18-24 May 2015, Institute of Contemporary Arts (ICA), London <https://www.artrabbit.com/events/fig-2-2050-david-cheeseman-ole-hagen-and-roberto-trotta>

fig-2: 50 projects in 50 weeks launch, 22 January 2018, <http://www.fatosustek.com/fig-2-50-projects-in-50-weeks-2>

Publication available at <https://www.blackdogonline.com/imported-products-8/3zo0f77m2lry3c1i8bfjo097lxw3em>

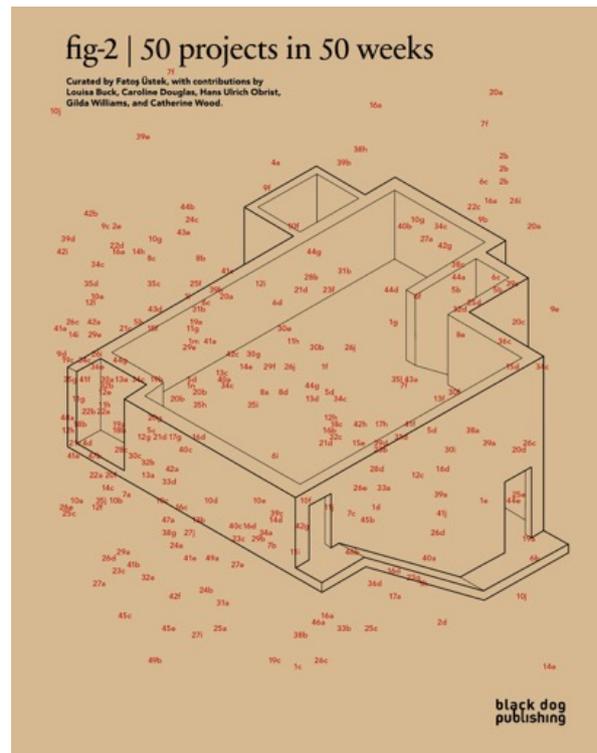


fig-2: 50 projects in 50 weeks
Publication cover

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(overleaf)
Non-Euclidean Blackboard 4
 Foam, blackboard-paint,
 aluminium ball, chalk

All There Was

