
INTRO-
DUCTION


SEEING
SCALE

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Introduction: *Seeing Scale*

Several years ago, while researching the monumental images of *The Birds of America* by John James Audubon (1785–1851), I encountered an unexpected epistemological problem. I was interested in the decision that Audubon had made, at immense technical and financial cost, to depict each of the birds at actual size. Why did he choose to work at this 1:1 scale when it would have been so much easier to shrink everything down to a manageable size?[1] I knew, of course, that I would need to look at Audubon's original prints in the original volumes—to see the images, in other words, at their original size—to understand what scale meant to Audubon. I settled down in the rare book room with Audubon's four immense tomes and prepared to be enlightened. But, strangely, I found it difficult to have the kind of "actual size" experience that Audubon would presumably have wished for me. As I gazed at the hummingbirds, egrets, warblers, and turkeys that Audubon had so painstakingly rendered, I knew, rationally, that I was looking at images that matched the true extent of the specimens from which they were drawn (Audubon had remarked that his drawings were so exact in their measurement that they could function like nature prints; they would "always correspond with *nature* when brought into contact").[2] Yet somehow, as hard as I stared at the birds, I found it difficult to sense this actuality. I kept having to remind myself: "This is the real size of a whooping crane!" "Wow, the roseate spoonbill is actually this actual size!" But, experientially, it was difficult to hold on to this awareness in the act of looking. The birds seemed to keep slipping away from me, out of their actuality, into a virtual visual space

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Robert Havell, Jr., after John James Audubon, *Arctic Yager (Lestris Parasitica)*, 1835 (detail with hand for scale). Plate 267 from *The Birds of America*. Etching, engraving, and aquatint, with watercolor. Plate: 76.5 × 54.7 cm (30 ⅛ × 21 ⅝ in.).

where their scale lost its fixity. Having long been acclimated to seeing representational images as virtual projections in which objects are indifferently rescaled (as in the drastically shrunken trees or buildings one would find in any snapshot), I found it difficult to see these birds otherwise. I discovered that it was only when I placed my (gloved) hand on the surface of a page that the real scale of the bird was stabilized. At least it was stabilized in relation to a real-world constant of my own body. This—essentially an attempt to hold the image to the haptic rather than the optic register—was the only way that I could fix my experience of these images at anything like the determinate scale that Audubon had intended.

As I continued to investigate the topic of scale in the course of my research, I came to understand that my difficulty in seeing scale had more systemic origins and implications. The evasiveness of the scale of Audubon's birds that I had experienced at the scene of reception, it turns out, exemplifies much broader, more fundamental challenges—physiological, historical, and disciplinary—in the analysis of scale. Scale, quite simply, is difficult to see. It is difficult, first, for physiological reasons: the eye and its lensing operations inherently rescale all objects, breaking them out of their real material extent and re-presenting them at a different size. (How else, looking up at, say, Mount Rushmore, would one get the monument into one's eyeballs?) As David Summers has argued, abstraction from size is a fundamental operation of vision. We can judge the real size of objects through learned calculations of perspective and other perceptual cues, but we can never have a primary, visual experience of size.[3] This helps explain why I could "see" the size of Audubon's birds better with my hands than with my eyes: as Summers put it, "We may only touch things at the size they are."[4]

The scalar elasticity at the core of visual perception also governs the Western pictorial tradition. A typical image in this vein is conceived as a window through which one looks into a virtual space where objects can be relocated at much smaller or occasionally much larger size while retaining their recognizable proportions. Summers has discussed this as well, arguing that the act of scaling up and down is the originary, founding proposition of Western virtual-pictorial space. As inheritors of this basic concept of the image, we tend to treat pictures as infinitely scalable representations with no fixed relationship to the size of their referents. This is why, even if an artist has taken great pains to depict objects at actual size, or indeed at any specific scale, the very fact of their being represented in picture format makes it hard to

experience them as such. The virtualizing force of the tradition drains them of any specific scalar identity.

If both vision and pictorial representation tend to decouple objects from specific scale, making scale inherently difficult to address concretely, so does the discipline of art history. Art history suffers from an unresolved and perhaps unresolvable internal conflict around the problem of scale. On the one hand, the discipline upholds the fundamental importance of confronting objects in the flesh, at actual size, in museums, in galleries, and at other sites. In doing so, it implicitly subscribes to the profundity of scale as a poetic, social, and cultural metric. And yet because the discipline is ultimately dependent on an assembly of phantasmagoric optical/digital projection technologies, its material emphasis on scale is perpetually compromised. Art history's reliance on the photographic reproduction of art objects is particularly important in this regard. As Olivier Lugon has eloquently put it, a camera or enlarger is like a "pantograph of light" that contributes a new scalar flexibility, and thus mobility, to the objects or images it reproduces.[5] This mobility is inseparable from the rise of art history itself. The construction of art history as a discipline with academic claims to a global historical narrative has, since the nineteenth century, required the collection and recombination of reproductive surrogates in books and lectures.[6] As Craig Owens aptly put it, "Art History is, of course, not the history of works of art; it's the history of slides of works of art."[7] As anyone who has ever taken an art history class can attest, the objects under discussion, projected onto the walls and screens of the classroom, enter a gossamer virtual space in which they are released from any link to their real size.

The virtualizing force of pictorial representation, with its attendant elasticity of scale, governs the way art history is conceived, practiced, and taught (and this is equally true of art history that focuses on nonpictorial or nonrepresentational art). This, in turn, has affected the discipline's capacity to acknowledge or analyze scale as an element of meaning. For example, for all the vehemence with which we, as art historians, insist on the fidelity of our teaching images, we are structurally discouraged from including fidelity to size among our criteria. While, in a slide projection, many material qualities of art objects can be relatively well preserved (shape, composition, color), clues to the size of the original objects are almost completely evacuated from the scene. The thoroughness with which scale has been exiled from art-historical communication becomes evident upon attempting to imagine how we would go about our daily operations if the preserva-

tion of size were truly important to us. Imagine, for example, trying to adapt one of your PowerPoint presentations so that all the objects you showed appeared on the wall of the lecture hall at their original size. Not only would the dimensions of each object have to be researched and each PowerPoint image subsequently rescaled for internal consistency, but the optical settings on the projector and the distance between it and the wall would have to be taken into account. Or imagine publishing a book in which all the objects under discussion were reproduced at actual size (this is what Audubon did, which is why his *Birds of America* seems vaguely ridiculous as a book). Even if you simply wanted to reproduce all your illustrations so that the relative sizes of the objects they depict were accurately captured (big paintings represented with big illustrations; small paintings with accordingly small illustrations), you would need to develop an exasperatingly precise form of communication with your book designer that would stretch the patience (and no doubt the budget) of the press. Paradoxically, then, scale is difficult to see because the apparatus of art and visual culture rescales objects too readily. Objects do not have much of a chance to register their original scales before being swept into a vague, infinitely scalable (and therefore scaleless) representational realm.

Art historians are not working alone in this scalable world. "Scalability" is an increasingly common promotional catchword in everything from software design to organizational management, designating the capacity of a system to function smoothly across multiple different scales of operation.[8] Scalability today is an aspirational category, trumpeted as a key virtue in multiple industries. And in the virtual spaces of digital technology, which have evolved out of the scale-shifting grids of perspective and optics, extreme scalability is now performed so commonly (in the fluid zooming of our smartphone maps, for instance) as to seem unremarkable.[9] This "smooth zoom effect" (as Derek Woods has called it) offers up a world in which objects put up no material or conceptual resistance to their total scalar manipulability.[10]

The 1977 film *Powers of Ten* by Charles and Ray Eames, which sweeps the viewer smoothly (without perceptible lurches or gaps) from the subatomic to the galactic scale, is often cited as both harbinger and epitome of this state of affairs. Because of its status as a seminal articulation of scalability at the cusp of the digital era, *Powers of Ten* has become a flashpoint for an interdisciplinary field of analysis now emerging under the rubric of "scale critique" (a field to which this

volume aspires to contribute). Commonly noted, for example, is the way *Powers of Ten* installs the viewing subject in a position of mastery over (and instant perceptual access to) phenomena at all scales, disregarding the fact that the human body and its sensory/cognitive apparatus cannot exist, much less function, at any scale other than its own.[11] The enormous categorical (even ontological) differences between these scales are effaced. The urgency of the present critique of the Eameses' scalar imaginary derives from the fact that the smooth-zoom effect that they worked so hard to accomplish in the film is now becoming naturalized, even banal.

The chief goal of this volume is to contribute to the development of what I will call *scalar specificity* in the study of American art and visual culture.[12] While acknowledging the inherent relativism of scale (scale is defined as a comparative relationship between two or more extents or quantities), the essays collected here work to stabilize scale in the course of analysis in order to counteract the total, indifferent scalability that pervades contemporary rhetoric and accompanies the very structure of our disciplinary apparatus. The relational experiences promoted by objects generate specific forms of historical and physical information that are lost or categorically altered when the original scales of the objects are disregarded. Hence the importance of accounting for the specific scalar relationships that objects produce in different environments at different historical moments.[13] The operative binary here is "scalar specificity" versus "hyperscalability": we attempt to establish the historical meanings of scalar relationships against the indifference of the contemporary hyperscalable milieu. This has the added advantage of highlighting hyperscalability itself as a historical phenomenon and topic of critical analysis—an increasingly urgent project and one that is taken up by many of the authors in this volume. Each of the essays in this volume testifies to the value of pursuing this kind of scalar specificity, and although each experiments with a different approach to capturing and representing it, the essays share two primary qualities: an insistence on the scalar specificity of materials and an insistence on the political specificity of scale.

Materials

Matter does not conform to the fantasies of total scalability through which it is often represented. It is one thing to rescale a representation of an object in the digital space of the computer, but quite another to rescale the physical object itself. The physical matter of which artworks and other objects are made has properties that change drastically with

size.[14] If one wants to translate a small promotional model of the Statue of Liberty into the actual Statue of Liberty, one is going to have to figure out, as Darcy Grimaldo Grigsby has noted, "how the hell to make it stand."[15] As the size of an object changes, its materials interact differently with gravity, magnetism, and other physical forces, so that rescaling it usually requires restructuring it or translating it into another material. Some of the most convincing demonstrations of this principle of structural scale variance have arisen in the biological literature. Biologist J. B. S. Haldane's "On Being the Right Size" (1926) remains one of the most astute essays on scale variance.[16] D'Arcy Thompson's *On Growth and Form* (1917) offers another classic discussion of the scalar conditions determining animal morphology. Although life forms of different sizes (from microorganisms to megafauna) emerge from the same set of universal physical forces, those forces have differently calibrated effects at different scales.[17] The forms of single-celled organisms, for example, are determined primarily by surface tension, whereas those of mammals are answerable primarily to gravity. Insects and microorganisms don't just live in a smaller version of the human world; they exist in a world "of which we have no experience, and where all our preconceptions must be recast."[18] Essential to Thompson's insight is its outright rejection of the basic premise of smooth scalability. Rather than a graduated continuum of scales, "the observation and the operation of systems are subject to different constraints at different scales due to real discontinuities."[19]

Glenn Adamson and Joshua G. Stein pointedly assert the scalar specificity of materials in their essay treating "scaled-up" contemporary sculpture: work such as Jeff Koons's monumental stainless steel versions of birthday-party balloon animals and Anish Kapoor's famous *Cloud Gate* (modeled on a drop of mercury) in Chicago's Millennium Park. Adamson and Stein note the pressure on contemporary artists, jostling for recognition in the constant whirl of international exhibitions, to make very large, attention-getting works. Unlike the majority of commentary on these works, which disregards the material processes by which small prototypes and models are enlarged to attain monumental scale, Adamson and Stein linger on the incredible technical and artisanal complexity involved in rescaling. They detail the expertise of the armies of technicians, artisans, and fabricators that goes into the rescaling process, expertise that is too often "laboriously disguised" in the finished work and overlooked by historians and critics still prone to see enlargement as an uncomplicated expression of an artist's transcendent idea. Adamson and Stein reveal the material,

financial, and conceptual risks that accompany the process of enlargement, and the political stakes of continuing to disregard these risks. Crucially, they also propose a new set of key terms (friction, figurability, and fidelity) through which to articulate the operations and implications of any kind of scale shift in the production of objects; their scheme is so lucid and broadly applicable that their essay might well be regarded as an alternative introduction to this volume.

Because many of the scaled-up works discussed by Adamson and Stein are partially designed or modeled by computer (scanned and manipulated in digital space, but ultimately realized in aluminum, marble, or latex), their essay also contributes to a better understanding of the ways objects move in and out of different technologies of scalability in the process of their creation. Darcy Grimaldo Grigsby's essay on the mountainous sculpture of Gutzon Borglum demonstrates that these technical crossovers have a history stretching well before the digital era. Grigsby, whose 2012 book *Colossal* sets the standard for scalar critique in this field, reveals the translational difficulties besetting Borglum as he tacked between the conflicting imperatives of optical and material production of gargantuan form. In his commission for a monumental Confederate relief at Georgia's Stone Mountain, Borglum struggled with the physical and logistical difficulty involved in blowing up an image to the size of a mountainside. First, he used optical means: a series of custom slide projectors. Then, along with countless unnamed workers, he strained to translate that optical zoom into the actual sculpting of colossal figures on the rock face. This was ultimately accomplished, after several false starts, using dynamite.

Like most of the other entries in this volume, Grigsby's essay plumbs the scalar adventures of photographic media, marking photography's position at the crux of any discussion of scale and its representation in modernity. Yet it also helpfully corrects for the tendency to exaggerate the ease with which optical rescaling is actually produced. The "zoom" was not simple for Borglum. Indeed, one of the key virtues of Grigsby's essay is its insistence on the material challenges of even the most seemingly immaterial optical effects. Borglum's projections were beset at every turn by technical problems, and remind us that enfolded within the practice of optical projection is a long history of mechanical struggle (it is for this reason that Bruno Latour, in a well-known essay, used an overhead projector as his exemplar of a "blackboxed" technology that hides its own history).[20]

Grigsby generates her critique from the collision of the different forms and intensities of labor in optical and material blowups. Here,

where the slide projector meets the stick of dynamite, where the "zoom" becomes the "boom," the hidden energies—and violence—of scaling explode into visibility. Throughout her discussion of these various labors, especially given the Confederate subject matter of Borglum's Stone Mountain project, Grigsby inevitably confronts the question of slavery. We might see Borglum's work at Stone Mountain as a double testament to the ongoing shadow of slavery in early twentieth-century America: both in its overt monumentalization of the Confederacy, and because, in Borglum's consistent failure to predict the technical and labor costs required to produce such gigantic sculpture, his project calls up—and even effectively presumes—the system of forced labor in which the costs of colossal projects were silently absorbed by slaves.

Jason Weems's essay on the construction and promotion of Chicago's Union Stockyards approaches the material stakes of enlargement in a slightly different way. Rather than exploring the inflation of individual figurative bodies, as in Borglum's gigantic presidents and generals, Weems interrogates the multiplication of bodies—in this case, both the animal bodies gathered and slaughtered and the human bodies gathered to slaughter them. As Weems explains, the stockyards represented an exponential increase in the processing capacity of the meatpacking industry. Addressing the convergence of scale and capital in modernity, Weems shows how the scaling up of this material processing system triggered organizational and administrative restructuring, "new and massive formulations of space, labor, capital, commerce, and organization." A quantitative increase required qualitative change. In his analysis of the contradictory perspectival structures of photographs taken of the stockyards, Weems detects the anxiety besetting the visceral, individual spectator confronting this new scale of organization and administration. The photographs, wavering between rational overviews and embedded, embodied confrontations with the machinery of slaughter, mirror the larger "uncertainty over the place of the individual in modernity's increasingly totalized and systematic, not to mention abstracting, order."

Politics

If we define politics as the set of structural mediations between the individual and the social body, Weems's thoughts on the "uncertainty over the place of the individual" deftly illuminate the fundamental role of scale as a political, as well as a material, metric. The material implications of scale are always also political. This is true not only because physical acts of scaling require technical innovations that

often reconfigure labor practices, but also because scale so frequently serves as a the formal language of political relationality. Indeed, American political discourse has often taken on an acutely scalar quality. Alexis de Tocqueville (1805–1859), in his analysis of American democracy, had early on expressed the plight of the American citizen in scalar terms: the American is "habitually engaged in the contemplation of a very puny object: namely, himself. If he ever raises his looks higher, he perceives only the immense form of society at large or the still more imposing aspect of mankind."[21] Without evenly gradated political hierarchies mediating between the individual and the "society at large," Americans experience political life as a series of drastic, lurching scale shifts. For Tocqueville, the lack of gradation between the individual and society in democracy (or, we might say, the lack of a political "smooth zoom") is experienced and represented as a kind of scalar trauma or disorientation. Something like this experience reemerges in the images of the Chicago stockyards as the scalar politics of modern organizational capital take form.

Wouter Davidts's essay on Barnett Newman's paintings shows how a single artist, working in a postwar moment in which the technical and organizational implications of the Chicago slaughterhouses had been horrifically realized, addressed the crisis of individual scale through painting. Newman clearly understood the political and humanitarian crises of his time as scalar problems, and, more rigorously than perhaps any other artist of his era, created a body of work that harnessed scale as a medium (rather than simply an effect) for confronting those conditions. Newman sought to create, through the internal scale of his works and their scaled relation to his viewers, experiences in which the viewer would be given "the feeling of his own totality, of his own separateness, of his own individuality, and at the same time of his connection to others, who are also separate."[22] For Newman, this experience could only be engineered through the manipulation of scale, and it required intensive investment in both the act of painting and the structure of display. Davidts also explores the extreme care with which Newman managed the appearance of his paintings in photographs—this, of course, attests to the threat that photography's optical scalability posed to these works whose determinate dimensions were charged with a serious political purpose.

Newman's large canvases are often discussed as exemplars of the aesthetic tradition of the sublime. Davidts is rightly skeptical about this truism (Newman was as invested in his smaller works as he was in his large ones, and he refused to sanction the production of sensation

through largeness alone). But the impulse to interpret Newman's work under the rubric of the sublime does demonstrate the close relationship between scale, politics, and aesthetics. The Burkean/Kantian sublime, as Weems helpfully reminds us, was a concept itself developed in order to manage frightening new gaps between the human individual and the ever more vastly scaled systems of modernity.[23] The sublime has of course often been associated with American art, particularly American landscape painting of the nineteenth century and its extensions in postwar abstraction.

None of the authors in this volume address the sublime as their primary subject, but it lurks throughout the essays as a common aesthetic background, a keyword for modern scalar experience on which all American artists emphasizing scale have had to take a position. Christopher P. Heuer's essay on early modern images of the Arctic provides, surprisingly, the most direct testament in this volume to the entrenchment of the sublime as a mode of scalar comportment in American art. Heuer demonstrates the historicity of the mode by showing how the strange landscapes of the Arctic were understood before that "common aesthetic background" emerged, before Burke or Kant had provided the scaffolding of the sublime. Sixteenth-century Arctic explorers confronted a site (not yet a "landscape") that disturbed their capacity to judge size or distance and disallowed their usual tactics of analogical thinking. Not yet able to avail themselves of the convention of the sublime, they created forms of verbal and visual testimony that struggled with the unpicturability of a world where scalar relations could not take hold. As Heuer argues, this indeterminate Arctic, processed partly through Reformation skepticism about vision and visual evidence, offers compelling parallels (and lessons) to contemporary ecocritics as they attempt to reject pictorial conventions and reimagine the meaning of scale in the postnatural world.

As befits a volume sponsored by the Terra Foundation, I wish to conclude this discussion by emphasizing that the material and political relations indexed by scale in American art are not limited to the domestic realm. These relations have always also been international. Indeed, within and around American art and literature, scale has long been a key language of international relations. To give just one example: scale was central to the formulation of American national identity from the start, as the new nation began negotiating its sovereign status during the era in which the Comte de Buffon's (1707–1788) degeneracy theory held sway. (Put bluntly, Buffon's theory held that all species shrank and weakened upon arrival on American shores). In an 1818 letter, Thomas

Jefferson passed along an anecdote about a dinner in France held by Benjamin Franklin some years earlier. Among the invitees to this dinner was the Abbé Raynal (1713–1796), a famous acolyte of Buffon. As Jefferson narrated the scene,

> *The Doctor [Benjamin Franklin] . . . had a party to dine with him one day at Passy, of whom one half were Americans, the other half French, and among the last was the Abbé [Raynal]. During the dinner he got on his favorite theory of the degeneracy of animals, and even of man, in America, and urged it with his usual eloquence. The Doctor at length noticed the accidental stature and position of his guest, at table, "Come," says he, "M. l'Abbé. Let us try this question by the fact before us. We are here one half Americans, and one half French, and it happens that the Americans have placed themselves on one side of the table, and our French friends are on the other. Let both parties rise, and we will see on which side nature has degenerated." It happened that his American guests were Carmichael Harmer, Humphreys, and others of the finest stature and form; while those of the other side were remarkably diminutive, and the Abbé himself particularly, was a mere shrimp.*[24]

This international body-size face-off, however lighthearted in its conception, shows how strongly scale in the Early Republic was bound up in serious questions of nature, politics, and self-determination.

Although most of the essays in this volume address the global or intercultural implications of scale in one way or another, Wendy Bellion's examination of liberty poles in eighteenth-century New York holds directly to this theme. Liberty poles were literal and symbolic centers of transatlantic conflict between Britain and its American colonies in the years leading up to the Revolutionary War. Exploring their status as objects of identification on the part of the colonists, and of furious iconoclastic energy on the part of British soldiers and loyalists, Bellion demonstrates that it was no accident that liberty poles were the largest things in the colonial landscape. Their scale made them "inescapable assertions of colonial will" as well as prominent markers and founders of public space. Their origin as majestic white pines, native to New England, appropriated by the metropole for shipbuilding as "mast trees," and then reappropriated by colonists

as expressions of parliamentary resistance, indicates that the natural scale of America (big trees, big land, etc.) carried transatlantic political signification from the outset. Bellion demonstrates that colonials and soldiers battled not only over the literal possession of these giant objects but also over their rhetorical status. The poles even sparked competing interpretations about scale itself, with colonists taking the immensity of the poles as an expression of power and soldiers taking the blunt materiality of these huge ceremonial objects as evidence of colonial participation in the despicable practice of idolatry. In many ways, then, the scale of the poles focused a range of different conflicts and created a matrix for the development of the kind of oppositional language that would go on to drive the Revolution.

Scale is a powerful tool for historical analysis because it is a relational concept, one that is acutely responsive to specific historical formulations of normalcy, standardization, hierarchy, variation, and conflict. It crystallizes social and political relations. But it can only be useful to us as a category of art-historical attention if something of the specificity of historical experiences of scale can be retained in our analyses, over and against the cultural and disciplinary propensity to discard scale information in the process of representation. Given the intrinsic and extrinsic difficulties involved in seeing scale, this task is huge—one might even say colossal. But it is well worth the effort for the insights it may yield into the matter of American art.

1 Audubon's *Birds of America* was printed between 1827 and 1838. See Jennifer L. Roberts, "Audubon's Burden: Materiality and Transmission in *The Birds of America*," in *Transporting Visions: The Movement of Images in Early America* (Berkeley: University of California Press, 2014), 69–115.

2 John James Audubon, "Account of the Method of Drawing Birds employed by J. J. Audubon, Esq. F.R.S.E.: in a Letter to a Friend," in *Audubon: Writings and Drawings*, ed. Christoph Irmscher (New York: Library of America, 1999), 754. Of course, given that his images translated each bird from three to two dimensions, Audubon's precision could apply only to the lateral measurements of each bird as it was stretched out on a flat surface commensurate with the picture plane. For a description of his preparation of specimens on planar surfaces, see Roberts, "Audubon's Burden," 71, 80–81.

3 David Summers, *Real Spaces: World Art History and the Rise of Western Modernism* (London: Phaidon, 2003), 35.

4 Ibid., 317.

5 Olivier Lugon, "Photography and Scale: Projection, Exhibition, Collection," *Art History* 38, 2 (Apr. 2015): 387. Lugon's article is an outstanding recent treatment of photography's scale effects.

6 On projection in art history, see Robert S. Nelson, "The Slide Lecture, or the Work of Art *History* in the Age of Mechanical Reproduction," *Critical Inquiry* 26, 3 (Spring 2000): 414–34; and Christopher P. Heuer, "Diaprojektion als Lehr- und Analysemethode," in *Kunstgeschichten 1915: Heinrich Wölfflins, 'Kunstgeschichtliche Grundbegriffe' im Kontext*, ed. Ulrich Pfisterer (Munich: Zentralinstitut für Kunstgeschichte, 2015). On the role of rescaled illustration in the birth of the art-historical discipline, see Amy von Lintel, "Wood Engravings, the 'Marvellous Spread of Illustrated Publications,' and the History of Art," *Modernism/modernity* 19, 3 (Sept. 2012): 515–42.

7 Craig Owens, *Beyond Recognition: Representation, Power, and Culture* (Berkeley: University of California Press, 1992), 327.

8 The interdisciplinary literature on the adventures of scale in virtual space is growing. A few starting points from various disciplines: Paul Emmons, "Size Matters: Virtual Scale and Bodily Imagination in Architectural Drawing," *arq* 9, 3–4 (2005): 227–35; Natasha Myers, "Molecular Embodiments and the Body-Work of Modeling in Protein Crystallography," *Social Studies of Science* 38, 2 (Apr. 2008): 163–99; Stephen G. Eick and Alan F. Karr, "Visual Scalability," *Journal of Computational and Graphical Statistics* 11, 1 (Mar. 2002): 22–43.

9 See Mark Dorrian, "On Google Earth," in *Seeing from Above: The Aerial View in Visual Culture*, ed. Mark Dorrian and Frédéric Poussin (New York: Tauris, 2013), 290–307.

10 Derek Woods, "Scale Critique for the Anthropocene," *minnesota review* 83 (Dec. 2014): 133–42.

11 See ibid. for a discussion and bibliography of the critique of *Powers of Ten*.

12 Although "scale critique" does not yet have a firm foothold in the field of American art, there are several excellent treatments of scale scattered throughout the literature. A few that have been most important for my thinking include Darcy Grimaldo Grigsby, *Colossal: Engineering the Suez Canal, Statue of Liberty, Eiffel Tower and Panama Canal* (Pittsburgh, PA: Periscope Press, 2012); T. J. Clark, "Pollock's Smallness," in *Jackson Pollock—New Approaches*, ed. Kirk Varnedoe and Pepe Karmel (New York, 1999), 15–31; Alexander Nemerov, "Great Unknowns: The Anatomical Sculptures of William Rush and the Problem of Democratic Scale," in *Mammoth Scale: The Anatomical Sculptures of William Rush* (Philadelphia: The Wistar Institute, 2002), 6–31; Ruth Phillips, "Representation in the Miniature: Effigy, Toy, Model, Souvenir," in *Trading Identities: The Souvenir in Native North American Art from the Northeast, 1700–1900* (Seattle: University of Washington Press, 1998), 72–102; Eric Slauter, "The Matter and Meaning of Representation," in *The State as a Work of Art: The Cultural Origins of the Constitution* (Chicago: University of Chicago Press, 2009). An important, very recent contribution to art-historical writing on scale is Joan Kee and Emanuele Lugli's edited issue of *Art History* devoted to scale (vol. 38, no. 2, Apr. 2015; although most of the articles in this issue derive from outside the American art field).

13 It is worth emphasizing that by pursuing the scalar specificity of works of art, we are aiming to

recover from the historical record the specific scalar relationships that these works generate. This is not the same as attempting to recover some absolutely objective quality of the works' "size." Indeed, in the last analysis, we treat size and scale as equivalent. Size, like scale, is ultimately relational. "Size" must be measured in order to be expressed, and every act of measurement is inherently comparative. A rattlesnake whose length is thirty-six inches is a rattlesnake in a particular scale relationship with a standardized unit of measure (itself a slippery proposition, as any glimpse at the history of the National Bureau of Standards will demonstrate).

14 This, of course, is an idea that is not entirely foreign to art historians. If our own representational practices make us complicit in the smooth-zoom world, as art historians we also have unique recourse to a history of strong materialist values that have the potential to correct for the excesses of the culture of scalability. Art historians have strong methodological and institutional ties to the practice of material culture analysis, especially in the American art field. This basis in material analysis, resurgent today with the "material turn" in the humanities, puts us in an excellent position to articulate the importance of material constraints on scale.

15 Darcy Grimaldo Grigsby, "Geometry/Labor = Volume/Mass?" *October* 106 (Fall 2003): 10.

16 J. B. S. Haldane, "On Being the Right Size," *Harper's Magazine*, Mar. 1926, 424–27. See the discussion of Haldane's essay in Glenn Adamson and Joshua G. Stein's essay in this volume.

17 D'Arcy Wentworth Thompson, "On Magnitude," in *On Growth and Form* (1917; rev. ed., Cambridge: Cambridge University Press, 1945), 22–77. My thanks to Kevin Lotery for this reference.

18 Ibid., 77.

19 Woods, "Scale Critique for the Anthropocene," 133.

20 Bruno Latour, *Pandora's Hope: Essays on the Reality of Science Studies* (Cambridge, MA: Harvard University Press, 1999), 183–85.

21 Alexis de Tocqueville, *Democracy in America*, 7th ed., trans. Henry Reeve (New York: Edward Walker, 1847), 2:82.

22 Barnett Newman, "Interview with David Sylvester," in *Barnett Newman: Selected Writings and Interviews*, ed. John P. O'Neill (New York: Alfred Knopf, 1990), 257–58.

23 The key texts here are Terry Eagleton, *The Ideology of the Aesthetic* (Oxford: Blackwell, 1990); and David Nye, *The American Technological Sublime* (Cambridge, MA: MIT Press, 1994).

24 Thomas Jefferson to Robert Walsh Jr., Dec. 4, 1818, p. 6, Library of Congress, accessed July 2, 2015, http://www.loc.gov/resource/mtj1.051_0113_0119/?sp=6.