point/cloud: diffusive spatial imaginaries

Carl Douglas

AUT University

0000-0002-8374-5838

abstract

Laser scanning holds out the possibility of extreme certainty. Digital scanning has become deeply integrated in contemporary archaeological surveying, and in architectural heritage and preservation contexts digital scans are now common. Certainty in this text-based essay is understood as an *affect*, an experiential quality rather than an absolute measure. It does not question the possibility or usefulness of precise measurement (although it does question the rhetorical use of exactitude and precision), but explores the imaginative role of exactitude in this form of digital imaging. It makes readings of a series of moving-image works that use point clouds generated by laser scanning. Rhetorically, the term 'point cloud' is suspended between the apparent certainty and exactitude of the mathematical point, and the vague ungraspability of vapour. Rather than expressing exactitude and objectivity, the works discussed here highlight ambiguities of human perception, and seek to see from nonhuman perspectives (the driverless car, the kāhu/hawk, and an oak forest). It concludes by suggesting that such works in particular, and point cloud imagery in general, can be understood in terms of a diffusive material imaginary.

keywords

scanning; digital imaging; moving image; material imaginary; heritage

part one—certain images

Laser scanning holds out the possibility of extreme certainty. A laser scanner measures distance by timing how long light takes to bounce back from a surface, producing an (x, y, z) position in Cartesian space calculated from the angle of the beam and the measured distance. Optionally, it may also use an image sensor to record a Red, Green, Blue (R, G, B) value as the visible colour of this point in space. Turning, the device records many thousands of such points, yielding a large table of data that can be plotted using three-dimensional modelling software to produce a visualisation known as a *point cloud* [Fig. 01]. These point clouds can be viewed from any angle, processed further, manipulated, and coordinated with other digitally-modelled elements.[01]
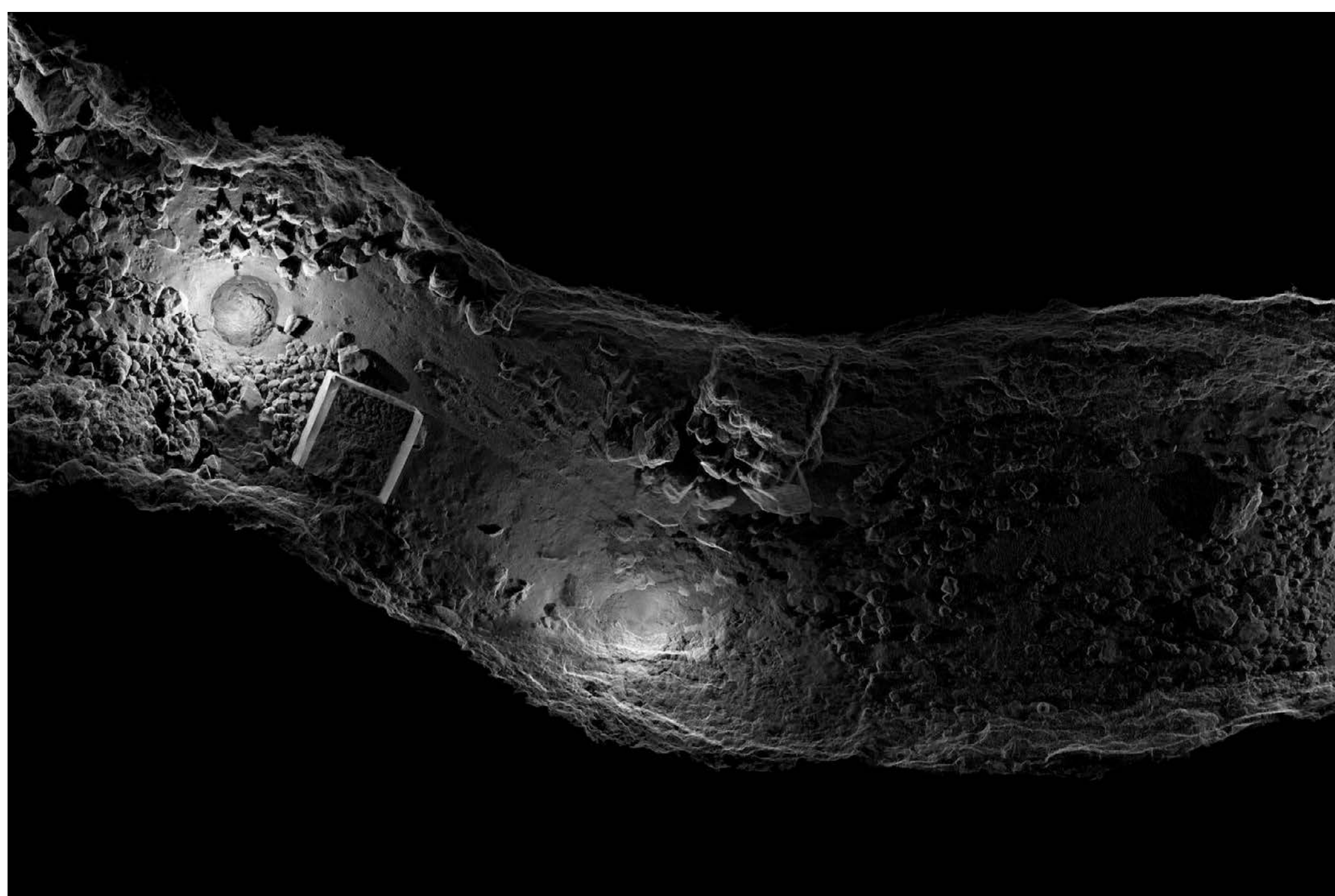

Figure 01.
Mount Royal Cave, Ōwairaka. Terrestrial LiDAR scan (from the series 'Ngā Mahi Rarowhenua', Chirag Jindal, 2018).

Laser scans have become ubiquitous in heritage architecture and interior design because they allow for accurate measurement of surfaces and building elements that may be irregular, worn, or have shifted from their original position, and because they allow for new elements to be designed to interface exactly with their current position. The literature studying applications in archaeology, architectural preservation, and museum contexts commonly describe scanning as *capturing*—a symptomatic term.[02] Many museums have scanned items from their collections and made these available on the grounds that this facilitates public access and study, and can act as a digital backup in case the original is lost or damaged.[03] Digital scanning has become deeply integrated in contemporary archaeological surveying, and in architectural heritage and preservation contexts digital scans are now common.

The apparent certainty of the laser scan rests on its exactitude. In an ever-increasing array of contexts, what is certain is what can be measured accurately and precisely. But, as Susan Stewart writes of the emergence of literary realism, 'exactness is a mirror, not of the world, but of the ideology of the world'.[04] Exactitude, writes Mark Wigley, 'involves fantasies of control, of controlling and being controlled, constraint and release. The world of calculation is never separate from that of sensuality, desire, and emotion'.[05] If exactitude is a desire, however, it is shadowed by anxieties: in particular, worries about things dissipating or eluding our grasp, being vague or indefinite.

vol.20, no.01
2023

uncertain
interiors

research
essay

carl douglas

point/cloud: diffusive
spatial imaginaries

28

Certainty in this essay is understood as an *affect*, an experiential quality rather than an absolute measure. It does not question the possibility or usefulness of precise measurement (although it does question the rhetorical use of exactitude and the 'troping of precision'), but explores the imaginative role of exactitude in this form of digital imaging, and the ideology it reveals.[06] It also points out a peculiar inversion by which an excess of certainty can produce experiences of uncertainty, experiences that can be exploited and creatively cultivated. While this essay does not detail the technical production of point clouds, it is concerned with them not as purely technical means, but as a form of imaging that activates a particular material imaginary: that of particulate and diffusive matter.

Technologies do not only operate in terms of their technical operation, but function in relationship to imaginations about what they are capable of. What matters is not only what the technology *does* but also what it is *imagined to be doing*. Such imaginations condition how technologies are applied, how their operation is interpreted to perform socially or politically, how they are subsequently developed, what new contexts they might be applied to, and how they might be applied as metaphors or analogies. These have been referred to as 'sociotechnical' or 'technoscientific' imaginaries.[07] Intuitions, assumptions, and narratives associated with physical experiences of material bleed into our understandings of technology. Here, imaginings of particles, clouds, and dust are found to permeate the practice and aesthetics of laser scanning.

Point cloud visualisations often appear ghostly and insubstantial, with odd lighting and gaps. The term *point cloud* embeds a tension between extreme certainty and indistinct vagueness. If a point is a moment of absolute precision, a 'concentrated certitude' or 'bare position', a cloud is a figure of indeterminacy.[08] In the words of art historian Hubert Damisch, it 'contradicts the idea of outline and delineation and through its relative insubstantiality constitutes a negation of the solidity, permanence, and identity that define *shape*'.[09] The internal contradictions of the point cloud, then (exactitude and vagueness, certainty, and the indefinite), orient this discussion.

In the first part of this essay, I examine the idea of scanning as *capture* with reference to a point cloud scan of London's Soane Museum produced by ScanLAB and presented as a 'virtual tour' on the museum's website. I link the ideology of grasping and acquiring to eighteenth- and nineteenth-century practices of touring, collecting, and describing, and explore clouds as part of the material imaginary of the ungraspable. I then discuss several moving-image artworks based on point cloud scans. Rather than expressing exactitude and objectivity, these works make explicit the ambiguities of human perception, and seek to see from nonhuman perspectives: the driverless car, the kāhu (hawk), and an oak forest. Textural and material qualities and effects that are suppressed in the idea of capture are expressly articulated in these works. I conclude by reflecting on atoms, dust, and the diffusive material imaginary.

carrying off the palace

Marketing materials for scanning devices often evoke the idea of a perfect correspondence with the world. Leica Geosystems, a major manufacturer of laser scanners, and Autodesk, who produce software for scanning, describe their products as 'reality capture', imagining imaging as directly grasping or arresting rather than mirroring or representing.[10] This term is usually given an anodyne definition such as 'the use of technical means to record and visualize elements from the physical world', but this obscures its evidently acquisitive and positivistic implications.[11] The paradigm of possession, and language of grasping and controlling, pervade the use and literature of scanning.[12] This acquisitive paradigm harmonises with older practices of collection and heritage preservation, as we can see by looking at a scan of London's John Soane Museum.

The museum was architect John Soane's house in Lincoln's Inn Fields from 1792 until his death in 1837. Over forty years, Soane slowly converted it into a live-in museum, eventually assimilating the neighbouring houses and filling them with an eclectic collection of plaster casts, architectural models, paintings, antiquities, and other curiosities.[13] The museum today is preserved close to the way Soane left it. Like many museums, the Soane Museum has experimented with scanning both individual artefacts and spaces. This work was carried out by ScanLAB, the LIDAR-imaging firm of Matthew Shaw and William Trossell, who work across archival, art, and architectural contexts.[14] On the museum's

website, visitors are invited to 'explore' this imaged museum by viewing and interacting with visualisations of these scans.[15] The opening text suggests that website does not merely picture the museum in detail, but offers it 'made digital'. Only three spaces can be visited through this interface, however: the Model Room, the Sepulchral Chamber, and the Picture Room. These rooms can be rotated to view, and several items in each space can be isolated for a more detailed view.

This virtual tour aligns neatly with Soane's original intentions for the museum: to be a teaching tool and place of public outreach, making accessible places, times, and material culture to those unable to travel or access these in their original place:

> The whole object (a building or a ruin in its native site, whether in England or further afield) was here supplanted by an assemblage of parts [… while] artists would still need to travel to the actual sites of ancient remains, they would be doing so only to confirm the image provided by souvenirs and representations back in London.[16]

Where a physical tour involves displacing oneself, the virtual tour displaces sites and things, arranging them around the viewer. Soane's published catalogue *Description of the House and Museum on the North Side of Lincoln's Inn Fields* led the viewer from the street, up the front stairs, and through each room in turn, revealing its contents: paintings, cornices, books, stones, vessels,

vol.20, no.01
2023

uncertain
interiors

research
essay

carl douglas

point/cloud: diffusive
spatial imaginaries

30

and plaster casts.[17] Soane was concerned that without such a guide, 'many of the smaller Models and Sculptures might be overlooked, by those who will delight in tracing their happy conception and delicate workmanship.'[18] Soane's guide is itself a kind of tracing or scan, a complete and rigorous viewing attentive to detail and form, that could obviate the need for travel by concentrating historical experience into a selection of objects and images.

The reality captured by these exacting scans is conspicuously superficial. As the virtual camera ghosts through the museum, there is no intimation that floors or walls have mass or substance. Rather, the museum is exfoliated and rendered as an atom-thick surface. A laser scanner has no way of registering the solidity or depth behind the outermost surface. It is up to the viewer to supply an understanding of what might lie beneath from superficial cues. The scanner valorises a single temporal state, deprioritising substrates, concealed elements, and overlays except insofar as they can be read forensically from the surface. The scanner is myopic, unable to see beyond the surface it is focused on, comprehending distance but not depth.

crawling over things

Optical scanners, of course, are not the first visual technology claiming to transcend mere representation to grasp reality directly. The camera, for example, has often been imagined to be such a tool, so that '[p]hotographed images do not seem to be statements about the world so much as pieces of it, miniatures

of reality that anyone can make or acquire.'[19] Even John Ruskin, sceptical of the value of photography, saw its value for producing documents of built heritage that outdid drawing in precision and detail:

It is a noble invention, say what they will of it, and any one who has worked and blundered and stammered as I have done for four days, and then sees the thing he has been trying to do so long in vain done perfectly and faultlessly in half a minute, won't abuse it after-wards. It is very nearly the same as carrying off the palace itself—every chip of stone & stain is there—and, of course, there is no mistake about proportions.[20]

Where drawing was attended with long labour, blunders, and stammering, the photograph almost instantaneously comprehended its object. Ruskin's language recalls that of contemporary writers on digital scanning: by tracing the surface in ever-increasing detail, the object is imagined to be so fully mastered that it has been arrested and carried off.[21]

Ruskin's prioritisation of detail can be understood in the context of a rising fascination with detailed description through the seventeenth and eighteenth centuries. Literary historian Cynthia Sundberg Wall writes that new descriptive genres emerged in this period:

Improvements in trade and travel, discoveries and methodologies of

vol.20, no.01
2023

uncertain
interiors

research
essay

carl douglas

point/cloud: diffusive
spatial imaginaries

31

empirical science, Puritan habits of self-examination, the passion for collecting and classifying, all found wide-open spaces for description in topographies and maps, micrographies and meditations, lists and catalogs, diaries and satires.[22]

These new genres were associated with swelling consumerism, practices of collecting, touring, and new scientific practices. The microscopes of Robert Hooke for instance, revealed a new world of detail. The smallest typographical marks on a page were revealed by the microscope to be 'smutty daubings', and a flea found to be 'adorn'd with a curiously polish'd suit of sable Armour, neatly jointed, and beset with multitudes of sharp pins'.[23] A new paradigm emerged: 'Minute observation and description [...] will, in fact, get closer to something essential than will pulling away and constructing larger "truths".'[24] By examining and rendering detail, a territory, object, space, or person could be traced out exhaustively. As Wall puts it, description 'crawls over things', elaborating surface rather than depth.[25] Where once meaning was assumed to be concealed in underlying principles, now '[t]he surfaces of objects—the surface world—were acquiring an interpretive richness in their own right'.[26]

To the extent that laser scanning also crawls over things and enables one to carry off the palace, it can be seen as reflecting a collector's reality, in which items are not merely to be pictured, but acquired. The contexts in which this data is typically handled—framed on the screens of portable devices, or viewed from one's own desk, reinforce this sense of possession. Scans, like the collector's objects, render portable, accessible, manipulable, and intricately detailed objects. As James Scott memorably put it, 'Certain forms of knowledge and control require a narrowing of vision [...] [simplification] makes the phenomenon at the center of the field of vision more legible and hence more susceptible to careful measurement and calculation', yielding an 'aggregate, synoptic view of a selective reality' that enables 'control, and manipulation'.[27] The term 'reality capture' masks ideological and imaginative assertions about the nature of reality, and the possibility of absorbing value and meaning into computational space.

gaps in the clouds

In the reality capture paradigm, scans are understood to be realistic to the extent that they are sensitive to detail beyond the practical capacity of traditional measuring and drawing practices. From another perspective, however, the imagery resulting from these scans is wildly unrealistic: a ghostly and insubstantial resemblance that would be difficult to mistake for the real thing. A virtual visitor to the Soane Museum is disembodied, moving like a ghost through a building itself rendered ghostly. The façade becomes transparent as we draw close, like a thin veil disclosing the museum's interiors: chairs, cabinets, panelled surfaces, paintings, and other objects. The detail is impressive, but overwhelming, layering up and gliding past faster than we can catch hold of it. The imagery is riddled with gaps and inconsistencies.[28]

[ij]

vol.20, no.01
2023

uncertain
interiors

research
essay

carl douglas

point/cloud: diffusive
spatial imaginaries

32

One of the key characteristics of a laser scan is variable resolution. From its standpoint in front of the building, the rotating head of the scanner fires its laser outward. This means nearby surfaces are sampled very closely, creating a denser cloud of points. Further out, however, the angle between the points means they are being sampled further apart, creating a less dense cloud. This results in a gradient that is particularly visible on a flat floor [Fig. 02]. The surface directly below the scanner can't be imaged, leaving circular gaps in the data. From this circle, lines of points radiate outwards, becoming progressively more sparse until they reach the limit of the scanner's range (either set in software or reaching the limits of the hardware).

Surfaces occluded from its camera can register no points. With a black background to the image, this appears as a shadow cast by the occulding surface. These occlusions can only be filled by repositioning the camera to capture the hidden surface from another viewpoint. The effect is to render the scene as if it were lit from a point source at the location of the camera. If the scene is rendered against a black backdrop, the lighting resembles that of a candle or lantern at night, diffusing into darkness. Laser scanners have particular trouble with glass, mirrors, and other reflective surfaces, which can create visual ghosts and other unexpected effects.[29]
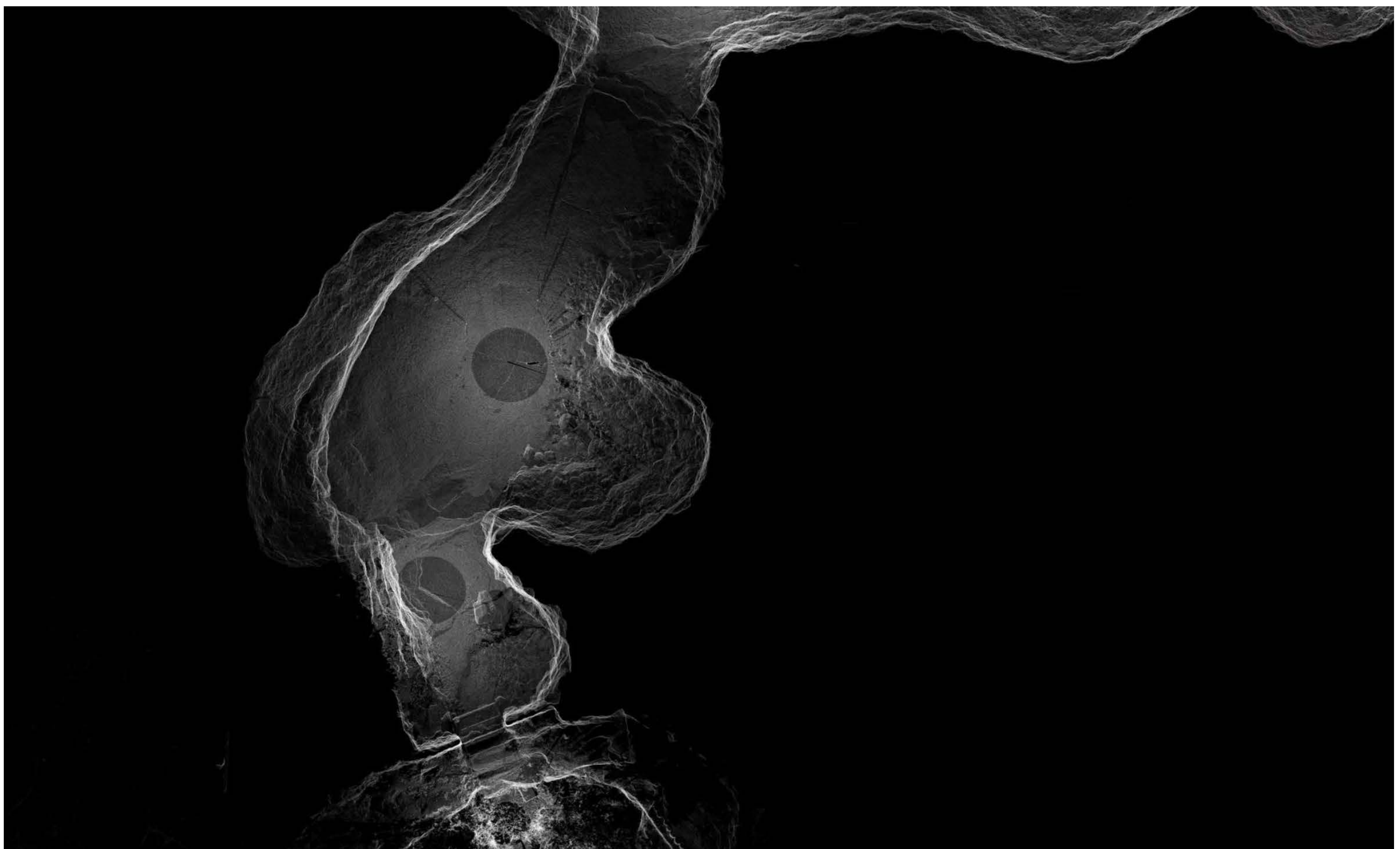

Figure 02.
Ambury Cave, Māngere Bridge. Terrestrial LiDAR scan (from the series 'Ngā Mahi Rarowhenua', Chirag Jindal, 2018).

Clouds are arguably one of the most important material images of our time, serving as they do to describe diffusive, vague, or distributed phenomena. Art theorist Hubert Damisch suggests we can discern in the ways artists have approached the portrayal of clouds the boundaries of semiotic and perspectival understandings of image-making. Cloud 'contradicts the very idea of outline and delineation and through its relative insubstantiality constitutes a negation of the solidity, permanence, and identity that define *shape*'.[30] Damisch examines Ruskin's perspectival studies of clouds, in which they were modelled as simplified forms in three-dimensional space [Fig. 03], comparing them with the clouds and mists of Chinese Song and Ming paintings, and the works of Turner. In his studies, Ruskin attempted to bring clouds within the perspectival frame. In the latter, however, clouds expressed a condition of unknowing that can obscure or muddle objects and their spatial location, or act as the ground from which they resolve, but were not discrete objects themselves. In portraying clouds, argues Damsich, artists find themselves suspending the rational order of perspective and exposing their work to uncertainty.[31]
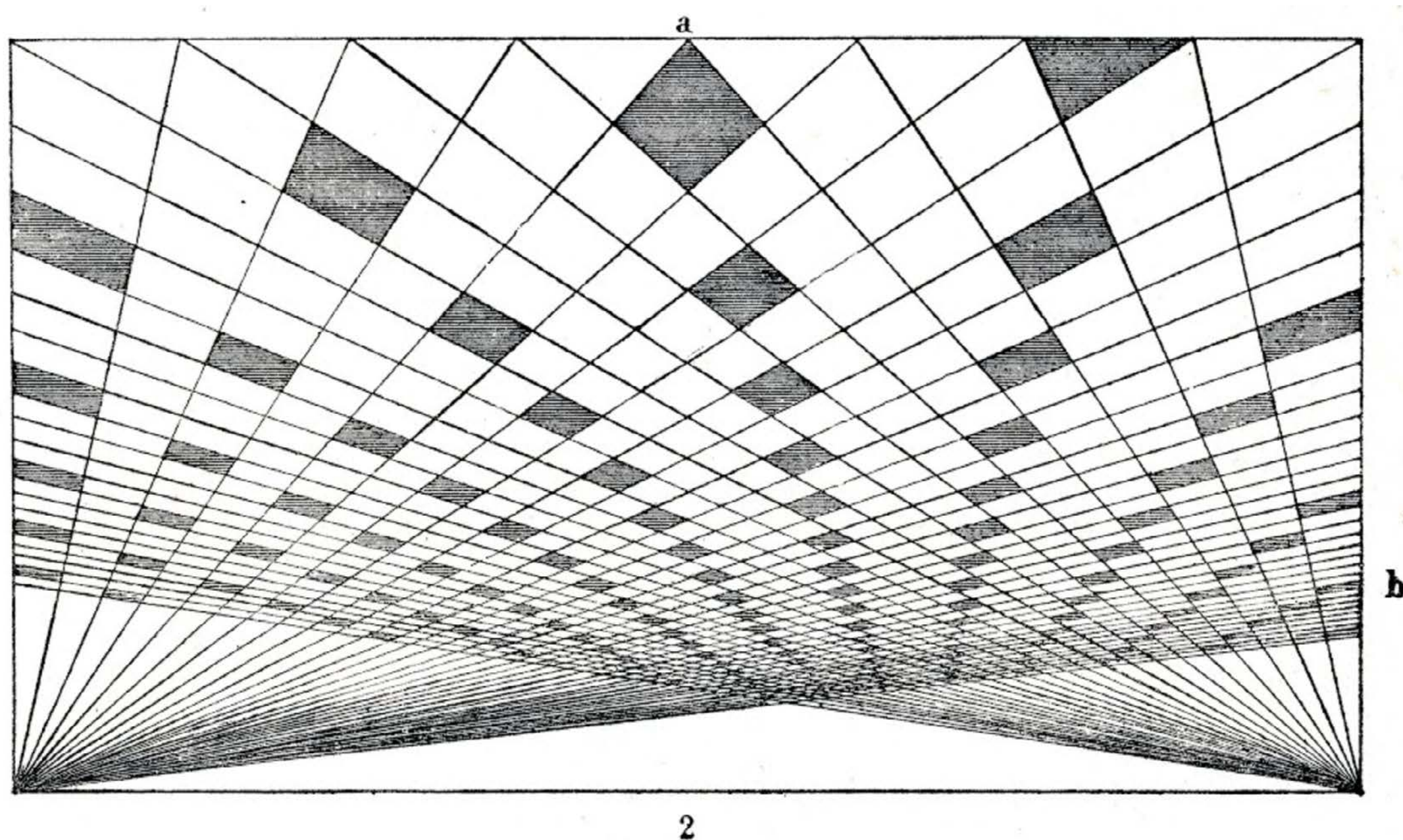

Figure 03.
Diagram showing how to draw clouds in perspective (John Ruskin, *Modern Painters V*, 1860, p. 152). Public Domain.[32]

part two—a view from everywhere and nowhere

the dream life of driverless cars
While laser scanning has been used as a means to accurately document, record, and archive, it also seems to offer alternative ways of seeing. How does a machine perceive? Artists and speculative designers have worked with scanning vision in a way that highlights its alienating, detached qualities: the sense it offers of a view from nowhere. That is, laser scanning is not only a convenient means for collecting and visualising precise information, but also provokes imagination. One of the critical forms this imagination takes is as uncertainty or anxiety about the dissolution of the traditional viewing subject.

In its 2015 video work 'The Dream Life of Driverless Cars', ScanLAB asked how sensing machines might be understood to perceive, imagining how the world might be revealed through their sensory apparatus, and what opportunities for action and sense-making might come into focus.[33] Having modified the sensors of a self-driving car prototype, Shaw and Trossell recorded its output as it passed down the streets of London. The space they make visible is an unsettling version of our own visual world. Where the Soane Museum scans were intended to produce a sense of mastery and possession, 'The Dream Life of Driverless Cars' revels in the sense of uncanny familiarity.

In the rendered animation the virtual camera moves through a point cloud coloured pale blue and violet [Fig. 04]. Solid buildings appear as thin veils. While the Soane Musuem scan is thickened by overlaying multiple sets of data taken from different station points, the moving scanner is riddled with gaps. The initial sequences are relatively familiar: we recognise buildings and trees, and pass over a bridge. Along the street are vague wisps, fleetingly touched by the laser: this is how the sensors are perceiving vehicles and people in motion (making human bodies solid in the perception of self-driving cars has proved to be notoriously problematic). Partway through the animation, however, the camera begins to move like a drone, looking down from above an intersection, where a strange elongated object appears. This is revealed to be a double-decker bus in motion alongside the scanning vehicle, smeared like a Gerhard Richter painting in three dimensions. The illusion that the scanner is producing images like a human eye dissolves.
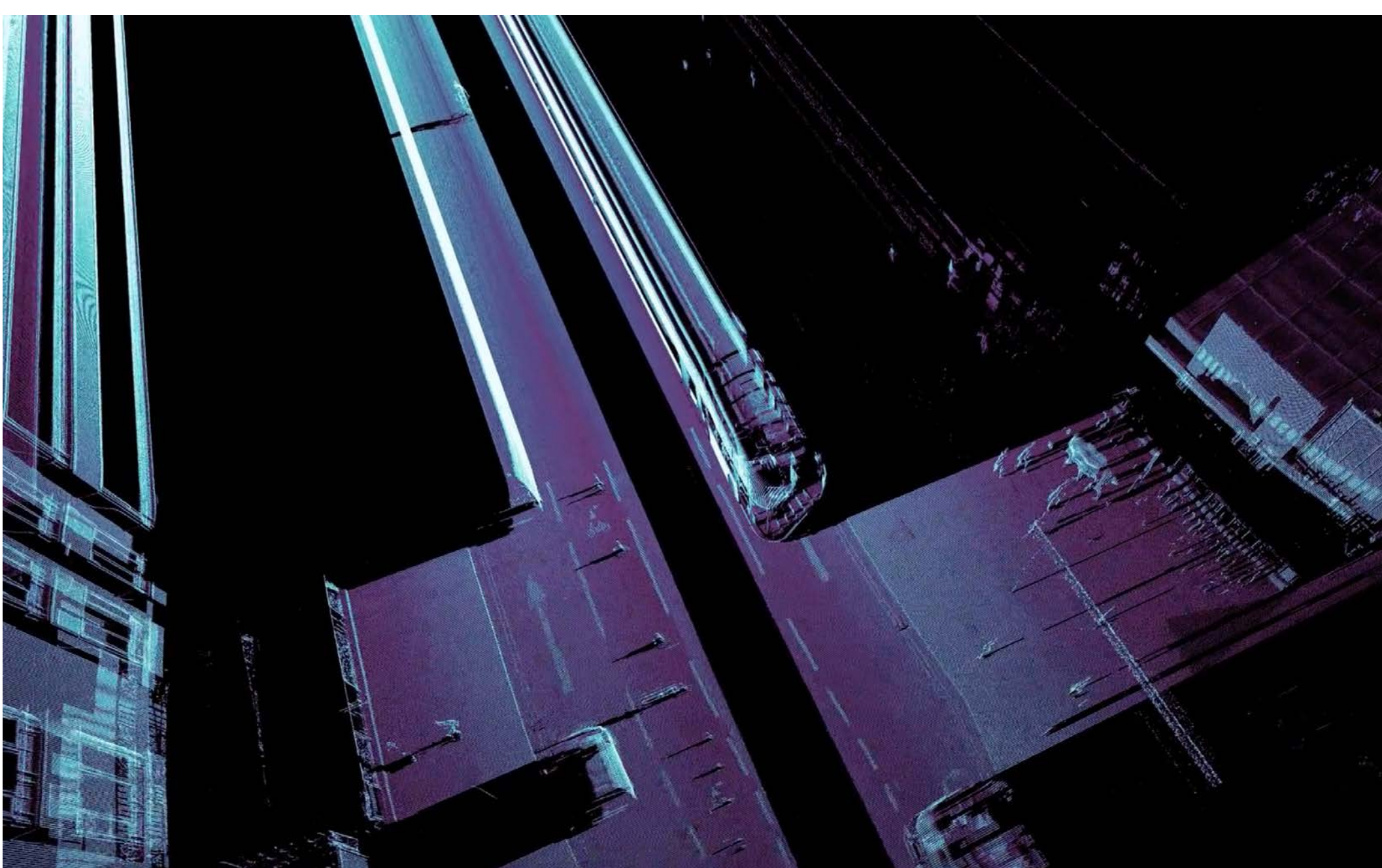

Figure 04.
Still from 'The Dream Life of Driverless Cars' (ScanLAB, 2015).

The scanned imagery is a technical composite of times and movements: the period of the rotating scanhead, the movement of the vehicle, the static point cloud, and the reanimated timeline of the virtual camera. ScanLAB's imagery, according to media theorist Jussi Parikka:

> [...] relates to the complexity of the technological laser scan records both as a movement across the city and as a sensitive way of dealing with light as a living entity that records the complexity of the multiple surfaces of the city, itself as an image, a trajectory of light.[34]

The view is characterised not only by gaps in vision, but also by 'over-seeing', in which 'complex architectural forms, reflective surfaces, unpredictable weather and temporary construction sites' interact with the sensors to produce unexpected results.[35] When the car turns a corner, Big Ben is re-scanned, appearing doubled a few seconds into the animation. While the driverless car's software attempts to eliminate and process out these ambiguities and confusions, Shaw and Trossel suggest they are a view into the vehicle's subconscious, a kind of dream-state, 'mad machine hallucinations'.[36] On this view, mad vision would be not merely the opposite of rational vision, but one of its emergent possibilities.

te ahua, te wa, te atea

In *Te Ahua, Te Wa, Te Atea* (2022) a recent work by Māori artist Russ Flatt (Ngāti Kahungunu), point cloud imagery suggests

the possibility of seeing through, or seeing in parallel. Point cloud sequences alternate and blend with photographic imagery to create the sense that the same space might be being simultaneously perceived as being very different worlds. The opening sequence orbits a hill (properly, the maunga Te Wheao, important to Kahungunu and Heretaunga iwi). As we would expect from laser scan imagery produced by drone, the land appears as a thin veil [Fig. 05]. The imagery cuts and fades between point cloud and black-and-white drone photography.

Figure 05.
Still from *Te Ahua, Te Wa, Te Atea* (Russ Flatt, 2022).

Curator Brook Konia, writing of the work, recalls a Heretaunga whakataukī (proverb) that refers to the whenua (land) as 'Heretaunga Haaro o te Kaahu': 'Heretaunga, beauty of which can only be seen by the hawk', inviting us to see how the work 'invokes the eyes of the hawk'.[37] Where Shaw and Trossell use the point cloud to express the life of a technological other, Flatt (in Konia's reading) aligns the vision of the scanner with the eye of the indigenous kāhu (swamp harrier). In each case, the laser scanner serves

as a means of othering sight. The drone/kāhu glides over the terrain, and at several points pauses to reveal forms traced out on the land: the circle of a roundabout, the square base of a monument, the outline of a parcel of land, the irregular bars of bridges over a river. Late in the video, the virtual camera rises up through the veil of the ground from below: the kāhu flies through the land, not only over it. The virtual camera suggests the presence of other viewers, other occupants of the whenua (land, understood as animate), other lives. It is as if we are viewing at an angle, obliquely, askance, watching a performance from the wings. The gaps and ambiguities of the point cloud make explicit the uncertainties of human perception.[38]

In a series of recent point cloud portraits, *Tekau ma Rūa*, Flatt portrays wāhine Māori (Māori women) as 'ethereal female figures who still defiantly occupy the veiled landscapes of their whenua'.[39] As monochrome point clouds, material mass is subtracted. Although light has produced the image, it is not illuminated in the manner we are accustomed to. The laser is agnostic about whether it has rebounded from the trunk of a tree, the side panel of a car, or the hair of a human figure. Body and place, wāhine and whenua read as comprised of the same stuff, as continuous. Flatt softens the discreteness of things, working against the objectifying quality emphasised by the 'reality capture' paradigm. Instead, the agnostic, myopic vision of the scanner is taken to disclose an underlying reality, a world oriented to other-than-human eyes.

vol.20, no.01
2023

uncertain
interiors

research
essay

carl douglas

point/cloud: diffusive
spatial imaginaries

36

Quercus

A similar use of scanned imagery to dissolve human subjectivity is found in *Quercus*, a digital animation by Italian design duo Formafantasma as part of their exhibition Cambio, commissioned by London's Serpentine Gallery.[40] *Quercus* takes the viewer on a slowly gliding tour through a digitally scanned oak forest, with a voiceover from the perspective of the trees, provided by philosopher and author of *The Life of Plants* Emanuele Coccia.[41] The forest is imaged as a point cloud, rendered in a gradient from red to white, disassociating them from the greens and browns that would appear to human vision [Fig. 06].

Figure 06.
Still detail from *Quercus* (Formafantasma, 2020).

While the video presents a single point cloud, it has been assembled from a number of scans: an aerial scan from a drone renders the topography; terrestrial point scans image a region of the forest in more detail (there are tell-tale circles indicating the position of the tripod); and at least one tree has been imaged at a higher resolution again.

Sometimes the view is an aerial one: rivers appear as black meandering threads through the red and white forest. At other points we recognise individual trees, looking up into their canopies, meandering among their trunks, and tracing the contours of individual boles. The impression is that the camera is able to move smoothly and freely from seeing the forest as a whole to the surface contours of an individual tree. In this seemingly visual world, however, the virtual camera moves in ways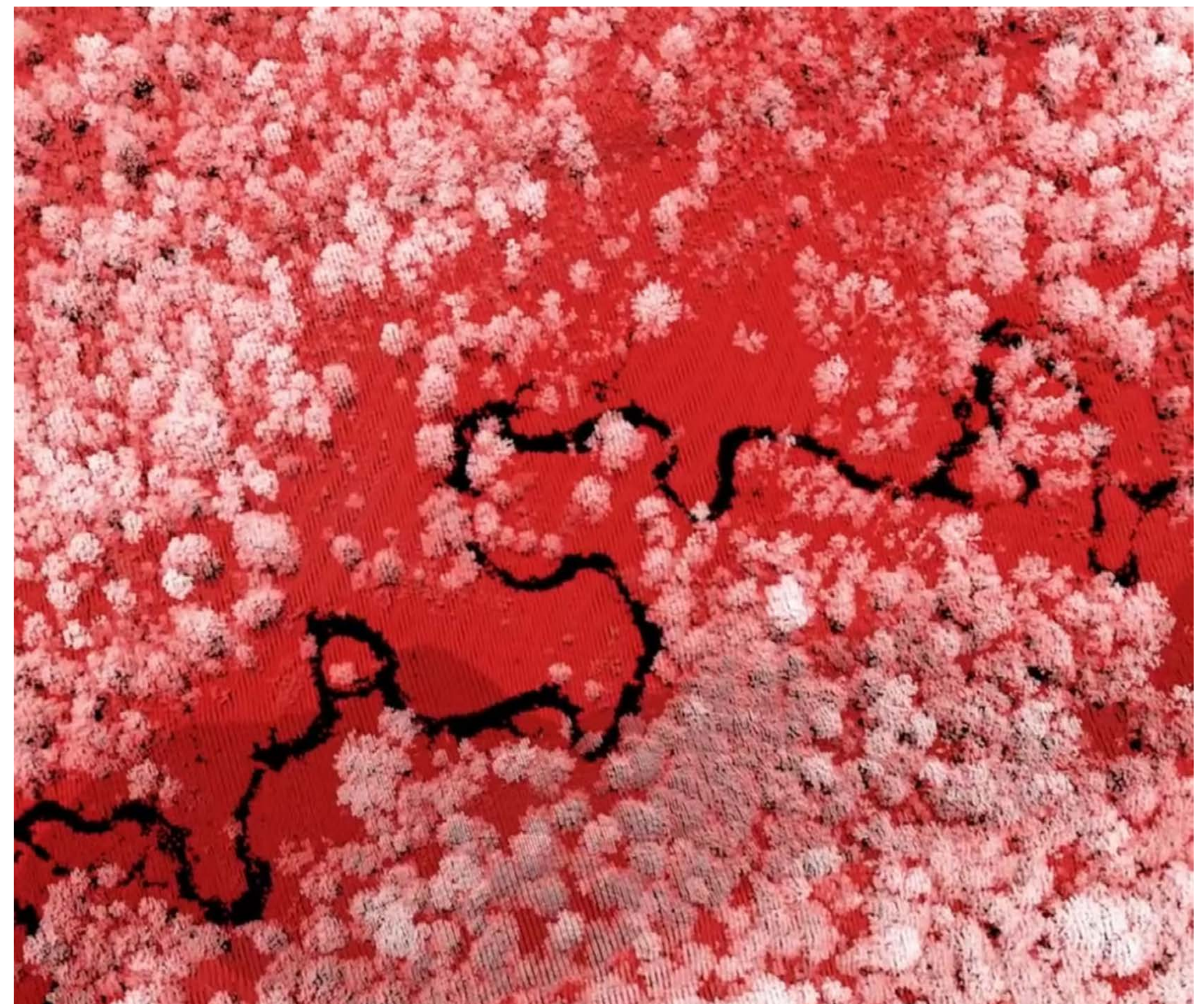 impossible or difficult for a physical lens. It passes through tree trunks, pivots off kilter around multiple axes, and drifts lazily in continuous gliding pans. Perhaps the language of cameras and shots, drawing on analogies with the performance of physical lenses and the logic of assembling film is not apt for this kind of simulated sight.

The film has a quality of reverie; the unblinking slowness of the pans, the sense of something at once familiar and strange suggest a kind of dream or meditation (as in *The Dream Life of Driverless Cars*). The voiceover insistently uses collective pronouns ('we' are the trees, 'you' are humans), and the point cloud reinforces this through the difficulty of distinguishing one tree from another. Formafantasma deepen this loss of distinction by zooming in until even the sense of surface disappears. In a passage just past ten minutes into the film, the frame is filled with a blizzard of

vol.20, no.01
2023

uncertain
interiors

research
essay

carl douglas

point/cloud: diffusive
spatial imaginaries

37

pink and white static blowing back and
forth against blackness [Fig. 07]. For
nearly a minute this Lucretian atomic rain
rushes and shifts as if driven by the wind.[42]
Sometimes it seems like a pattern might be
emerging, like an old television broadcast
as you fiddle with the antenna. In flat tones,
the voiceover is discussing the difference
between sculpting in wood and building in
brick or cement, drawing our attention to
questions of substance and matter. Lines
and streaks emerge from the hail and finally
settle into a lumpy pattern, which quite
suddenly resolves as the forest, viewed
once again from above. Although the point
cloud renders the environment as a ghostly
veil, the movement of the camera reinforces
the ghostliness of the viewer. Forests are
places of ritual, elemental, and spiritual
experience, in which individuals might
discover themselves to be only part of an
ecology, community, or cosmos. *Quercus*
revels in approaching solid matter to reveal
it dissolving in detail. Up close, in the precise
domain of the discretely measured point, the
image disperses completely.

affective certainty

In each of these works, the point cloud
renders a view from elsewhere, or even
nowhere. They exploit the *affect* of certainty
while calling certainty into question. By
rendering the world as clouds of particulate
or diaphanous veils, ScanLAB, Flatt, and
Formafantasma relish the dematerialising
effects of scanning. They are sufficiently
intricate in their detail to present recognisable
elements—trees, buildings. At times the

Figure 07.
Still detail from *Quercus* (Formafantasma, 2020).

effect of the scanner's position creates the
impression of lighting effects. But the image
is only *apparently* lit, *apparently* viewed,
apparently solid. Each activates a short-
circuit or contradiction between the accurate
and precisely measured data point and the
affective vagueness of the point cloud. They
each make explicit the question-begging
nature of digital precision. The ambiguities
they manipulate are not simply unclarities
that can be resolved with the addition of
further precision. In fact, a number of their
ambiguities emerge precisely through
'over-seeing', a surfeit of precise data.[43]

This surfeit produces a sense of an excessive and ceaseless process. Traditional orthographic drawings typically emphasise completeness and discreteness by employing devices like framing and scaling. Scans, however, have a flatness that I have referred to as agnosticism or myopia. An apparent lack of judgement (or perhaps rather a deliberate suppression of it) forms part of its affect of detached, authoritative certainty.

part three—diffusive imaginaries

Philosopher of computation Alexander Galloway writes:

> Computational vision takes it as a given that objects and worlds can and will be viewable from all sides. Indeed, the point should be made more forcefully. Computational vision takes it as a given that point of view is not necessary for seeing.[44]

The history of computational vision, suggests Galloway, is a story of transcending the single perspectival viewpoint. For example, he describes François Willème's 'photosculpture' technique, in which the object to be imaged was positioned in the centre of a ring of twenty-four cameras that were triggered simultaneously.[45] This yielded twenty-four profiles of the figure viewed in fifteen degree increments. In early versions of the method, these profiles were cut from thin sheets of timber and then assembled into a three-dimensional form as a preliminary to producing a carved sculpture. According to Galloway:

> Willème's technique reveals something profound, that there is an alternative history of photography *in which point of view has no meaning*, at least not a single point of view [...] in escaping the limitations of the camera obscura's single aperture, photography smeared itself across a limitless grid of points, neutering the axis of time while emboldening the axes of space.[46]

Zeynep Çelik Alexander, in her history of scanning as part of the technics of design, writes that technical vision, at first understood in terms of tools and techniques, came to merge with understandings of human perception.[47] That is, human perception itself became understood in technical terms. In the late nineteenth century, a widely held understanding of sight divided it into a two-stage process: first a non-semantic 'gazing/scanning' which yielded the raw data of perception, followed a process of recognition or interpretation.[48] The foundation of contemporary scanning techniques is the idea of the non-perspectival and non-semantic view. Seeing rested on a foundation of bare perception: the eye was imagined to be an unconscious detector that accumulated data points that could then be rendered and interpreted in the mind's eye. Sight — whether organic, mental, or technical—was understood to include a stage of assembly interposed between detection and interpretation and overlapping with them.

[ij]

vol.20, no.01
2023

uncertain
interiors

research
essay

carl douglas

point/cloud: diffusive
spatial imaginaries

39

The visual field needed to be composed. The aggregation of the visual field became allied with the discretisation necessary for digital processing of images:

> […] all imaging today is a process of detecting energy emitted by an environment and chopping it into discrete, measurable electrical charges called signals, which are stored, calculated, managed, and manipulated through various statistical methods. Images are thus the outputs of energetic processes defined by signalization, and these signals, in their accumulation, are what we mean when we say the word data.[49]

Computational vision, according to Galloway and Çelik Alexander, is exact to the extent that it is quantified and signalised, but accompanying this process is the dissolution and decomposition of the image, and the diffusion of the perspectival viewpoint (not so that there is no viewpoint, but so that the viewpoint is *everywhere simultaneously*).[50] If we recall Damisch's idea that clouds required artists to wrestle with non-perspectival epistemologies, we might see computational vision as a becoming-cloudy as much as a becoming-exact.

Even before photography, these features of contemporary imaging were anticipated by techniques of measured drawing. As drawing was reinvented as geometric calculation, a fascination with parsimony—the minimum number of points

needed to represent accurately—arose.[51] Drawings that became overwhelmed by points, on the other hand, could become lost, dissolving into impressionism, and losing their instructional functions.

In rendering its cloudy world, laser scanning triggers a 'material imagination' of particles and diffusion.[52] Gaston Bachelard points out that the intelligence and imagination we develop from our experience of materials becomes a heuristic through which we interpret, diagnose possibility, orient ourselves, and take action. Our expectations, assumptions, and intuitions are pervaded by our imaginations of matter. As Bachelard describes it, imagination is not merely situated in the minds of individuals. On the contrary, it 'eludes the determinations of psychology [… and] constitutes an autochthonous, autogenous realm'.[53] That is, imaginations such as the diffusive material imagination indicated here, are simultaneously metaphoric and literal, social and individual, creative and technical, poetic and practical. Through imagination, we attribute meaning to the world and discern what possibilities for action lie open to us.

One of Bachelard's forays into material imagination inquired into the idea of the *atom*, which he argued we primarily imagine through the material imagination of *dust*: 'From the phenomena of dust, powder, and smoke, Homo faber learns to meditate upon the delicate structure and the mysterious power of the infinitely small; along this path lies the knowledge of the impalpable

vol.20, no.01
2023

uncertain
interiors

research
essay

carl douglas

point/cloud: diffusive
spatial imaginaries

40

and the invisible.'[54] Bachelard's invocation of dust suggests another reading of the point cloud. The data points of a laser scan accumulate like a superficial residue. In the case of the Soane Museum we might be reminded of the close affiliation between archives and dust. Museums, their contents, and their occupants are often reputed to be dusty. As items become thickly coated with dust, their withdrawal from use and life is ever clearer. Dust, 'associated with uneventfulness and inactivity, and things that are still, dull and out of date', becomes an accusation of lateness, being out-of-time, lost in the past, or useless.[55]

Dusting is part of the domestic labour of cleaning, wiping away the traces of human presence, reasserting the present. By wiping away dust, we insist that a space is in current use. Dusting is also morally coded: 'a surrogate for the absence of social concern [...] a failure of control over the environment' or even 'a moral breakdown'.[56] The laser scanner, slowly turning, carefully strokes the interior surfaces of the museum, trying like a diligent cleaner not to miss a spot. The idea of meticulous attention, of missing nothing, connects such scans with the labour of cleanliness. Digital spaces perpetuate the possibility of being dustless; philosopher Michael Marder writes that 'the virtualization of existence instills in us the illusion of a dust-free world'.[57] The genre of point cloud imagery seems to assert a domain of precision, certainty, and acquirable objects: a world of precisely defined things in a continual present. But, just as obsessive

cleaning might be taken to indicate a fear of dirt, the obsessive precision of scanning might also indicate anxieties about the diffusion of world and subject.

In imagination, dust becomes a way to conceive of time and loss, and our own physical matter. Marder writes that, 'as we clash with external dust, we displace existential anxieties and obliquely confront our mortal, rootless, restless selves, no longer discernable as such'.[58] Dust 'corroborates our suspicion that reality is not a hard and unchipped rock, against which we throw meaning and ourselves in vain, but loose residue on a surface without depth'.[59] The threat posed by dust, according to Marder, is the idea of 'mereness', that something might have nothing more to it, or that it could be reduced to some kind of minimum. Art critic Mario Praz points out that in the end, a museum's occupant may themselves become figured as dust:

> I see myself as having myself become an object and an image, a museum piece among museum pieces, already detached and remote [...] I have looked at myself in a convex mirror, and have seen myself as no bigger than a handful of dust.[60]

conclusion

The dusty interior and the particulate spaces of point cloud visualisations tap into a diffusive material imagination. They unsettle ideas of time, substance, and viewpoint by activating intuitions and experiences

vol.20, no.01
2023

uncertain
interiors

research
essay

carl douglas

point/cloud: diffusive
spatial imaginaries

41

of the vaporous, atomised material world. The results of a laser scan are imagined to be ethereal or dreamlike because they resonate with our ideas and images of dust, atoms, particles, and clouds. In the moving image works considered in this essay, these resonances are amplified, revealing how technical methods of sampling, scattering, and plotting, and the idea of nonhuman vision are themselves conditioned by such imagery. In examining the technical practices and aesthetics of laser scanning and point cloud imagery, I have taken particular note of affective qualities—diffusion, vagueness, emptiness—that are in tension with ideas and techniques of exactitude, precision, and certainty. The apparent internal contradiction of the term 'point cloud' is not a minor coincidence but exposes emotional and imaginative investments that overflow and trouble the distinction between the technical and the imaginative, the certain and the uncertain.

acknowledgements

author biography

Carl Douglas is a Senior Lecturer in Spatial Design at Auckland University of Technology. His research circulates around two themes: procedural design techniques (cartography, design computation, abstraction, and orthographic drawing); and diffusion (as a creative method, aesthetic effect, and material imaginary). His book *Bodies and Space in Architectural Drawing* (co-authored with Marian Macken) will be published by Routledge in 2025.

notes

01 For detailed technical discussion, see G. F. Marshall (ed.), *Handbook of Optical and Laser Scanning*. Optical Engineering 90 (New York: Marcel Dekker, 2004). For a discussion of scanning in the context of media and imaging practices, see Jussi Parikka, 'On Seeing Where There's Nothing to See: Practices of Light Beyond Photography', in *Photography Off the Scale: Technologies and Theories of the Mass Image*, ed. by Tomás Dvořák and Jussi Parikka (Edinburgh: Edinburgh University Press, 2021), pp. 185–210. The other main approach to scanning three-dimensional objects is photogrammetry, which uses coordinates sets of photographs (sometimes taken with a specialised binocular camera) to locate points in space and generate a point cloud. There are nuanced differences between these methods that are outside the scope of this essay, which focuses on laser scanning.

02 Filippo Stanco, Sebastiano Battiato, and Giovanni Gallo, *Digital Imaging for Cultural Heritage Preservation: Analysis, Restoration, and Reconstruction of Ancient Artworks*. Digital Imaging and Computer Vision Series (Boca Raton: CRC Press, 2011). Christopher Beorkrem, 'Review of Three-Dimensional Scanning', *Journal of the Society of Architectural Historians, 75*.1 (2016), 122–124. Karen E. Hughes and Elizabeth I. Louden, 'Bridging the Gap: Using 3-D Laser Scanning in Historic-Building Documentation', *APT Bulletin: The Journal of Preservation Technology 36*:2/3 (2005), 37-46.

03 These projects have often been pilots or trials. For example, twelve items from the British Museum can be accessed here <https://www.bmimages.com/3d-scans.asp>. For an example of a larger project, see the Acropolis Museum's intentions, which can be viewed here <https://www.theacropolismuseum.gr/en/digital-museum> [accessed 20 September 2023]

04 Susan Stewart, *On Longing* (Durham NC: Duke University Press, 1993), p. 5.

05 Mark Wigley, 'The Intolerances of Architecture', in *Exactitude: On Precision and Play in Contemporary Architecture*, ed. by Pari Riahi, Laure Katsaros, and Michael T. Davis (Amherst MA: University of Massachusetts Press, 2022), pp. 15–31 (p.18).

06 Francesca Hughes, *The Architecture of Error. Matter, Measure, and the Misadventures of Precision* (Cambridge MA: MIT Press, 2014), p.17.

07 Sheila Jasanoff and Sang-Hyun Kim, 'Containing the Atom: Sociotechnical Imaginaries and Nuclear Power in the United States and South Korea', *Minerva*, 47.2 (2009), 119–46. George E. Marcus, (ed.), *Technoscientific Imaginaries: Conversations, Profiles, and Memoirs*, Late Editions, 2 (Chicago: University of Chicago Press, 1995).

08 Carl Douglas, 'Epizeuxis. Point / Cloud', in *Into the Under World / Ngā Mahi Rarowhenua. Suburban Lava Caves of Auckland. A Selection of Critical Texts*, ed. by Chirag Jindal (Auckland: Chirag Jindal, 2018), pp. 4–7 (p. 4). Edward S. Casey, *The Fate of Place. A Philosophical History* (Berkeley: University of California, 1997), p. 281.

09 Hubert Damisch, A Theory of /Cloud/. Toward a History of Painting (Stanford: Stanford University Press, 2002), p. 15. This figurative role of the term 'cloud' is only reinforced by its recent use to describe the dispersed infrastructures of the contemporary internet. Shannon Mattern, 'Cloud and Field: On the Resurgence of "Field Guides" in a Networked Age', *Places Journal*, 2016 <https://doi.org/10.22269/160802>

10 Leica Geosystems, Reality Capture <https://leica-geosystems.com/industries/reality-capture> [accessed 20 September 2023]. Autodesk, Reality Capture <https://www.autodesk.com/campaigns/reality-capture> [accessed 20 September 2023]

11 Danielle S. Willkens, 'The Craft and Care of Reality Capture', *Buildings & Landscapes*, 29.2 (2022), 2–14 (p. 2).

12 For example, an archaeologist describing the scanning of a building in southern Spain writes, 'Having a Muslim tower of the thirteenth century in our hands was something unthinkable until a few years ago, but today the development of new technologies has made it possible.' Francisco Arias, Carlos Enríquez, Juan Manuel Jurado, Lidia Ortega, Antonio Romero-Manchado, and Juan José Cubillas, 'Use of 3D Models as a Didactic Resource in Archaeology. A Case Study Analysis', *Heritage Science*, 10.1 (2022), 1-15 (p. 3) <https://doi.org/10.1186/s40494-022-00738-x>

13 Helene Furján, *Glorious Visions: John Soane's Spectacular Theater* (Florence SC: Taylor & Francis Group, 2011).

14 ScanLAB Projects <https://scanlabprojects.co.uk> [accessed 20 September 2023]

15 The animated scan imagery can be viewed at <http://explore.soane.org> [accessed 20 September 2023]

16 Furján, *Glorious Visions*, p. 28.

17 John Soane, *Description of the House and Museum on the North Side of Lincoln's Inn Fields, the Residence of Sir John Soane* (London: Levey, Robson, and Franklyn, 1835).

Furján writes that 'Soane enlisted a whole range of scenographic and aesthetic tropes—from a *lumière mystérieuse* formed from light, shadow and color, to the fragment and the mirror—to produce a spectacular space in the service of memorialization and display'. Furján, *Glorious Visions*, p. 4.

18 Soane, *Description of the House and Museum on the North Side of Lincoln's Inn Fields*, p. vii.

19 Susan Sontag, *On Photography* (London: Penguin Books, 2002), pp. 3–4.

20 In a letter to Ruskin's father, quoted by Wigley, 'The Intolerances of Architecture', p. 32.

21 For example, Arias et al., 'Use of 3D Models as a Didactic Resource in Archaeology', p. 3.

22 Cynthia Sundberg Wall, *The Prose of Things: Transformations of Description in the Eighteenth Century* (Chicago: University of Chicago Press, 2014), p. 41.

23 Hooke, quoted by Wall, *The Prose of Things*, pp. 76, 73.

24 Hooke, quoted by Wall, *The Prose of Things*, pp. 77.

25 Wall, *The Prose of Things*, p. 21.

26 Wall, *The Prose of Things*, p.77

27 James C. Scott, *Seeing Like a State. How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998), p. 11.

28 For example, Willkens explores inconsistencies resulting from the interaction of the laser scanner with mirrors and reflective surfaces. Danielle Willkens, 'Clouds and Cataracts: Optical Experiments at Sir John Soane's Museum', *Technology|Architecture + Design*, 3.2 (2019), 211–20.

29   Willkens, 'Clouds and Cataracts'.

30   Damisch, *A Theory of /Cloud/*, p. 15.

31   Particularly by suspending 'the coherence and consistency of a syntactical ordering'. Damisch, *A Theory of /Cloud/* p.185. John Durham Peters writes that our fascination with the sky produced two sciences: *chronos*, astronomy and the knowledge of the constant movements of the heavenly bodies, 'the epitome of an exact science'; and *kairos*, the probabilistic knowledge 'of weather, rain, hail, thunder and lightning, temperature, and clouds'. John Durham Peters, *The Marvelous Clouds: Toward a Philosophy of Elemental Media* (Chicago; London: University of Chicago Press, 2015), p. 166. Notably, the laser time-of-flight range-finding techniques at the heart of laser scanning were pioneered by meteorologists seeking to take readings of clouds. G.G. Goyer and R. Watson, 'The Laser and Its Application to Meteorology', *Bulletin of the American Meteorological Society*, 44.9 (1963), 564–70.32   John Ruskin. *Modern Painters V* (London: George Allen, 1860) <https://www.gutenberg.org/ebooks/44329> [accessed 20 September 2023]

33   Geoff Manaugh, 'The Dream Life of Driverless Cars', *The New York Times*, 11 November 2015, section Magazine <https://www.nytimes.com/2015/11/15/magazine/the-dream-life-of-driverless-cars.html> [accessed 17 November 2022]

34   Jussi Parikka, 'On Seeing Where There's Nothing to See: Practices of Light beyond Photography', in *Photography off the Scale: Technologies and Theories of the Mass Image*, Technicities, ed. by Tomás Dvořák and Jussi Parikka (Edinburgh: Edinburgh University Press, 2021), pp. 185–210 (p. 198).

35   Manaugh, 'The Dream Life of Driverless Cars'.

36   Manaugh, 'The Dream Life of Driverless Cars'.

37   Brook Konia, 'Heretaunga Haukū Nui', *Pantograph Punch* <https://pantograph-punch.com//posts/russ-flatt> [accessed 18 November 2022]

38   Another use of point cloud imagery to explore animal perception is the virtual reality experience *In the Eyes of the Animal* (2023) by the group Marshmallow Laser Feast, of which a sample can be viewed here <https://vimeo.com/213658343> [accessed 20 September 2023]. My thanks to one of this essay's reviewers for bringing this work to my attention.

39   Russ Flatt, 'Tekau Mā Rua', 2022 <http://www.russflatt.com/tekau-ma-rua> [accessed 17 February 2023]

40   *Quercus* can be viewed at <https://vimeo.com/394196768> and the wider project at <https://formafantasma.com/work/cambio> [accessed 20 September 2023]. I viewed the work as part of the Speaking Surfaces exhibition at Auckland's St Paul St Gallery (now Te Wai Ngutu Kākā Gallery) in 2020 <https://stpaulst.aut.ac.nz/all-exhibitions/speaking-surfaces> [accessed 20 September 2023]

41   Emanuele Coccia, *The Life of Plants: A Metaphysics of Mixture* (Medford MA: Polity, 2018).

42   'The atoms, as their own weight bears them down / Plumb through the void, at scarce determined times, / In scarce determined places, from their course / Decline a little--call it, so to speak, / Mere changed trend. For were it not their wont / Thuswise to swerve, down would they fall, each one, / Like drops of rain, through the unbottomed void". Titus Lucretius Carus, *On the Nature of Things*, trans. by

William Ellery Leonard (1916) <https://www.gutenberg.org/ebooks/785> [accessed 20 September 2023]

43   Manaugh, 'The Dream Life of Driverless Cars'.

44   Alexander Galloway, *Uncomputable: Play and Politics in the Long Digital Age* (New York: Verso Books, 2021), pp. 63–4.

45   Galloway, *Uncomputable*, p. 31.

46   Galloway, *Uncomputable*, pp. 35, 37.

47   Zeynep Çelik Alexander, 'Scanning. A Technical History of Form', in *Design Technics: Archaeologies of Architectural Practice*, ed. by Zeynep Çelik Alexander and John May (Minneapolis: University of Minnesota Press, 2020), pp. 71–102 (p. 95).

48   Galloway, *Uncomputable*, p. 74, citing media theorist Wolfgang Ernst.

49   John May, 'Afterword. Architecture in Real Time', In *Design Technics: Archaeologies of Architectural Practice*, ed. by Zeynep Çelik Alexander and John May (Minneapolis: University of Minnesota Press, 2020), pp. 219–43 (p. 224). Janet Vertesi explores the contestable nature of forming images from data through processes of 'seeing as'. Janet Vertesi, *Seeing Like a Rover: How Robots, Teams, and Images Craft Knowledge of Mars* (Chicago: University of Chicago Press, 2015), p. 79.

50   Jonathan Crary wrote of another optical device in similar terms: 'If perspective implied a homogeneous and potentially a metric space, the stereoscope discloses a fundamentally disunified and aggregate field of disjunct elements [...] Our eyes follow a choppy and erratic path into its depth: it is an assemblage of local zones of three-dimensionality, zones imbued with a hallucinatory clarity, but which, when taken together never coalesce

into a homogeneous field.' Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century* (Cambridge MA: MIT Press, 1990), pp. 125–26.

51   See Robin Evan's discussion of Piero della Francesca's geometrically constructed heads. Robin Evans, *The Projective Cast. Architecture and Its Three Geometries* (Cambridge MA: MIT Press, 1995).

52   Gaston Bachelard, *Water and Dreams. An Essay on the Imagination of Matter* (Dallas: Dallas Institute of Humanities and Culture, 1983), p. 17.

53   Gaston Bachelard, *The Psychoanalysis of Fire* (Boston: Beacon Press, 1968), p. 110.

54   Gaston Bachelard, *Atomistic Intuitions: An Essay on Classification*. SUNY Series in Contemporary French Thought (Albany: State University of New York. 2018), p. 17.

55   Inkeri Hakamies, 'The Dusty Museum', *Nordisk Museologi*, 1 (2018), 74–88 (p. 80) <https://doi.org/10.5617/nm.6399>

56   Gary A. Fine and Tim Hallett, 'Dust: A Study in Sociological Miniaturism', *The Sociological Quarterly*, 44.1 (2003), 1–15 (pp. 3, 5).

57   Michael Marder, Dust (New York: Bloomsbury, 2016), p. 69.

58   Marder, *Dust*, p.16.

59   Marder, *Dust*, p. 110.

60   Mario Praz, *The House of Life*, trans. by Angus Davidson (New York: Akadine, 1999), p. 350 <https://archive.org/details/houseoflife00praz> [accessed 20 September 2023]