The Scan: Prototypes for a Post-Human Sceenography

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THE SCAN

Prototypes for a Post-Human Scenography*

A collaboration between The Bartlett UCL, Royal Central School of Speech and Drama, Shunt, and Scanlab Projects.

Text by Bob Sheil & Thomas Pearce

A live survey: time-based narrative tableaux staged around the scanner's circular sweep.

I am in another room, I am crying. You said hurtful things to me and you weren't sorry. Right now you are on a bus eating cake. The woman sitting next to you died six months ago.

— Shunt, The Scan

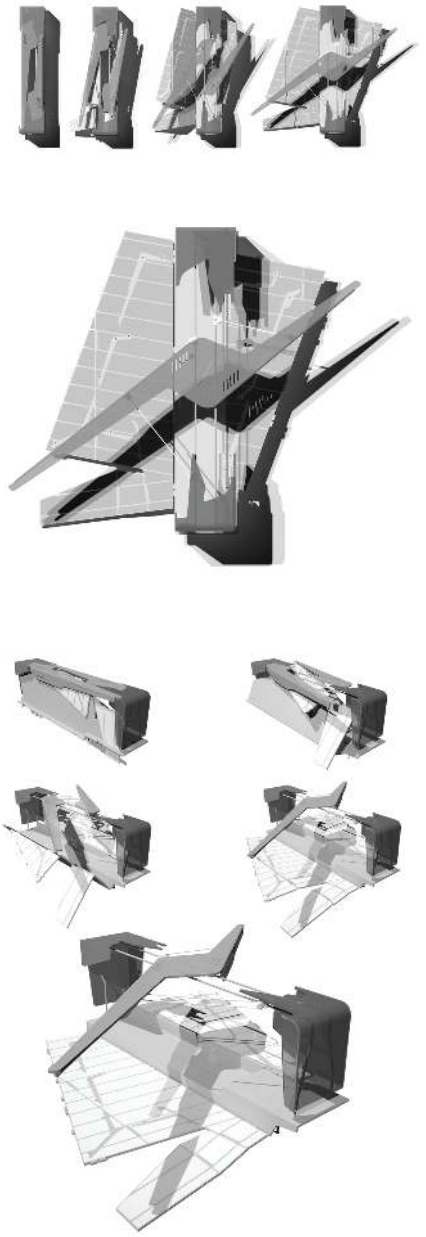
***** This article was originally published in *Organs Everywhere No.5*, July 2017. An updated version of the article can be found in Butcher and O'Shea (2020).

In our digital age, the human eye has lost its privileged position as the sole and central audience of an unfolding perspectival world as it finds itself challenged by a plethora of post-human eyes. Emerging technologies of vision such as 3D laser scanning—regarded as less faulty, faster and more accurate than the human eye—find an ever more central role in production, analytics, control and decision making.

Architecture and scenography, practices that are both firmly shaped around the centrality of vision of the human subject, are challenged to find novel ways to address a hybrid audience of human and non-human modes of vision. How do we perform and build facing this new audience? How do we deceive or delight these new eyes? How do we infiltrate and inhabit the parallel digital data space they create? How can we uncover their shadows, their glitches and fallacies, and subvert the realism of their representation? How can we design an architecture or scenography for the post-human eye?

The Scan (2013) is a prototype for a post-human scenography that develops 1:1 collaborative and site-specific acts between designers and performers through 3D scanning, bespoke instrumentation, robotics, rehearsal and live performance. With a particular emphasis on how 3D scanning may be manipulated in situ, the work seeks to mediate between live performance and digital representation, and thus explores a new relationship between performance and audience through time and location.

The Scan presents a sequence of investigations that utilize an ad hoc space at the Royal Central School of Speech and Drama's Eton Avenue premises to explore synthetic processes of design prototyping and exploratory performance. Central to the work is the manipulation of 3D



Challenging the black box: prototype design for a deployable, mechanically choreographed mobile stage platform.

laser scanning as a critical and creative spatial tool. Installed in three locations at the RCSSD, a series of spatial instruments are introduced to disrupt, provoke and distort rehearsals that are captured as 3D architectural models. Through specifically located reflective panels, performers are digitally projected from interior to exterior spaces and composited in digital montages. Creatively appropriating and instrumentalizing machine vision for a novel post-perspectival and post-anthropocentric scenography, the work simultaneously dismantles the spatio-temporal realism of this vision while forwarding hybrid and fragmented notions of site/stage, subjectivity and authorship.

The work is the latest iteration of a creative collaboration between the RCSSD and The Protoarchitecture Lab at The Bartlett School of Architecture, UCL. SHUNT, an award-winning artists' collective, created an original score for the performance at the RCSSD. Protoarchitecture Lab worked with ScanLAB to develop novel and bespoke instruments in response to Shunt's proposals and used digital technologies of capture and modeling to blur the boundaries between the represented and the actual in the subsequent performance.

PERFORMANCE SPACE / PERFORMATIVE SPACE

The development of *The Scan* combines two research interests that have been central to Protoarchitecture Lab's body of work during the last couple of years: firstly, the exploration of performative space—both as the spatial and architectural framing of theatrical performance and as the acknowledgement of the inherently performative nature of architectural materials and spaces; secondly, a critical and subversive approach to novel technologies of digital fabrication and representation.

Our interest in the production of theatrical space led to a first creative collaboration with the RCCSD called PerFORM between 2007

1 —
Led by Bob Sheil and EmmanuelVercruysse.

and 2009. Initially, a group of students of the Bartlett's Diploma Unit 23[1] worked on a project to design and build a small performance space exploring issues of sustainability and spatial innovation. During this design studio and an ensuing funded research project,[2] some key conceptual positions were developed that would prove to define the agenda of our further research.

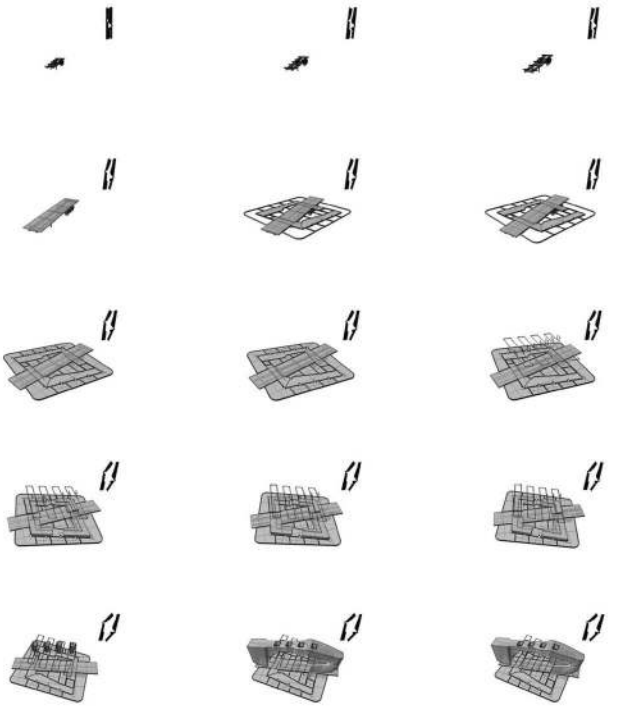
As both a prototype design and an event design, the work was specifically framed to further strategies of audience participation and challenge the conventions of "black box" theatre, including the relationships between auditorium, stage and backstage. Also, by envisioning the traveling mobile stage platform as a temporary deployable structure, unfolding in a mechanical choreography, we developed the notion of stage architecture as a performance in its own right. Finally, the work tapped into the experimental representation of time-based (architectural and theatrical) performance. This involved, among others, the production of two sets of flipbooks: while a first flipbook animated the choreographed deployment of the project's 3D design model, a second one contained a sequence of images showing the re-enactment of this performance by a dancer's figurative movements.

RESHUFFLING THE CARDS OF REALITY

With regards to our critical approach towards novel technologies of digital fabrication and representation, 3D laser scanning has become a crucial tool in our design research. Initial steps in 3D scanning were made during the PerFORM project, during which the scanner was used as a survey tool that allowed for the design and fabrication of bespoke and highly accurate site insertions. This conventional approach to the use of scanning technology, however, changed dramatically between this first collaboration and the development of *The Scan*, which instead undertook a subversive artistic appropriation of the same technology.

2 —
Hosted by the Centre for Creative Collaboration and led by Bob Sheil and research assistant Matt Shaw.

Representing architectural performativity: flipbook animating the choreographed deployment of the mobile stage.



Between the two project phases, the emphasis of our research in scanning shifted away from a positivist assumption of the congruence between the physical world and its digital representation towards a growing interest in the disjunction and discrepancy between the two. Such discrepancy appears in the case of measuring errors, which create so called "noise" in the point cloud, for example when the scanner's laser beam hits a reflective surface or the edge of an object. This noise, digital points that do not correspond to any actual physical object, is normally elaborately filtered out of the point cloud. We, on the contrary, recognize this noise as the space of potential occupation and artistic appropriation as it turns the scanner from a passive, realist measuring tool into an active *surrealist* agent that actually *creates* spaces in the digital realm.

The artistic appropriation of this noise starts with the understanding of the physical and geometrical principles that lie at its origin and leads to the retro-engineering of these principles so that the noise can be controlled and purposefully created. As such, the scanner

can be turned into a phantasmagorical, high-tech surrealist device of engineered illusionism. This engineered illusionism allows us designers to create fictional digital spaces and illusionary environments through understanding and then misusing the rules of techniques of representation.

The suitability of such subversive scanning strategies of engineered illusionism for scenographic purposes is evident: it echoes the very origins of the discipline of scenography, which was first developed by artists practicing illusionistic architectural painting techniques such as *quadratura* and *trompe l'oeil*. Such anamorphic illusions suggesting the spatial extensions of a given space beyond the surface of a painted wall or ceiling were in turn used for the creation of illusions of environments in stage designs.

The technique of representation crucial to these engineered architectural and scenographic illusions was the development in the renaissance of the rules of perspective. Bruno Latour describes the double role of perspective as a tool of realism and illusion as the "four-way freeway" of representation: perspective does not only allow us to realistically represent a scene (one way freeway) or to pragmatically act upon an external reality by implementing alterations designed within the technique of perspective (two way freeway)—not only can we

displace cities, landscapes, or natives and go back and forth to and from them along avenues through space, but we can also reach saints, gods, heavens, palaces, or dreams with the same two-way avenues and look at them through the same "windowpane" on the same two-dimensional surface. The two ways become a four-lane freeway! Impossible palaces can be drawn realistically, but it is also possible to draw possible objects as if they were utopian ones (Latour 1986, 8).

3 —
Cf. Anne Friedberg (2006, 33).

Perspective thus is a technique of realistic representation rather than a dogma of realism of the subject matter depicted.[3] Mastering this technique allows us not only to depict a "reality" but also to challenge it. Perspective, to speak with Latour again, is a technique with which we can create "complete hybrids between the real and the imagined: nature seen as fiction, and fiction seen as nature, with all the elements made so homogeneous in space that it is now possible to reshuffle them like a pack of cards" (1986, 9).

A POST-PERSPECTIVAL ILLUSIONISM

This "four-way freeway," however, cannot be directly translated to the case of the 3D scanner, as its relation between data collection and representation is more complex and less direct than is the case for classical perspective. We could in fact state that 3D scanning functions at once in a post-perspectival and pre-perspectival way.

To elaborate on this statement, it is critical to very briefly explain how a 3D laser scanner works. The scanner's range finder measures the distance between itself and objects in a scene by using time-of-flight measurement: shooting laser beams at the objects, it converts the signal's return time to a distance value. Constrained only by the speed of light, it can create millions of measured points per minute, which can then be translated into a set of three-dimensional xyz-values.

Similar to other technologies of active optics and remote sensing (e.g. radar), the scanner is post-perspectival: although it collects data from a fixed position, it does not have a picture plane, retina or photographic plate. In this sense, speaking of the scanner "eye"—as we have done until now—is in fact a case of stubborn anthropomorphism that resorts to an essentially humanist epistemological understanding of the human observer as the active knowing subject acting upon the passive known—be it real or manipulated.

At the same time, the scanner's measuring method is pre-perspectival: the translation of collected distance values to xyz-values and their representation on a perspectival picture plane is but a matter of post-processing to make the point cloud data legible to the human eye. This means that, as opposed to classical perspective, in which the viewer's position was identical to the painter's, the observer's location is no longer necessarily "encoded into its representation" (Friedberg 2006, 28). Instead, she/he can now freely navigate through the point cloud model—echoing futurist Bruce Sterling's speculations on the future of the camera which

simply absorbs every photon that touches it from any angle. And then in order to take a picture I simply tell the system to calculate what that picture *would have looked like* from that angle at that moment (Vimeo Festival & Awards 2011).

These considerations imply that techniques of "scanning illusionism" cannot simply operate on the level of "realist" representation (simulating fictional narratives within the flat constraints of pictorial representation)—but instead will have to engage with this pre-perspectival stage of data collection. As this data collection (the actual measurement) is firmly embedded within the material reality of the measured scene,[4] the trigger for such illusionism will necessarily lie in the realm of physical intervention and thus become a spatial, architectural challenge.

A LIVE SURVEY

As a prototype for a post-human scenography, *The Scan* applies such a post-perspectival engineered illusionism to create a "stage" that is marked by hybridity—hybridity between physical and digital performance spaces, and hybridity between realist and fictitious spatial representations.

Human and post-human eye: perspectival point cloud representations imposing a humanist picture plane on post-perspectival data.

4 —
Karen Barad uses precisely time-of-flight measurement to illustrate the material entanglement of processes of knowing (the materiality of the laser beam) with processes of being (the measured material object), and todefine her concept of an entangled ontoepistemology (Barad 2007, 78).

Similar to our first cooperation, there was a shared interest to break out of the theatrical convention of the black box stage. This time however, rather than designing a movable stage, an existing building—the premises of the RCSSD at Eton Road—was used as performance spaces. The attraction of these spaces lies in their labyrinthine quality: it is a conglomerate of buildings that has been extended, added and layered upon, a complex set of spatial relations that becomes legible only through a longer experience of navigating its rooms—but even then would need a set of universal keys to reveal its unexpected backdoor connections. In a first stage of the project, a survey of the building is conducted using the 3D scanner. A routine 3D scan of an existing building is largely planned around maximizing the efficiency of selected scan positions so that the exercise captures all necessary information in the fewest number of set ups. Set up positions can be seen as black circles. These are the blind spots directly beneath the unit that the instrument does not measure when operating. If undesired, they can be eliminated by data from another position that looks back to that position. In this case they were left in and allow the total number of scans in this assembly to be understood by the reader.

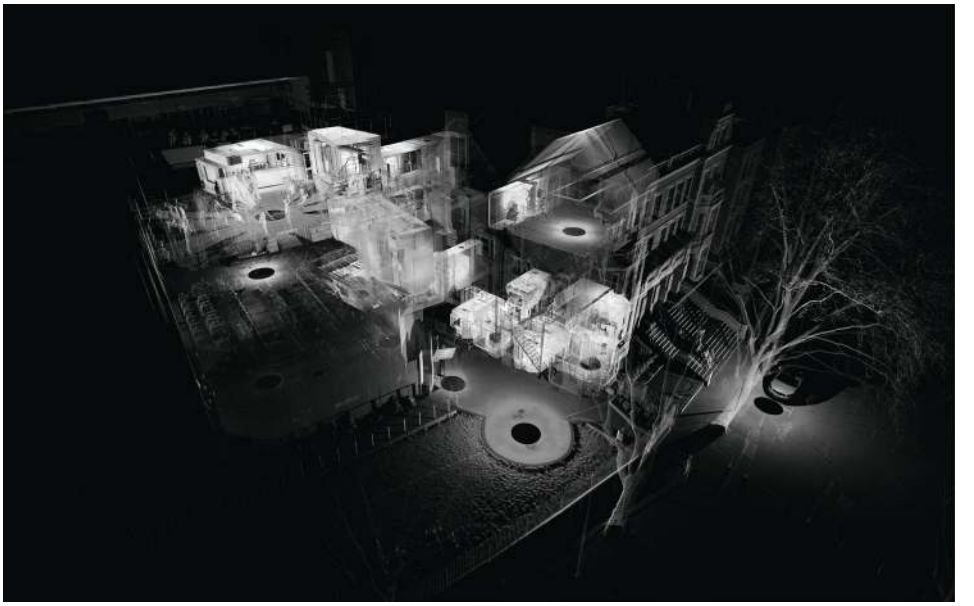
Looking at perspectival representations of the assembled scans, the opaque walls and floors of the buildings dissolve as they are turned into clouds of millions of points, whose pixel size and hence opacity can be controlled within the digital model. The spatial correlations, lost in the additive complexity of the floor plans and labyrinthine circulation, become transparent and legible.

However, the conventional metrological use of the scanner as a realist instrument of truth—elucidating, revealing, making legible the site—was simultaneously challenged during this first survey. The exercise to scan selected areas of the RCSSD was exploited for simultaneous performance experimentations

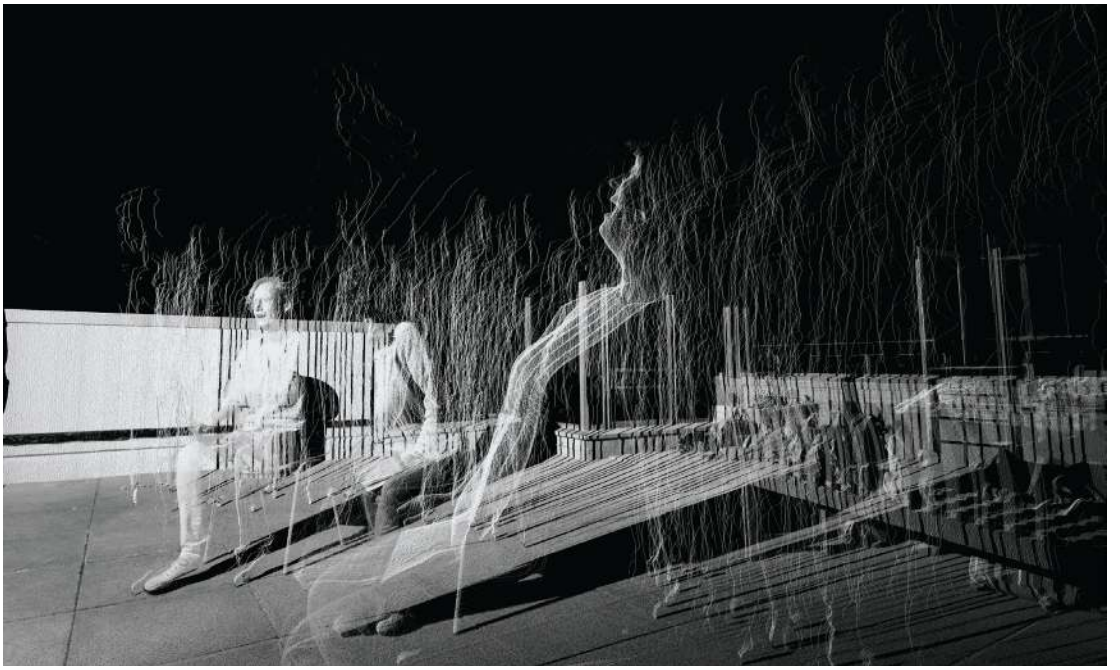
by two production groups, SHUNT and a group of performers soon nicknamed “CSI” due to their interest in the forensic use of scanning technology. Some experiments were spontaneous and others were partially scripted, based on a briefing by ScanLAB prior to the survey. Each experiment was designed to explore the implications for performance and documentation generated by the time-based spatial capturing offered through 3D scanning. The experiments intervened across a suite of scheduled capture positions with unscheduled performance tests that explored conditions such as sound, movement, materiality, dialogue, montage, blind spots, building fabric and narrative.

A first set of performance experiments created narrative tableaux wherein the actors, like in early photography, would stand still waiting for “full exposure” while the scanner's rays swept past them (depending on resolution and accuracy, the scanner describes a 360° rotation that creates tens of millions of measured points in a matter of minutes). Soon, however, the performers recognized this very rotational movement as inherently choreographic, a time-based constraint and opportunity creating a narrative space to be inhabited by their performance. It meant that, for example, one moving performer could appear multiple times within a single scan. Also, as the scanner reads a scene as concentric sections of reality, it can slice a moving body, disassembling, warping and extending it.

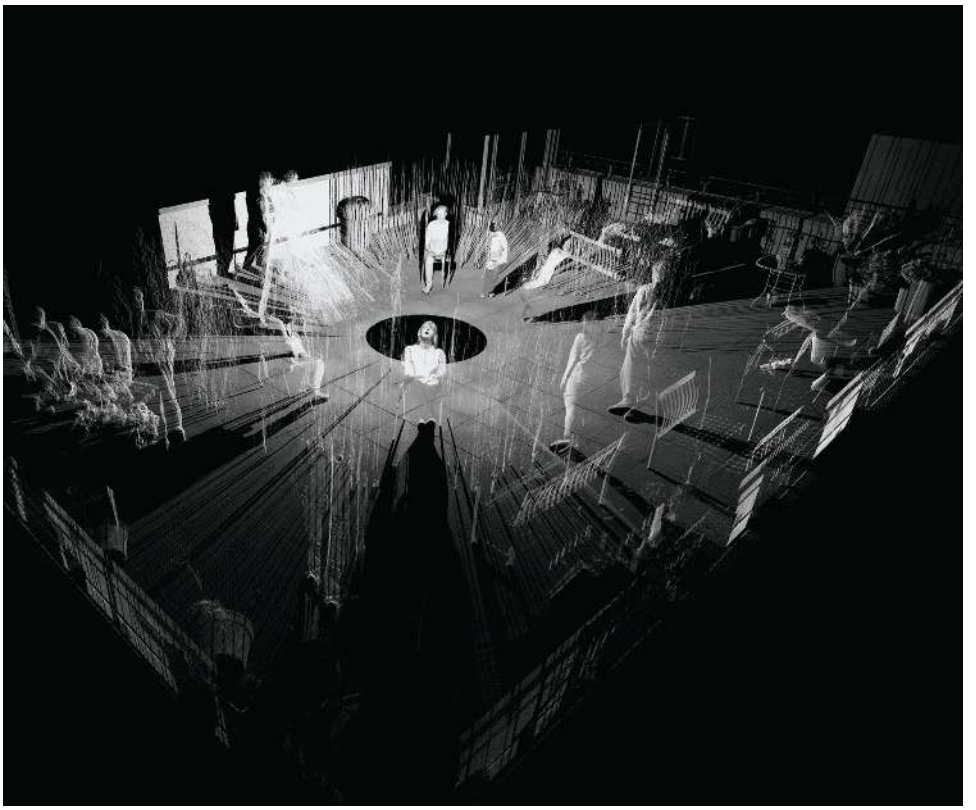
Shady evidence: first scanned performance experiments staging fictitious forensic scenes and exploring the scanner's shadow zones.



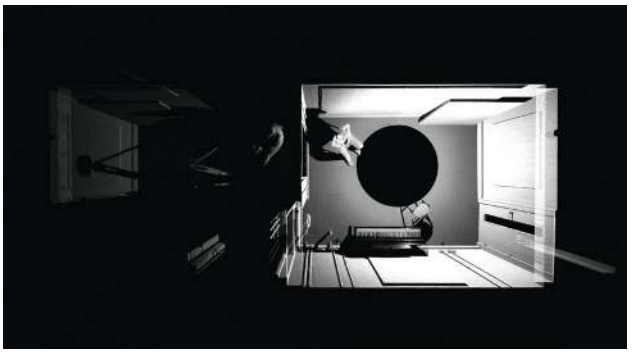
The elucidating scanner: the complex spatial correlations of the labyrinthine RCSSD buildings are rendered transparent and become legible.



A digitally displaced, multi-perspectival point cloud.



“There is no circle”: the scanner reads the scene as concentric sections of reality; it slices, disassembles and recomposes performing bodies.



The Crying Room: the performer's "blind side" appears in a non-existent, mirrored digital room created by the ignorant scanner.

The notion of time-based tableaux or of a "live" site survey emerged, and established the ambiguity between the forensic accuracy and "realist" capture of the scanner on the one side, and its phantasmagoric, fictional, and deceptive potential on the other—an ambiguity that would remain the main impetus of the rest of the project.

BENDING A BLIND MAN'S CANE

One key scene, called "the Crying Room," enacted and scanned during this process of live surveying, would become crucial to the further development of the piece. The scene involved a woman, crying and reciting a text in front of a large mirror in one of the RCSSD's many rehearsal rooms. The resulting point cloud model showed a non-existent, mirrored digital room, in which the performer's "blind side" appeared.

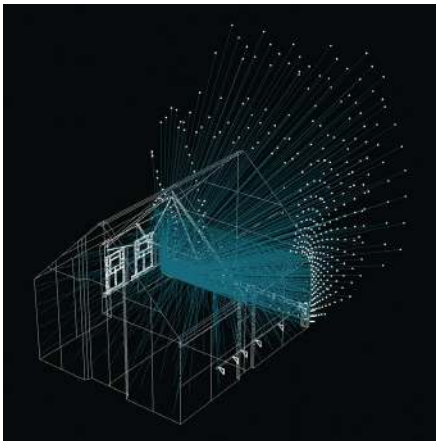
This is explained by the fact that the scanner's laser ray measures strictly one-dimensionally—rather like Descartes' (faulty) description of vision as a blind man stabbing his cane in the dark until it meets an object. What happens here is that this cane is "bent" or deflected by the mirrored surface and travels on to meet an object in front of the mirror. The ignorant blind man (the scanner) however assumes that the object lies in the extended direction of his stabbings and thus digitally creates this parallel, fictional room behind the mirror.

This result provoked an interest in developing the reflected data as a parallel

performance space exclusively within a digital environment. Scanning instrument manufacturers recommend to avoid capturing shiny or reflective surfaces, as these would generate noise in the resulting point cloud. By focusing on what we were advised not to do, reflection became a key tool in establishing and manipulating an additional, purely digital, extended performance space. A design and prototyping phase followed, with the aim of transforming these mirrored spaces from incidental digital spillages into purposefully created mirages. Custom software components were scripted that reverse-engineer the reflections created by parametrically controlled reflective panels and can calculate the position of the resulting displaced point clouds in relation to the performance position. The point cloud produced during the initial survey was not only essential for this simulation of the scanner positions and the reflective panels' orientation but also for the design and prototyping of the prosthetic armatures that would hold them in place. The accuracy of the scanning data and digital simulation could be passed on into the physical prototyping stage through the implementation of digital design fabrication methods (laser and waterjet cutting) that allow for the fabrication of bespoke and highly precise insertions that fit accurately onto the scanned building elements.

DIGITAL DOPPELGANGERS, COLLIDING MID-AIR

Adding digitally fabricated spaces using these developed simulation algorithms provided a new scenographic strategy towards the given site conditions, a strategy governed by the ambiguity between making the labyrinthine building transparent and legible on the one side and, on the other side, the urge to continue and emulate the additive complexity of the as-found physical space through an equally complex juxtaposition of



From spillage to engineered mirage: custom software component written to parametrically control reflective panels and displaced performance point clouds.

fabricated digital spaces—hence adding even more “rooms” to the building.

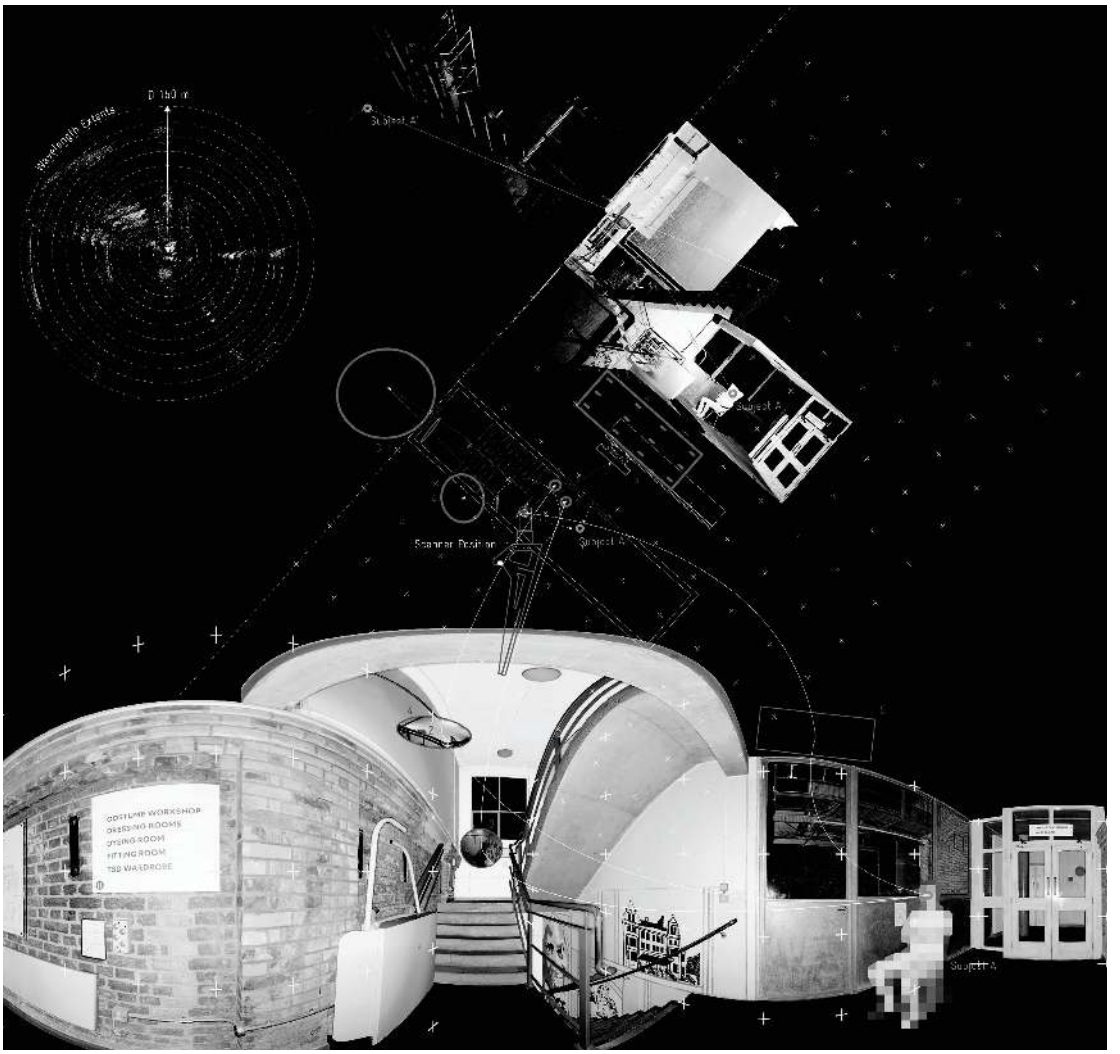
A series of positions within the RCSSD building were selected to receive the installation of paired bespoke instruments creating such digital performance spaces. Each of these paired instruments incorporates a 3D scanner head mounted on an armature that faces a second housing of programmable reflective panels. The orientation of the paired elements to one another is informed by results of the live survey and further develops the enactment of a performance in real space that is designed to be read and alternatively explored in a digital model. The installed instruments capture performances that are designed to “occupy” the hidden space in the presence of an audience who only sees the performance that is being reflected. All reflected digital spaces sample, copy and paste elements of indoor rehearsal and circulation spaces to converge in the (digital double of the) courtyard of the building, piercing the walls that surround it and colliding in suspension high above ground.

The resulting conglomerate of digital and physical performance spaces reminds of Katrina Varian's project, one of the 2008 students who imagined a series of external “parasite” spaces enveloping the RCSSD's courtyard to house experimental performance and audience locations. However, as opposed to her project— and more general to the first phase of the collaboration—it is not *The Scan*'s physical insertions that form the actual scenographic space. The reflective panels, rather than being a scenography in their own right, are both signifiers of and triggers to the digitally extended scenography. Like in illusionist baroque painting, surfaces become a portal to a further three-dimensional space that supposedly/ digitally lies beyond them.

Around a first of these scanner positions, a scene is staged in a staircase on the north side

of the courtyard. Through three pairs of mirrors, a scanner on the upper floor captures a single performance, which is taking place on the lower floor, simultaneously from three different angles. These three different “views” are projected outwards (using the logic of the blind man's broken cane—which in this case is broken twice) and are digitally created as fictional spaces floating above the courtyard. This scenario is not only post-perspectival but also post-Cartesian as it explodes, multiplies and scatters the xyz-values of a single geometric entity into a digitally displaced, multi-perspectival point cloud.

A digitally displaced, multi-perspectival point cloud.



Post-Cartesian explosion: three sets of bespokely fabricated mirrored instruments capturing a single performance simultaneously from three different angles.

A second scene is developed for the ballet room, in which the two techniques described above— the scanner's rotational choreography and the reflective screens—are combined. An array of ten mirrors delicately balances from the ballet rail and against the wall, lined up like serially connected metallic ballerinas. As the scanner makes its rotational movement and sweeps across these mirrors, each mirror consecutively reflects its rays towards one and the same focal point for the duration of a couple of second. Hence, a performance, taking place on this "hot spot," is reflected, scanned and digitally "created" ten times behind the mirrors. Hovering three stories above ground, a four-dimensional "film reel," a spatialized Muybridge image sequence occupies the space beyond the wall, capturing the performance in ten consecutive "frames."

The performers, by studying analytical drawings and through scanned rehearsals and explorations of the resulting digital point cloud mirages, become accustomed to inhabiting and interacting with this four-dimensional scanner-timed scenography. They become guides for the audience and their projected digital doppelgangers.

RE-FRAGMENTING THE MIRROR STAGE

As time and gestures are exploded in space, the spatial and temporal realism of the point cloud is dismantled. Instead of the snapshot quality of a "unique" moment in time and space, a multiplicity and complex layering of both unfolds. With this spatio-temporal disruption, the notion of the autonomous performer/audience/subject as a unique spatial and temporal individual is exploded, too. If in the classical Lacanian theory of the so called "mirror stage," the child, by recognition of an image of the "self" in the mirror, develops an "imaginary wholeness" and self-consciousness, the mirrors in our case are used to quite the opposite end: they are devices that re-fragment notions of selfhood, identity and subjectivity.

This spatially scripted sense of fragmentation and displacement also becomes part of the spoken script of the piece, in which the role of the audience, which is led through the (digital and physical) spaces by the performers, is constantly obfuscated and ambiguated:

A: This is a summary of events.
You are all here.
We are walking in a circle together.
B: You aren't here.
You're jumping through walls and looking at yourself in the mirrors.
In some you look fatter.
There is no circle.

The audience's—partially uncomfortable—submission to the machine-timed and machine-recorded choreography destabilizes its usual centrality as the singular consuming perspectival "eye" to whom the piece is directed. As many scenes are acted out for the ominous post-perspectival eye of the scanner, the audience looses its privileged position—reflecting a post-anthropocentric reality in which a plethora of heterogeneous non-human eyes and agents have complemented or even replaced human vision.

The audience thus is confronted with its own inability to grasp the full "picture" of what is happening. This is not only due to the relative novelty of 3D laser scanning technology to most of the audience, but also due to the decision not to provide visual feedback (for example as a perspectival representation of the digitally created, partially fictional, point cloud) during this stage of the performance. This "reveal" will find place later in the piece and will be discussed below. For now, the absence of instantaneous representation is not only a technical issue,[5] but also a conscious curatorial decision: implementing visual feedback (be it through screens or more immersive technologies such as virtual reality goggles) would merely re-establish the perspectival centrality of the detached human observer and thus reinstate the "scopic regime" or "Cartesian perspectivalism."[6]

5 —
The laser scanners we use don't allow for real-time visualization.

6 —
Cf. Jay (1988, 4).

Parallel to the displacement of the audience's privileged spectatorship, a shift takes places towards a sense of audience authorship—however unclear this authorship may be at the moment of the actual performance—and hence towards an erosion of the sole authorship of both scenographer and performer. The humanist notion of an active subject/author, acting upon a passive world of objects—matter in the case of the architect, the audience in the case of the performer—is dismantled in favor of a notion of co-authorship over unfolding events.

From the onset, a fertile friction arose between our scenographic intentions—the prescriptive clockwork choreography described above, assuming the magician's (all too) perfect control over the engineered surrealism of their test person's reflective fragmentation—the performer's associative interpretation, and the audience, unknowingly stepping in and out of a "hot spot," a cross that marks their simultaneous vertiginous suspension fifteen meters above the courtyard behind the wall.

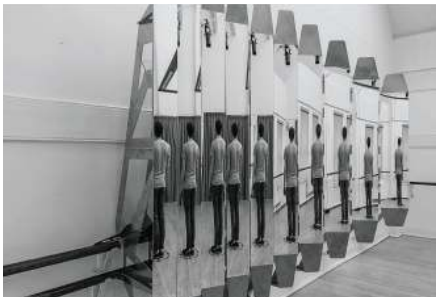
This notion of shared authorship however, goes beyond what would be commonly categorized under "public participation"—as it is not confined to the human actors involved but extends well beyond into a more ontological sense of participation that comprises human and non-human "actants" alike. The scanner, for example, becomes a central actor/performer in the piece. This is true in both a literal sense—the scanner being referred to in the text, being turned into an ominous and wondrous object, a spatial mediator around which the performance revolves—and in a more epistemological sense— the scanner not just being a passive *camera obscura* capturing the scene but an operative agent actively creating and augmenting the scene. As such, all human and non-human agents form a network that mutually creates the unfolding of the co-authored piece.

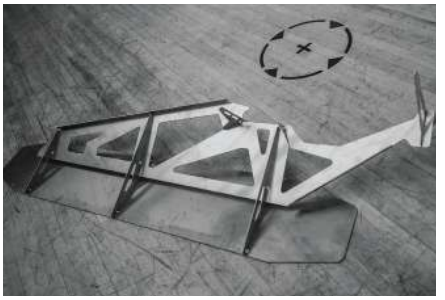
NO APPLAUSE

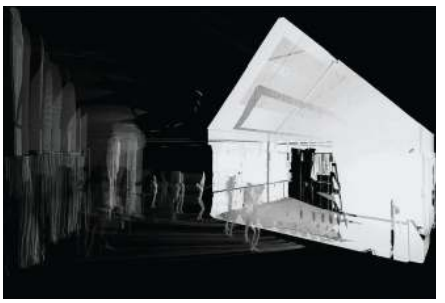
In the final act of the piece, after being guided through the building and along a series of scenes and scanner-timed choreographies, the audience is led through the backstage area and gathers onto the stage of the RCSSD's Embassy Theatre. The space is dark, the auditorium hidden behind the fire curtain. Projected onto the back of the fire curtain is a dense multimedia relay of point clouds, 3D models, animations, CCTV footage, infrared footage, photography, sound recordings and dialogue recorded during the piece. The performers sit lined up behind a long table full of computers and technical equipment and in front of the projections, facing away from the public. In hushed, barely understandable voices and using technical terms, they discuss the projected material. They react indifferently to the intrusion of the audience, suggesting a process that has started long before the audience arrived and will continue after they leave.

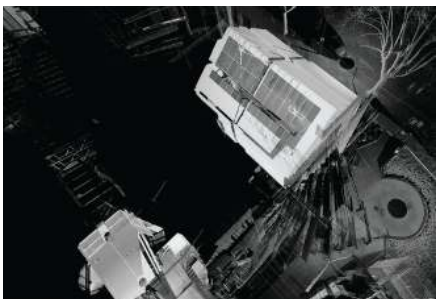
Again, the members of the audience no longer sit comfortably in their detached and privileged auditorium but instead become aware that they have been performers themselves, observed by a multitude of post-perspectival eyes. The choice of the backstage location is of course symbolic, displaying the system of pulleys, ropes and counterweights that normally provides the machinery and armatures for illusionistic scenographies. Now surrounded by this machinery, entangled in the inner workings of the performance, the audience is immersed in the unintelligible hyper-analysis of their own actions. Marking the end of the piece, the fire curtain rises. The projections disappear and actors, scenographers and audience face the auditorium. It is empty. There is no applause.

Masked performers inhabiting the focal point of the ballet room mirror array.









Hovering above the courtyard, a four-dimensional scan sequence captures the performance in ten consecutive frames.

POLYSCENIC ASSEMBLAGES

The largest part of the multi-screen display is taken up by projections of point cloud models. The scans are composited, digitally stitched together as is normally done after a scanning survey—only that now, the digitally created, parallel performance spaces appear, imploding the building's spaces into the courtyard. Hovering above the courtyard, mirage spaces overlap; performers and members of the audience hang upside down, protrude through walls or intersect with the fire escape staircase. While some fly-through animations are made before the evening of the performance, stitching together scenes from the initial survey, juxtaposing them with point clouds created during rehearsals, other point cloud displays are shown "live" by an operator panning through a model, layering "fresh" material from the evening's scans onto previous point clouds, further destabilizing time-scales. The operator zooms into a person's face in the ballet room, the face dissolves into points as we come closer: was this a performer, a member of a previous audience, a mirage?

The process of digital grafting, not only deconstructs the spatial realism of the composited scenes but also undermines the temporal realism of the snapshot moment as it blends and layers time-scales into a non-linear narrative spatio-temporal assemblage, suggesting the progression of performers through the scenes, playing different roles, enacting different scenes simultaneously. The plausibility of this narrative is constructed through the "optical consistency" (Latour 1986, 8) of the point cloud—again reminding us of what Latour, in the case of perspective, called "reshuffling the cards of reality." Indeed, the resulting scenes could be likened to so-called polyscenic paintings of the *quattrocento* renaissance, in which, using the then recently discovered (or re-discovered) unifying technique of perspective, multiple sequences of a story (e.g. Botticelli's *Three Miracles of Saint Zenobius*), were depicted within one single

perspectival scene, framed by an assemblage of existing and fictional architectural elements.

It would be oversimplifying, however, to consider these spatio-temporal point cloud assemblages as endpoints of the piece—as if describing a linear process of deception and revelation in which a "trick" played on the audience is resolved in a communal revelatory backstage aha moment. Such would not do justice to the complex and entangled notion of the digital (and its relation to fabrication) that was built up throughout the collaboration, and of which a brief discussion seems apposite at this point.

DIGITAL SCENOGRAPHIES FOR A SATURATED SPACE

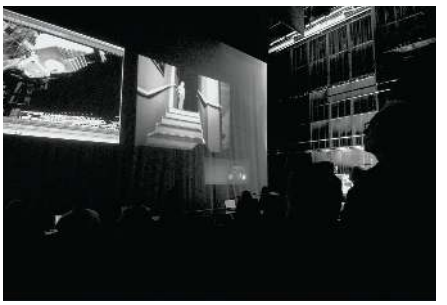
As with many practices, theatrical production has been revolutionized by digital technology. Performers such as Blast Theory, Me and the Machine (*When We Meet Again*), Rimini Protokoll (*Situation Rooms*) and Janet Cardiff (*Ghost Machine*), to name but a few, have successfully developed works that exploit the fluidity of contemporary life populated by digital media and technologies, where the audience experiences the event through devices such as phones, tablets and laptops. This is a novel route to open up new realms for performance in the context of environments that are increasingly digitally saturated and where audiences are literate and active in multiple spatial domains, such as receiving and transmitting location data, identities, information, contacts, media, et cetera.

In Janet Cardiff's *Ghost Machine* (2005), for example, the participants receive a camera with a pre-recorded tape and a set of headphones, which guide the participant through the theatre building. The videotape shows footage that was shot from the participants' location but at a different time so that "they find themselves in a confused jumble of overlapping realities" (Cardiff Miller 2011). This piece is characteristic of a theatrical practice that takes on the notion

of what could be called a hybrid or "augmented" scenography, to which, in parallel to the physical set, digitally represented sets and narratives are added as layers of information and representation.

At the moment in which they are experienced by the audience, however, such digitally augmented scenographies are closed, one could say pre-fabricated, so that even if the participator might move freely through them, she/he is not actually involved in their creation. This means that, eventually, the creator-consumer relationship between scenographer/performer and audience—and its sense of closed authorship—remains unaltered. What our approach suggests is a notion of fabrication not as a finished or finite process but as the ongoing production of phenomena mutually created by all human and non-human agents involved.

Reveal: entangled in the inner workings of the performance, the audience is immersed in the unintelligible hyper-analysis of its own actions.



DIGITALLY FABRICATING / FABRICATING DIGITALITY

A crucial shift in the notion of digital fabrication has taken place since the first collaboration of Protoarchitecture Lab with the RCSSD. In the first phase (vaguely coincident with the PerFORM project discussed at the beginning of the article), digital fabrication was understood as a methodology which, through the aid of digital metrology (3D scanning), digital design tools (CAD), and digitally controlled manufacturing (CNC), allowed for a heightened accuracy, customization and complexity— but which eventually still culminated in the fabrication of physical artefacts or sets.

This phase could be called *mimetic*: each consecutive translation between the digital and the physical is measured by the accuracy of its replication—the digital point cloud model is valuable because it accurately and realistically measures and represents the captured physical scene; the physical artefact or insertion is in turn evaluated by the low tolerance

of its materialization of the digital design model. This mimetic, consecutive impetus also marks the nature of the collaboration between scenography and performance—the flipbook notion of a scenographic architecture being a mechanically unfolding spectacle emulating the movement of a performer; and vice versa the consecutive "re-enactment" of this movement by a dancer's gestures.

In a second phase, a notion of translation and fabrication emerges that is *augmentative* rather than mimetic—all while retaining the pragmatic benefits of this mimesis. When the scenographic insertions, which are bespokely designed based on a "realist" scan and implemented into the site, are re-scanned, our digital point cloud mirages appear as elements that are additionally *created* by that very translation process. The role of the scanner as a tool of *verification* is ambiguated in that it both checks the truth (accuracy) of the insertions and *creates the truth* (from *verus facere*, to make true) of the mirages. A novel, extended sense of fabrication emerges, which comprises both the digital fabrication of the physical (using scans as a source of information) and the physical fabrication of the digital (using scans as a sources of fiction). The insertions, *digitally fabricated, fabricate digitality*.

FABRICATING FOR AN ENTANGLED DIGITALITY

The reader might sense the danger however that, by adding a next, be it digital, stage (the fabrication of digitality) to a linear fabrication workflow, we might be merely stretching its teleology with yet a new, but equally *final* goal. Therefore it is important to note that also the digital point cloud assemblage cannot be read as the new definitive goal, the ultimate repository of our scenographic practice. During the process of our experimental collaboration, a practice emerged that is instead characterized by a constant feedback between physical and digital creation. The digital site, the point cloud

archive, becomes a parallel performance stage that is constantly fed by (i.e., being scanned), but also feeds back into the physical space.

This feedback of the digital back into the physical affects both the appearance and experience of the physical performance space. Visually calibrated by the mirror and scanner armatures and annotated with markers indicating origins, hot spots and movements, it constantly refers to the parallel digital spaces being created. Maybe even more important, however, is the performer's accumulation of technical and spatial literacy regarding the resulting point cloud models: after each rehearsal session, performers and scenographers would sit down to explore and navigate through the resulting point clouds, compare and composite them with older results and refine strategies for further rehearsals and performances.

This way, each consecutive rehearsal becomes more and more deeply saturated with both the imprint of a remembered digitally created space and the anticipation of the digital space being created at that very moment. As the performers develop a sense of simultaneously inhabiting this digital space, they become guides to these spaces, leading the audience through its digital pitfalls:

A: We can see things you can't see // B: It's not always helpful // A: I can see through that wall // B: It's not very interesting.

Also, they develop techniques that creatively exploit the point cloud space's own peculiar rules and laws, modes of mobility and observation. When one performer, during the piece, starts writing the opening lines of T. S. Elliot's *Four Quartets* on the exterior wall of a ground floor rehearsal space, she does this *backwards*—literally becoming more literate within the point cloud space, she knows that digitally standing within the rehearsal space, she will be able to read it through the wall as soon as it dissolves into points:

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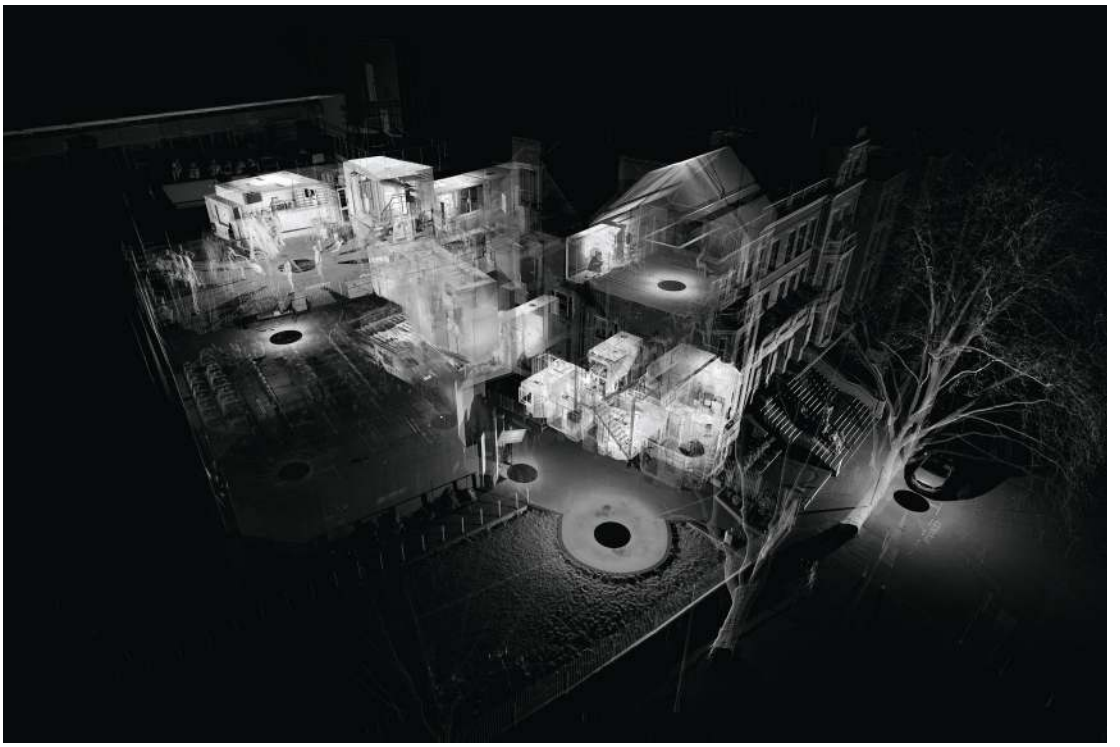

The elucidating scanner: the complex spatial correlations of the labyrinthine RCSSD buildings are rendered transparent and become legible.

Time present and time past
Are both perhaps present in time future
And time future contained in time passed.
If all time is eternally present
All time is unredeemable.
What might have been is an abstraction
Remaining a perpetual possibility
Only in a world of speculation.

Eventually, the physical space surrounding us dissolves into points, even without the mediation of its perspectival representation. As in Elliot's Quartet, scales of time and experience are now inextricably mingled, each performance taking place in its present physical space as well as interacting with the previously and presently recorded and soon to be represented space. In our digitally saturated age, digital fabrication becomes an ongoing reciprocal, non-teleological process, the digital and physical being both thoroughfares of an emergent digital-analog assemblage, an entangled continuum in which it is useless to attempt to distinguish what is represented or actual, recorded or created, fact or fiction.