S-337473

wexner center for the arts
AT THE OHIO STATE UNIVERSITY

SARAH OPPENHEIMER **S-337473**

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OUR BEST MACHINES ARE MADE OF SUNSHINE

Alexander R. Galloway

How did the computer learn to see? It is a difficult question, to be sure. The most common response is that the computer learned to see from *the movies*, that is, from the 20th century's most highly evolved technology of vision. But then where did the movies get it from? From 19th-century still photography of course, which apparently got it from the venerable *camera obscura*, which in turn gained the faculty from the sun itself. As an origin myth, the story has the benefit of being neat and tidy, perhaps too tidy, a bit like the old story of how Prometheus transferred the technology of illumination from divine nature to mortal man. An engaging tale, it nevertheless bears the distinct disadvantage of not being even remotely true.

How did the computer learn to see? A better answer, and the answer provided here by Sarah Oppenheimer in her work *S-337473*, is to say that the computer learned to see not from cinema but from *architecture*, specifically the tradition of architectural modeling—that special mode of sculpture devoted not to the integral object but to complexities of the built environment.

Instead of focusing on architecture in the classical sense of temples and monuments, or caves and campfires (as architecture critic Reyner Banham once put it), Oppenheimer focuses on space as the virtualization of multiple media systems. Just as an architect must multiplex across the many different aspects of design—acoustics, heating, envelope, structural engineering, environmental impact, and so on—Oppenheimer is attentive to the constant translation between media systems and tools: from 3D modeling and industrial fabrication to floor plans, pictures, video animation, even patents and intellectual property. In this sense her work exists *in medias res*, in the midst of things, or, better, in the *media* of things.

Part of this alternative conception—the notion that computers work more like an architect in a space and less like a photographer with a camera—has to do with a particular contract made between perception and the objects of perception. The photographic version of the contract, if it were drawn as a diagram, would resemble a cone splayed outward from an origin point, like a horn. This model assumes that something of great importance occupies the spot at the tip of the horn, something important like a lens or an aperture or an eyeball or a subject. Starting at the focal point, photographic vision fans out into the world, locating objects in proximal relation to the origin. Because of its putative resemblance to human vision, what with its rich focal point

(the eye, the mind) and conical purview (the human gaze), the photographic diagram has indeed been quite influential, playing an outsize role in philosophy and culture.

The human eye is too rich. Physiologically the eye has accumulated an excess of perceptual power. It looms over the other senses, disciplining them and claiming their territory for its own. Pity the eye, for its very success is a kind of handicap. Like the glutton who can no longer experience pleasure, the eye is so ravenously successful at raw perception that it obstructs and stunts the other senses. We are those fiddler crabs whose single claw, oversized and asymmetrical, lords over an atrophied body.

Gilles Deleuze used the term “deterritorialized” to describe the human face. His claim is counterintuitive at first, given how the face is home to a number of fragile and complex organs, the eyes above all. But Deleuze saw the face as deterritorialized because of the sheer amount of stuff that passes through it every day, stuff both material and immaterial. More promiscuous than the skin or the genitals or any other part of the body, the face allows for high throughput of air, food, and water, plus immeasurable amounts of sensational riches, from texts and ideas to caresses and kisses.

Yet what Oppenheimer’s work shows is that the translation effect of computational media has finally impoverished the eye, thereby hastening the dissolution of the face. Indeed, computational vision is also conical, but inverted, more like a funnel with the tip facing away. Here the perceiving subject is not focused into a dense, rich point, but diffuses itself outward toward the edge. The object, by contrast, lies at the point of the funnel, receiving all the many inputs issued to it from the perimeter. Thus if the photographic eye is, as it were, *convex*, like the prow of a ship jutting out into the world from the middle, then the computational eye is *concave*, flanking and encompassing the world from the fringe.

In other words, architecture, modeling, transmedia practice, and all those art forms where the complexities of system and dimension are more important than the integrity of the photographed object or the camera’s particular point of view, share a special condition, not so much a problem to be solved but a state of affairs waiting to be explored. The condition is simple: assume that objects and worlds will be viewable and manipulable from all sides in multiple dimensions. Industrial designers encounter this condition frequently; producers of conventional theater have likely

PREVIOUS PAGE
K-18_L of *S-281913*
Construction plane 01 (CP01) views:
top, right, and section

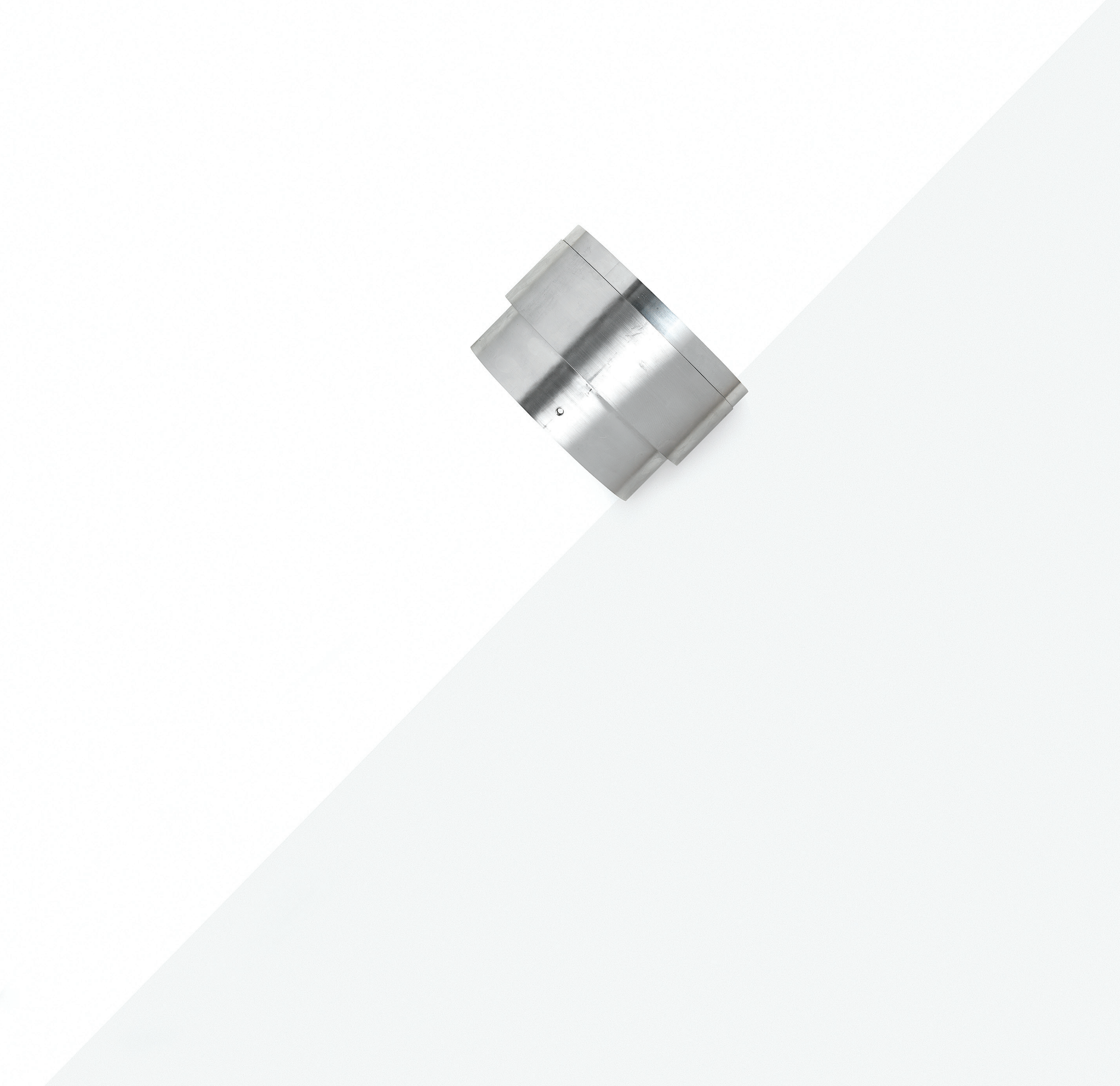
THIS PAGE
Lower kinetic group of *S-281913*
All construction plane views (CP01, CP02, CP03):
top, right, and front

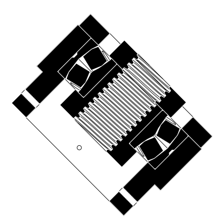
never considered it. Architects, all the time; photographers, almost never. And, it turns out, computer modelers encounter this condition as well. It is a basic part of what they do every day.

In conceiving *S-337473*, Oppenheimer's procedural method extends this logic of visualization throughout each phase of the work's development. In documenting the work, she took photographs of its kinetic detail, specifically the parts of the bearing assembly that allow the work's large glass boxes to pivot smoothly in the gallery. Each gorgeous hunk of metal is captured systematically according to a prearranged series of shots. Since these machine parts were first designed in software, Oppenheimer chose to mimic the same c-plane (or construction plane) views that she had grown so familiar with on the computer screen. Dubbed by the artist World Top, World Top 45, and Double Bias, her three c-plane views (along with nine correlated views) demonstrate the free-floating nature of computer vision, but also its regularity back into customary angles and perspectives. So while these are photographs, they are only photographs when considered in isolation, and thus only photographic by coincidence, as it were. Together the group of images indicate a way of seeing appropriate to computer modeling. Photography says *here is a view*, but modeling says *here are all of the views*.

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*. The issue is not simply that vision has become abstract, and not simply that vision has been set free from its subjective mooring, feats already accomplished during the Renaissance if not earlier. The crux of the issue is that seeing no longer requires a *point*. Indeed if we persist in granting the camera obscura pride of place within such a genealogy, the narrative will always return to the same point; luckily other arts (chief among them architecture, modeling, and postminimalist sculpture) exist to demonstrate the utility of pointlessness.

The concept of neutral vision has been taken up in many different ways throughout history. It has also played a role in the development of empiricism and the objective sciences, along with, in a different way, political theories about blind justice and the indifference of the machines of state. And of course the point of view has long been a problem in painting, the most ready if not clichéd example being cubism. Still, none of these approaches discards the eye entirely. These various techniques merely modify the quality of the eye, allowing it to be fluid rather than fixed, objective rather than subjective,



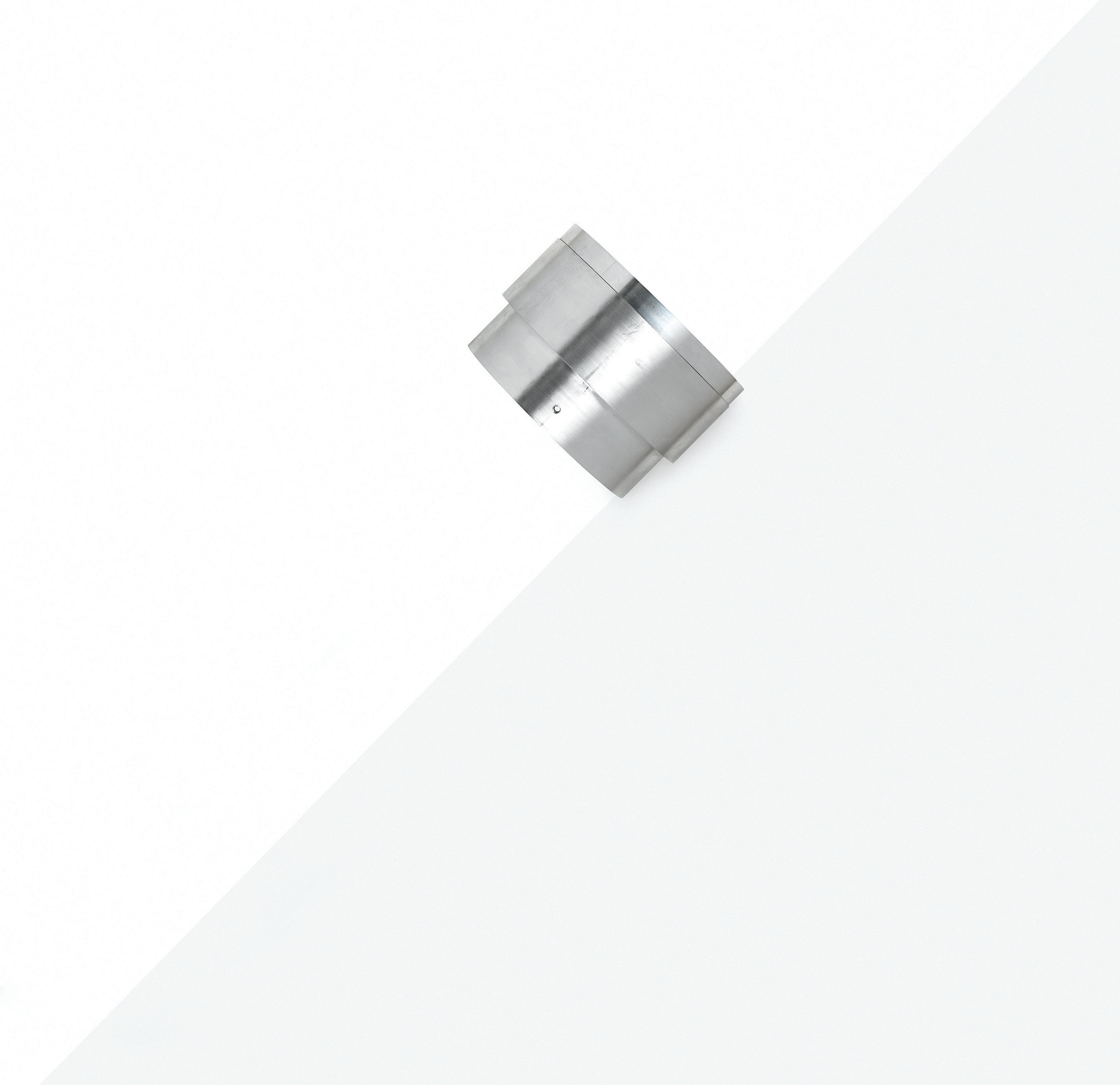
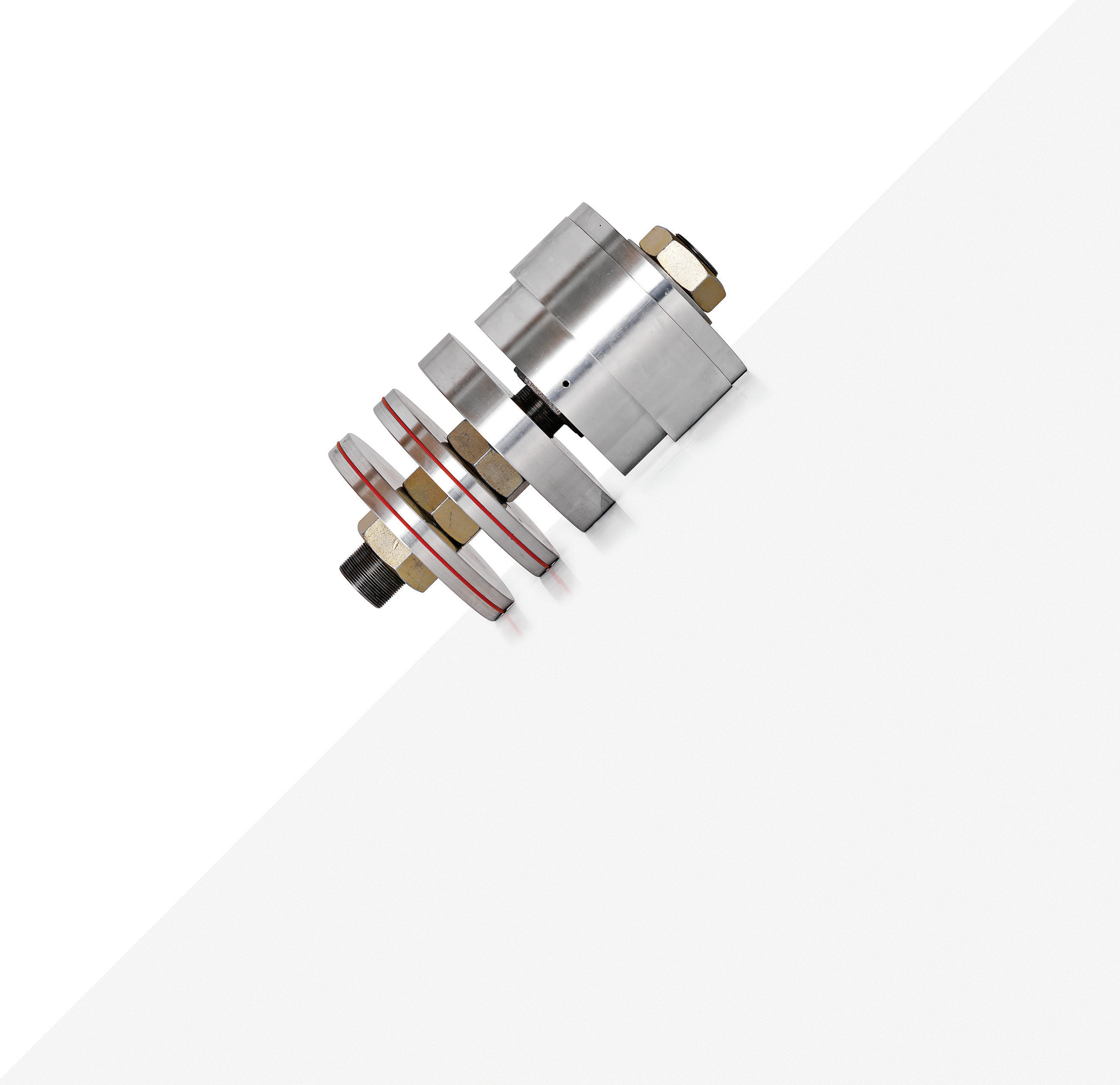


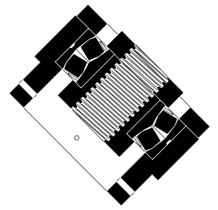
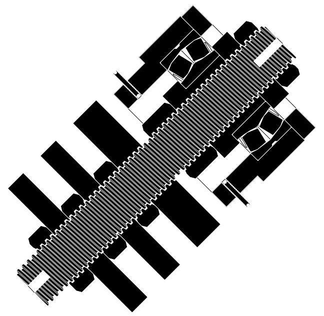
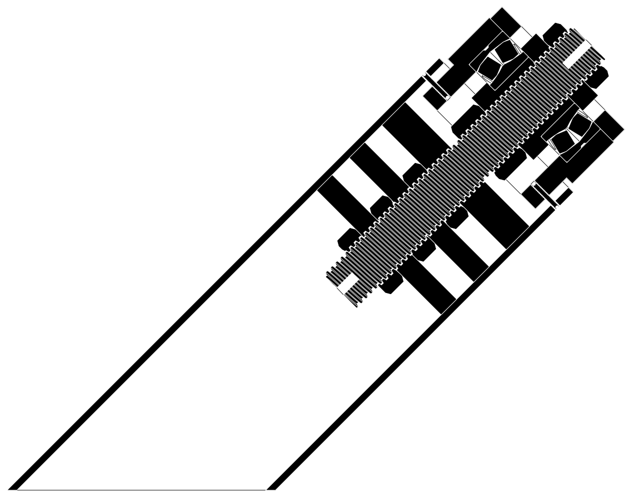
GATEFOLD (OPEN)
The lower kinetic assembly of *S-281913* is inserted inside tube KS-02 to become a component for the lower portion of the work.

LEFT
Lower kinetic group of *S-281913*
Construction plane one (CP 01)
views: right and section

CENTER
Lower kinetic assembly of *S-281913*
Construction plane one (CP 01)
views: right and section

RIGHT
Lower kinetic assembly and tube KS-02 of *S-281913*
Construction plane one (CP 01)
views: right and section

or neutral rather than motivated. So what would it mean to see something in all ways from all sides at all times? Not merely abstractly, not merely objectively, not merely neutrally, but actually? An "ethical" vision will be its proper moniker, for the ethical is that mode in which all points and positions dissolve in favor of a single, generic claim: "no one is illegal"; "all is love"; or, here, "there is no point of view."

Historically there have been two basic ways to obtain such ethical vision, either via the multiplicity of vision (the schizophrenic route), or via the virtualization of vision (the gnostic route—after the ancient Gnostics who privileged spiritual vision over sight limited by the material world). And if the cinema is a schizophrenic machine with its jump cuts and multiple cameras and parallel montage, the computer is most certainly a gnostic one, promising immediate knowledge of all things at all times from all places. Ironically, any art form in which seeing does not require point of view will experience a newfound freedom to reduplicate points and views to infinity. Here visuality does not vanish. On the contrary, visuality goes metastable, changing state and appearing at any place and any time under the aegis of the "virtual camera."

Vision is just a variable for the computer, a variable like anything else. And the typical elevations and sections inherited from architectural drafting are now as fungible as any other kind of input. Three-dimensional modeling software like AutoCAD or Rhino uses the concept of the c-plane as a way to identify separate, local coordinate systems different from the global Euclidean one. Oftentimes construction planes are mapped onto the faces of things, particularly faces that do not synchronize neatly with existing global axes (or what are called "world axes" in these programs). For instance the tilted outer wall of a pyramid might have its own construction plane, rendered flush against the triangular face without the foreshortening distortion of a typical elevation. Other times construction planes are attached to virtual objects, as a way to follow the object's local coordinate space.

In developing the kinetic logic of *S-337473*, Oppenheimer remapped these construction planes in her digital model to align with the work's axis of rotation. Positioned at a 45-degree angle to the planes of the gallery walls and floor, the vertical axis of the digital model is also oriented at a 45-degree angle with respect to the axis of gravity. The glass planes (and structure) rotate around this axis, articulated by an industrially scaled tube. Each tube simultaneously serves as the glass boxes' structural support and as the housing of a dynamic hinge. The dynamic mechanisms remain buried within the tube or wall. Ease of motion is important.

Bearings allow each glass box to pivot 180 degrees, and a rotational damper modulates this motion, decreasing acceleration and returning the piece gracefully to rest.

Glass and light are key elements in modernist architecture, as well as key signifiers in modern culture at large. As metaphor alone, light is ubiquitous within philosophy and art, and glass has long captured the attention of builders, from the 1851 Crystal Palace in London to the tallest skyscrapers of today. Cognizant of these many possible lines of allusion, but not debilitated by them, Oppenheimer opens a number of lines of conversation. The louvered *brise-soleil* is a recurring detail within architectural modernism, as designers grapple with the most effective way to select between illumination and shade (while also hopefully beautifying the building's facade). And architects like Ludwig Mies van der Rohe have long sought to uncouple engineering from form, moving engineering details like weight-bearing columns away from the corner of the building, then adding glass cladding as a way to accentuate the mystery. Here Oppenheimer performs a similar feat; each diagonal axle appears discontinuous, even while the glass boxes retain their structural integrity. As the glass panels pivot through space, reflecting and refracting light, they seem to rotate around nothing at all.

The viewer of the work is, in essence, operating an enormous switch, reorienting the piece and realigning the angle of the light, just as Oppenheimer herself is constantly switching through a complex field of media formats.

"Our best machines are made of sunshine," wrote scholar Donna Haraway, "they are all light and clean because they are nothing but signals, electromagnetic waves, a section of a spectrum."[1] In other words, computers still use light, even if they abjure the commands of the camera obscura. Computers are made of sunshine because they include things like fiber-optic cables and photon switches. They are made of sunshine in a figurative sense too because they consist of energy moving through matter. The discipline of computer modeling strives to simulate the behavior of light using mathematical equations, and thus is a kind of "sunshine simulator."

To accomplish this, a raft of Renaissance techniques were imported wholesale into computer graphics, from vanishing-point perspective to the diffusion and reflection of light. Media theorists like Friedrich Kittler have chronicled the complicated origins of computer graphics, granting admittance to the modern optical sciences, but also including strange antecedents like radar (which assigns addresses to dots), and indeed text and literature itself (which provides some explanation for all this wordy source code).[2] In fact the history of computer graphics is largely a history of *rendering*, that is, the process of projecting a volumetric space onto a flat rectangle. Oppenheimer is blissfully unconstrained by such a history, instead preferring three dimensions over two, the unrendered over the rectangular, media translation over static object, the model over the screen.

Not screens? No, not exactly. These glass panels are not screens in the conventional sense. They might better be understood as *switches*. A switch is a junction where connections are made, positions are rearranged, or choices are adopted. The various media systems superposed in Oppenheimer's *S-337473*—object modeling, industrial fabrication, photography, architecture—themselves constitute a colossal switch: not a simple on/off toggle but a tangled interchange where multiple media technologies alternate and interact. The grand switch of media translation finds physical form in the interplay of light with materials. In the Wexner Center's galleries, light interacts with the work, and each illuminated ray breaks or bends depending on the position of the glass. The viewer of the work is, in essence, operating an enormous switch, reorienting the piece and realigning the angle of the light, just as Oppenheimer herself is constantly switching through a complex field of media formats.

This physical switch has both static and kinetic components. The glass boxes move, and their very movement provides the capability to switch between states, between positions. And certainly one box is, in essence, a reverse switch of the other; the two boxes are the same shape, only flipped, with the glass in one taking the position of the aluminum in the other.

Glass itself is also a switch, and thus an ideal metonym for the work as a whole. In its very materiality, glass "switches" light by bouncing it, bending it, splitting it, even rejoining it. Consider the humble prism and its magical ability to split light into the spectrum of the rainbow. This is evidence of the switching capacity of glass, but it also happens in any number of other ways all the time, as glass allows for an endless interplay of shapes and images.

In optics, the switching of light happens in two basic ways, via reflection or refraction. The optics of reflection, also called catoptrics, deal primarily with mirrors and the various phenomena of light bouncing off of reflective surfaces.

By contrast the optics of refraction, called dioptrics, deal primarily with lenses and the way in which waves move differently through different materials. (The rainbow is thus a dioptric phenomenon.) In most cases both optical modes will be at work at the same time: a material such as glass or water will both reflect light off its surface and refract light passing through it, creating a complex interconnection of optical effects.

A number of switches are evident in the work, as we have seen, from changes in the viewer's relative position to the kinetic repositioning of the glass boxes. But the basic switch at the heart of the work is that between refraction and reflection. Multiple variables will affect the outcome of the switch: each of the two boxes has two panes of glass, with each of those panes having a front and back face. Add to that the backdrop of the scene, either the white walls of the gallery itself when the light passes clear through, or, when it does not, the boxes' own aluminum walls, powder coated with a black matte paint that eliminates backlighting and thereby heightens the reflective capacity of the glass.

Take the multiplicity of static switches, combined with the continuous variation of the kinetic switches, and the combinatorial possibilities become innumerable. Where will the light go? Which part of the switch prevails—which layer, which surface, which threshold? As it moves, light will encounter these thresholds in sequence, be they translucent or opaque, and bounce or bend accordingly. And through such interaction the work switches between reflection and refraction—or some combination of the two—becoming at one moment a silvery mirror and at another a beguiling lens. The result is less a meditation on light than an experiment within media systems, an experiment in which nothing is revealed except the novel revelation that light might not be revelatory after all.

ENDNOTES

INTRODUCTION
Megan Cavanaugh

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OUR BEST MACHINES ARE MADE OF SUNSHINE
Alexander R. Galloway

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A SWITCH
Laurent Stalder

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17. Thomas, ix.

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DRAWINGS

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INSTALLATION PHOTOGRAPHY

Sarah Oppenheimer
S-337473, 2017
Metal, glass, and existing architecture
Total dimensions variable
Installation views at the Wexner Center for the Arts, 2017

COMPONENT PHOTOGRAPHY

Sarah Oppenheimer
S-281913, 2016
Aluminum, glass, and existing architecture
Total dimensions variable
On view at the Pérez Art Museum Miami, September 30, 2016–April 30, 2017

Photos courtesy Stewart Clements