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When the Virtual becomes Tangible

Tracing Design, Architecture, and Art at the Beginning of the Twenty-First Century

Abstract

With the end of the twentieth century, technological change has led to an immense shift in our collective perception and experience of "reality," creating a powerful "cultural impact of computerization as a new digital virtuality" (Shields, 2003). How are the new digital technologies shaping the aesthetics of contemporary visual and material culture? Rather than looking at virtual space itself, this essay draws attention to the feedback loops that arise from the increasing digitization of visualization and design processes in the last decades and their impact on the material world. At its heart is a phenomenon that became viral in the first decade of the twenty-first century: a shift of aesthetic qualities in which *physical* artifacts began to display the aesthetics of the (digitally) virtual. As the phenomenon of "virtual aesthetics" pervades material culture widely, the examination of artworks such as the *Phantom Truck* by Iñigo Manglano-Ovalle shown at Documenta XII (2007) will be expanded to include design and architecture, with a focus on works that occupy a space between the virtual and the physical, between simulation and facticity.

Key Words

Feedback loops, virtual aesthetics, material culture, simulation, new spatial qualities, unmonumental

What is your position as the world begins to represent itself to you this way … as the world is now completely sophisticated, an almost seamless fabrication.[1]—*Iñigo Manglano-Ovalle*

With the end of the twentieth century, technological change has led to an immense shift in our collective perception and experience of "reality," creating a powerful "cultural impact of computerization as a new digital virtuality."[2] How are these new digital technologies

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1   Interview with Iñigo Manglano-Ovalle, February 2008. See also Philipp Messner, "Locating Positions—In Conversation with Iñigo Manglano-Ovalle," in *Virtual Aesthetics: Considering Perception at the Dawn of the 21st Century* (Innsbruck: Kyrene, 2008), pp. 47–62, here p. 60.

2   Rob Shields, *The Virtual* (London/New York: Routledge, 2003), p. 18. For a discussion of the terms "virtual" and "real," see "Chapter 2: The Virtual and the Real," pp. 18–44.

shaping the aesthetics of contemporary visual and material culture? Rather than looking at the virtual itself, this essay draws attention to the feedback loops that arise from the increasing digitization of visualization and design processes of the last decades and its impact on the physical, material world. At its heart is a phenomenon that became viral in the first decade of the twenty-first century: an aesthetic shift in which physical artifacts began to display aesthetic qualities of the (digitally) virtual. I will refer to this phenomenon as "virtual aesthetics," a term coined for earlier research that I conducted with design journalist and art historian Simona Heuberger and artist Philipp Messner on the significant change of aesthetic qualities in design, architecture, and art in the years 2007 and 2008, resulting in a publication with the eponymous name.[3]

In this essay, I will discuss not only art works such as the *Phantom Truck* (2007) by Iñigo Manglano-Ovalle and *La Produzione della Costruzione* (2007) by Philipp Messner but also positions in design and architecture. As the two latter disciplines were early adopters of computer graphics software and computer aided design, they were also the first to inscribe virtual aesthetics into the shapes and materials of physical artifacts. The designs I will refer to are early works in this field, circulating in galleries, exhibitions, and design weeks, such as the work of Ronan and Erwan Bouroullec, Julian Mayor, and Front Design, or architectural works in the context of contemporary art such as the New Museum in New York built by SANAA (Sejima And Nishizawa And Associates). What all the works have in common, as will be shown, is that they not only question our habits of perception, but also challenge us to redefine our position in relation to materiality, objects, and space.

According to sociologist and anthropologist Rob Shields, "[d]igital virtualities are synonymous with simulation, a process which was argued to be a liminoid genre, both standing outside of materiality of everyday and embodied life."[4] When these properties of the virtual, which Shields defines as "liminal, betwixt and between," are translated into the physical world, a new condition of the physical results.[5] This new condition can be described as a hybrid between the virtual and the physical: we are confronted with materialized, tangible objects to which their virtual generation is aesthetically inscribed. As highlighted in the work of Manglano-Ovalle and Messner (albeit from different angles), simulation, which is an essential part of these new aesthetics, cannot be separated from the notion of "fabrication" or "construction." Both works engage with the ambiguous relationship between fact and fiction, a phenomenon referred to as "post-truth" or "truthiness" in the late twentieth and

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3   See Ekkehart Baumgartner, Simona Heuberger, Philipp Messner, and Alexandra Weigand, *Virtual Aesthetics: Considering Perception at the Dawn of the 21st Century* (Innsbruck: Kyrene, 2008). For the definition of the term "virtual aesthetics," see Alexandra Weigand, "Virtual Aesthetics—Contemplating Images," in ibid., pp. 33–45, here p. 33. For notions of the virtual preceding the digital see, for example, Shields, *The Virtual*, 2003, Anne Friedberg, *The Virtual Window* (Cambridge, MA: MIT Press, 2006), and Jens Schröter, *3D: History and Theory of the Transplane Image* (New York: Bloomsbury, 2014). I owe the last two references to Elisabeth Anne Johnson, and I also want to thank her for her thoughtful comments and advice on the first draft of this essay.
4   Shields, *The Virtual*, 2003, p. 79.
5   Ibid., p. 49.

early twenty-first century.[6] As this is a discourse of the same period, the political connotations are therefore also important in considering the extent to which digital simulation (and its technologies) affects reality. Embodying this overlap, or rather fusion, of digital virtuality and reality, how can works such as the *Phantom Truck* or *La Produzione della Costruzione* be categorized?

Sculpture is "a historically bounded category and not a universal one," writes Rosalind Krauss in her 1979 essay "Sculpture in the Expanded Field."[7] Krauss's notion of the expanded field of sculpture in the 1960s and 1970s can be understood as a spatial expansion, as new spaces such as vast landscapes, for example, have been opened up by artists like Robert Morris, Robert Smithson, Mary Miss, Robert Long, and others. In addition, Land Art and Process Art can also be considered in terms of their temporal dimension, especially with regard to the sculptural actions of the artists as well as the changing processes of reception that unfold on the basis of structural premises.[8] Along with this expansion, Martina Dobbe and Ursula Ströbele propose to extend the classical (essentialist) concept of "sculpture" toward the "sculptural" as a postmodernist perspective, pointing to the fact that "it is no longer a matter of a limited conception bound to a medium or a form."[9] For my essay, I will take up this concept of the sculptural to explore the new condition of the virtual manifesting itself in the physical. As the phenomenon pervades material culture widely, I will expand my inquiry to include design and architecture, with a focus on works that occupy a space between the virtual and the physical, between simulation and facticity. What I am interested in is the response of these formative disciplines to a new technological paradigm that not only massively impacts the process of creating and producing artifacts but also leads to new aesthetic qualities.

Lev Manovich notes that whether we speak of "information society," "knowledge society," or "network society" to describe this "new dimension of contemporary existence," we must acknowledge that "all these new dimensions are enabled by software," adding that "[i]f we don't address software itself, we are in danger of always dealing only with its effects

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6   According to the Oxford English Dictionary, the term "post-truth" was brought up by Serbian-American playwright Steve Tesich for *The Nation* in 1992. American author Ralph Keyes used the term "post-truth era" for his book *The Post-Truth Era: Dishonesty and Deception in Contemporary Life* (New York: St. Martin's Press, 2004). In 2016, the Oxford Dictionaries made "post-truth" its word of the year. The term "truthiness" was coined by American satirist Stephen Colbert in 2005.
For Manglano-Ovalle's *Phantom Truck*, this discourse also provides the context for later exhibitions of the work. Since its premiere at Documenta XII, the *Phantom Truck* has been exhibited in group shows such as *Image Battles: 2,000 Years of News from the War* (Kunsthalle Dominikanerkirche Osnabrück, April 22–October 4, 2009), *Seeing is Believing* (Kunstwerke Berlin, September 11–November 13, 2011), or *More Real? Art in the Age of Truthiness* (Site Santa Fe, July 8, 2012–January 6, 2013, and Minneapolis Institute of Arts, March 21–June 9, 2013) to name but a few.

7   Rosalind Krauss, "Sculpture in the Expanded Field," *October*, no. 8 (Spring, 1979): 33.

8   See Martina Dobbe and Ursula Ströbele, "Gegenstand: Skulptur," in *Gegenstand: Skulptur*, ed. M. Dobbe and U. Ströbele (Paderborn: Wilhelm Fink, 2020), pp. 1–16, here p. 3.

9   Ibid., p. 4. Translation by the author.

rather than the causes."[10] The beginnings of computer graphics software can be traced back to the early 1960s, with the first pioneers being found in both computer science and art. It was Ivan Sutherland, an electrical engineer, who developed the first interactive design program, a software called Sketchpad (1962), which formed the basis for the commercial use of 3D models.[11] Sutherland also pioneered the "type of new media that can be called 'navigable 3D virtual space,'" and toward the end of the same decade, in 1968, he also created the "head mounted-system," the first ever virtual reality (VR) headset.[12] In the field of arts, Charles Csuri was one of the first to experiment with computers for the creation of images and even animations, starting in 1963. In the context of this essay, it should be highlighted that Csuri plotted 3D surfaces and made factual sculptures in wood by using a computer-driven milling machine.[13] Thus, he pioneered the transfer of digital graphics physically into the tangible world.[14] In the following decades, digital codification of data left the laboratories of scientific, military, and corporate institutions to find a home in commercial desktop applications. Parallel to the increasing integration of digital visualization technologies, the development of digital communication technologies and user-generated spaces began to evolve. Major platforms and technologies were founded in the first decade of our century: Wikipedia in 2001, Myspace and the virtual world of Second Life in 2003, Flickr in 2004, YouTube in 2005, Facebook in 2006,[15] Twitter in 2007, the first iPhone in 2007, Instagram in 2010.[16]

It is this decade that my essay will draw attention to, a period characterized by an emerging (but not yet evolved) permeation of the virtual and the physical, before the breakthrough, or rather explosion, of social media—a moment in digital culture just before the mass uptake of the smartphone and before the emergence of "post-internet" art and what

10 Lev Manovich, *Software Takes Command* (New York: Bloomsbury, 2013), pp. 8–9.
11 Ivan Sutherland, "Sketchpad: A man-machine graphical communication system," *Technical Report*, no. 574 (September 2003), https://www.cl.cam.ac.uk/techreports/UCAM-CL-TR-574.pdf (accessed January 15, 2022). The report is based on Sutherland's dissertation submitted January 1963 to the Massachusetts Institute of Technology. Also see Martin Lister, Jon Dovey, Seth Giddings, Iain Grant, and Kieran Kelly, *New Media: A Critical Introduction* (London/New York: Routledge, 2009), pp. 112–14. For a detailed chronology of virtual reality technologies see, for example, Shields, *The Virtual*, 2003, pp. 55–56.
12 Manovich, *Software Takes Command*, 2013, p. 63.
13 See for instance Charles Csuri and James Shaffer, "Art, Computers and Mathematics," *AFIPS— Conference Proceedings,* vol. 33 (Ohio State University, 1968), https://ohiostate.pressbooks.pub/app/uploads/sites/45/2017/09/FJCC-Csuri.pdf (accessed January 15, 2022).
14 On early pioneers in computer art such as Charles Csuri and Robert Mallary also see Michael Rottmann's essay in this publication.
15 Facebook was originally founded in 2004 but was only accessible to Harvard students at that time. The platform opened to 800 colleges in 2005, and to the public in 2006.
16 See Lauren Cornell and Ed Halter, "Hard Reboot: An Introduction to Mass Effect," in *Mass Effect Art and the Internet in the Twenty-First Century*, ed. Lauren Cornell, Ed Halter, Lisa Phillips, and Johanna Burton (Cambridge, MA: MIT Press, 2015), pp. xv–xxxiv, here p. xx.

James Bridle termed "the New Aesthetic."[17] I will borrow the term "feedback loops" from the technical field, which defines feedback as a general principle in which the result of a process acts back on the original process, thereby changing the properties of a given system, to look at the feedback loops that occur when simulating materials, objects, and space in 3D programs on 2D monitors. In a second step, I will look at what happens when the resulting computer graphics and renderings are transferred back into the physical world. As this is an investigation into still-evolving phenomena, the text itself will take the form of an exploratory journey through the first years of the twenty-first century. Research in the field of art, architecture, and design, including interviews, visits of exhibitions, and fairs, as well as architectural works will form the basis of an analysis of the virtual becoming tangible.
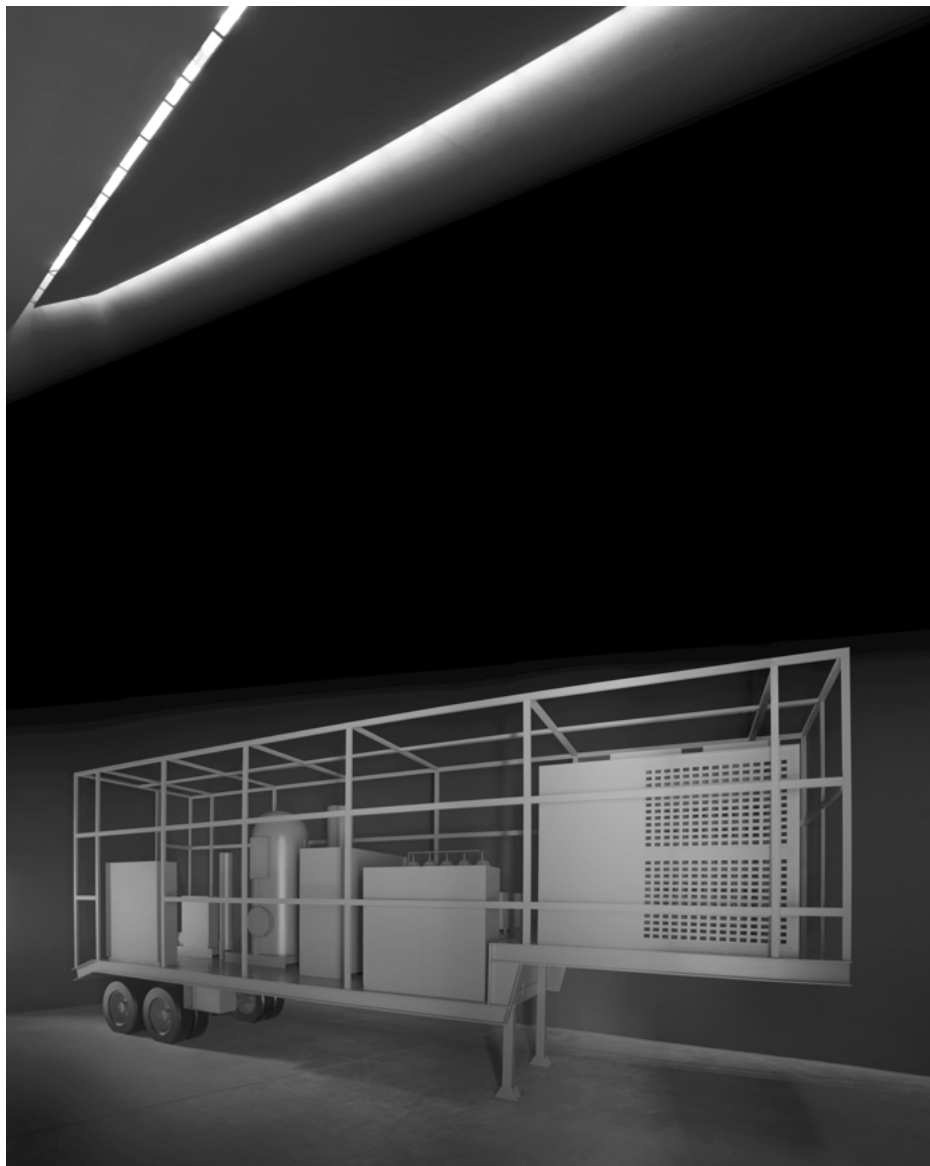
The Fuzzy Flatness of Facts and Things

When you enter one particular room at the Documenta Hall in 2007, a room shaded in diffuse nuances of gray, something makes you stop. It is not merely the lighting situation that your eye has to adjust to; it is rather the attempt to make sense of what is unfolding in front of you. A kind of trailer truck emerges from the darkness and hovers in space, more an appearance than an object. Its materiality evokes the notion of something metallic, but more in the sense of a simulation, and the blurry flatness of the artifact makes you wonder about its corporeality. The monochromatic, dark, grayish color of the space's floors, walls, and ceiling blurs the room's spatial dimensions. Although huge in scale, the object does not seem to touch the floor—rather, it appears to float in space, like a projection. Not knowing whether this object is real or not, you move cautiously in its direction.
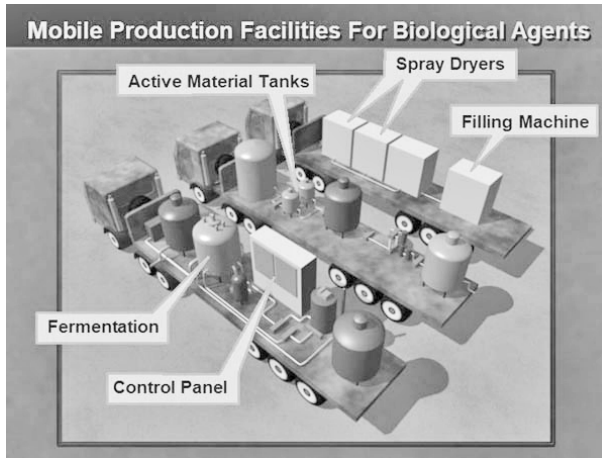
The installation on display is Spanish, Chicago-based artist Iñigo Manglano-Ovalle's *Phantom Truck*, created for Documenta XII in Kassel, Germany, in 2007 (fig. 1). It is a true-to-scale replica of computer-generated renderings used by the former US Secretary of State Colin Powell as justification for the US invasion of Iraq in 2003. His February 2003 speech to the United Nations Security Council was illustrated by a PowerPoint presentation that posed "sort of cartoonish" computer-generated images of mobile "bioweapons laboratories" as reliable information.[18] Drawing on these renderings, as well as photographs of actual trucks found in Iraq after the invasion, Manglano-Ovalle materializes what was presented as "evidence" but turns out to be a phantom, incapable of producing biological weapons. With the *Phantom Truck*, Manglano-Ovalle raises questions about truth and fiction and points to

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17   See Cornell and Halter, "Hard Reboot," 2015, pp. xv and xxvi. For "post-internet" see also Artie Vierkant, "The Image Object Post-Internet" 2010, https://jstchillin.org/artie/pdf/The_Image_Object_Post-Internet_a4.pdf (accessed January 20, 2022). For "The New Aesthetic," a research project started in 2011 by James Bridle, see https://new-aesthetic.tumblr.com and his essay "The New Aesthetic and its Politics," *booktwo.org*, June 12, 2013, http://booktwo.org/notebook/new-aesthetic-politics/ (accessed January 20, 2022).

18   Interview with Iñigo Manglano-Ovalle, February 2008. See also Messner, "Locating Positions," 2008, p. 54.

1   Iñigo Manglano-Ovalle, *Phantom Truck*, 2007. Installation view at Documenta Halle, Kassel, Documenta XII, 2007.

Mobile Production Facilities For Biological Agents

Active Material Tanks

Spray Dryers

Filling Machine

Fermentation

Control Panel

2   Slide 21 of the "Remarks to the United Nations Security Council, Secretary Colin L. Powell, New York, February 5, 2003," U.S. Department of State Archive.

the digital fabrication of "realities" that can even trigger wars. When read in the context of Documenta XII and its focus on the migration of form, the work also represents a migration from virtual to physical space.[19]

The renderings that Powell used for his presentation were simple 3D-generated computer infographics.[20] The twenty-first slide, titled "Mobile Production Facilities For Biological Agents," shows three stylized trucks standing side by side in an undefined space; its dusty brownish color dissolves the outlines of the trucks, which are only slightly darker in hue (fig. 2). The open loading areas of the vehicles are filled with container-like forms in various sizes and different shapes. Color-highlighted labels such as "Control Panel," "Fermentation," or "Active Material Tanks" point to the single objects and name their function.[21] Given the state of the art, the renderings that Powell presented in 2003 were of low quality, using only the basic features of the program.

Therefore, to manifest this "phantom truck" as a physical object, Manglano-Ovalle could only recreate these renderings by adopting their typical aesthetics. But what are the typical aesthetics? Manglano-Ovalle speaks of a "fuzzy flatness" inherent to digital renderings, which had to be translated into the physical space.[22] He is referring here to the generation of computer images that are digitally encoded "by uniformly subdividing the picture plane into a finite Cartesian grid of cells (known as pixels)," whereby "unlike photo-

19   Documenta XII was curated by Roger M. Buergel and Ruth Novak. For further information see Roger M. Buergel, Ruth Novak, Documenta GmbH, and Museum Fridericianum, *Documenta Kassel 12, 16/06– 23/09, 2007* (Cologne: Taschen, 2007).

20   "Remarks to the United Nations Security Council, Secretary Colin L. Powell, New York, February 5, 2003," US Department of State Archive, https://2001-2009.state.gov/secretary/former/powell/remarks/ 2003/17300.htm (accessed November 30, 2021).

21   Ibid.

22   Interview with Iñigo Manglano-Ovalle, February 2008. See also Messner, "Locating Positions," 2008, p. 57.

graphs, fine details and smooth curves are approximated to the grid, and continuous tonal gradients are broken up into discrete steps."[23] "Fuzzy flatness" thus encompasses a number of interrelated aspects: a textural flatness of the objects, blurred surfaces and edges, and the lack of spatial depth of both virtual objects and virtual space. To achieve the dissolution of spatial depth and the immaterial, detached atmosphere characteristic of computer renderings, the space was painted completely in black, creating a seamless transition between floor and wall:

> When you are in the black room with the truck, behind the truck, you cannot see where the floor hits the wall. And the architecture of the space, which existed before the truck, had a kind of slight curve. So … the space is not completely locatable. So even if you are standing still, you don't know exactly where you are standing. So there is a little bit of instability within the space already, which is then affected by the fact that the wall are painted dark. So dark that you don't know how far it is. The space is made almost infinitely deep and flat at the same time.[24]

As for the surface of the truck, Manglano-Ovalle was looking for a materiality that had no texture but was not completely flat either. Choosing an epoxy paint to cover the truck's aluminum structure would allow him to obtain a homogeneous matte surface that nevertheless had a metallic character, imitating the texture of simulated metal in renderings with its particular kind of fuzziness. For the floating effect of the truck—it is another aspect of the virtual space that the objects seem to levitate, never really touching the ground— Manglano-Ovalle had the wheels placed on thin, invisible pedestals. The only source of light was above the installation: a narrow, elongated window in the ceiling, illuminating the room according to the weather conditions outside. It is this atmospheric lighting that supports the simulated as well as animated effect of the *Phantom Truck*. By making a digital rendering physical, Manglano-Ovalle fabricated an object that oscillates between pictorial flatness and spatial depth in a seemingly infinite space—an object that "is more real than the virtual but not as real as reality."[25]

The *Phantom Truck* thus represents a critical position, as already indicated by its title: "We usually understand the word phantom as an illusion or a ghost, but in its original meaning as a Greek word it means 'to make visible, to make appear.'"[26] As a hybrid between the virtual and the physical, the sculpture covers the whole notion of fabrication: "Fabrication in terms of fabricating a story, fabricating an illusion, fabricating a lie, dismantling the fabrication, knowing that it is not real and yet fabricated, so the sculpture is a literal fabrication of what is, in its very inception, a fabrication itself."[27] The manifestation of digitally generated images in physical space expands the field of the sculptural toward a new spatial

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23   William J. Mitchell, *The Reconfigured Eye: Visual Truth in the Post-photographic Era* (Cambridge, MA: MIT Press, 1992), p. 5.
24   Interview with Iñigo Manglano-Ovalle, February 2008. See also Messner, "Locating Positions," 2008, p. 58.
25   Ibid., p. 54.
26   Ibid., p. 55.
27   Ibid., p. 54.

experience, that of a materialized, walkable "virtual" space. The "virtual," according to the *Cambridge Dictionary* and in the context of computer programming, means "created by computer technology and appearing to exist but not existing in the physical world."[28] At the beginning of the twenty-first century, however, computer-generated images had begun to leave the monitor. While the perception of digitally rendered images is largely limited to the sense of sight, Manglano-Ovalle's installation allows instead a physical experience of the virtual, a bodily confrontation with what he calls "speculative objects"—objects, in other words, with which we have no experience.[29] At Documenta, he could observe this phenomenological aspect in the reactions of the visitors:

> I found that a lot of people were going in there and then when they felt comfortable, they got closer to it. And I had to talk to the Documenta organizers saying, this is going to happen, let them do this. Touch it. See if it was real. And then, when they touched it, they felt that it was aluminum. There is a certain coldness [to] painted aluminum. And they thought: Oh my God, it is actually real! There is a moment in this sort of apprehension, which is completely optical but also phenomenological. Which can only be confronted by the tactile. The virtual always remains virtual until you touch it.[30]

The encounter with the phantom truck therefore evokes a contradictory, bodily experience in which our habitual perception of space is suspended. We find ourselves exposed to a three-dimensional space in which the spatial retreats to the two-dimensional, in which the factual sculpture appears to be a simulation. A dilemma that can only be overcome by another bodily experience—the haptic sensing of factual materiality. It is this opacity, this inaccessibility of what unfolds in front of us, that is characteristic of virtual aesthetics.

"The consequence of the computational nature of all digital worlds," states Martin Warnke, "is their detachment from the familiar," which leads to operating within a new set of possibilities that challenge established perceptions of images and spaces.[31] Manglano-Ovalle's manifestation of Powell's rendering creates a new experience by enabling a physical experience of a simulated space otherwise confined to the monitor.[32] Here, the sense of touch is needed to break the dominance of the visual, in order to verify what cannot be "grasped" by the eyes, and to uncover the twofold fabrication. That way, "[w]e are drawn … into a poetic awareness of the invisible forces that shape the contemporary

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28 "Virtual (Computer)," *Cambridge Dictionary*, https://dictionary.cambridge.org/de/worterbuch/englisch/virtual (accessed December 2, 2021).

29 Interview with Iñigo Manglano-Ovalle, February 2008. See also Messner, "Locating Positions," 2008, p. 59.

30 Ibid., p. 57.

31 Martin Warnke, "Aesthetik des Digitalen – Das Digitale und die Berechenbarkeit," *Zeitschrift für Aesthetik und Allgemeine Kunstwissenschaft* 59, no. 2 (2014): 278–86, here 279: "Die Folge der Berechnetheit aller digitalen Welten ist ihre Ablösung vom Gewohnten." Translation by the author.

32 Shields points out that in digital culture "'virtual' comes to equal 'simulated,'" see Shields, *The Virtual*, 2003, p. 46.

world,"[33] or, more dramatically, "we engage with the Phantom Truck … by realizing we have never left the monitor."[34]

The Fiction of Facticity

While Manglano-Ovalle renders a computer image into the physical world by imitating its virtual attributes, Italian artist Philipp Messner explicitly draws on materials displaying features of the virtual for his work.[35] The installation *La Produzione della Costruzione* (The Production of Construction) was shown in early 2007 in Bolzano, Italy, and is part of a body of work that also deals with fabrication—the fabrication of man-made structures, such as nations, and their visual, identity-generating representations (fig. 3). Symbols taken from national flags such as the star, the crescent moon, the cross, and others are transformed into large three-dimensional hollow bodies and piled on top of each other. For the space-filling sculpture, Messner chose an industrial composite material made of an anodized aluminum layer on the one side and a mirroring surface on the other. *La Produzione della Costruzione* is a visually complex work; its reflective interior surfaces immediately captivate the viewer upon entering the space, while the matte exterior of the work shows the same elusive materiality as does the *Phantom Truck*. The mirroring interiors create kaleidoscopic effects, which multiply through reflection and seem to expand into infinity. They invite the viewer to an "experimental examination of the observer's perception regarding the fiction of the surface."[36]

Messner's choice of material is based on his observations that the early years of the twenty-first century saw the development of materials associated with simulation and a focus on the surface. The principle of "surface" applicable to virtual objects, namely that "the surface exists … as a visible marker within a universal code structure," is rendered physical in Messner's installation.[37] Frieder Nake, a pioneer of computer art, suggests distinguishing between "surface" and "subface": "The surface stands for all those aspects of the entity that make it perceivable. The surface is oriented towards us. The surface stands for all those aspects of the entity that make it computable. The subface is oriented towards

33 Buergel, Novak, Documenta GmbH, and Museum Fridericianum, *Documenta Kassel*, 2007, p. 280.
34 Interview with Iñigo Manglano-Ovalle, February 2008, also see Messner, "Locating Positions," 2008, p. 58.
35 Ibid.
36 Sabine Gamper, "Philipp Messner: Die Produktion der Konstruktion: Ausstellung 31.3.–26.5.2007," https://www.argekunst.it/en/2014/02/15/la-produzione-della-costruzione/ (accessed December 10, 2021).
37 Christian Spies, "Formen skulpturaler Bildlichkeit: Spezifisches Objekt zwischen Skulptur und virtuellem Objekt," in *Skulptur – zwischen Realität und Virtualität*, ed. Gundolf Winter, Jens Schröter, and Christian Spies (Munich: Wilhelm Fink, 2006), pp. 75–100, here p. 89: "Und schliesslich muss sich hier auch das veränderte Verhältnis im virtuellen Objekt abzeichnen, wo die Oberfläche nur noch als sichtbare Markierung innerhalb einer universellen Codestruktur vorliegt." Translation by the author.

3   Philipp Messner, *La Produzione della Costruzione*, 2007. Installation view at ArGe Kunst, Bolzano, 2007.

the computer"—toward a dematerialized world of information and code.[38] The composite material chosen by Messner draws on what Nake calls "entities that are generated in algorithmic ways": the surface of the hollow bodies displays the characteristics of the virtual generation to the outside, while the subface creates self-referential codes within a closed system.[39] *La Produzione della Costruzione*, as the title suggests, refers to the fabrication of man-made artifacts, both conceptual and physical, to unmask the fictional quality of both.

Messner's work, like the work of Manglano-Ovalle, embodies this new condition of the physical which is linked to the notion of fabrication: Manglano-Ovalle materializes post-truth narratives by implementing the notion of fabrication, of simulation, within the materiality itself, while Messner explicitly uses existing industrial materials that carry the notion of the virtual, of simulation, to point to their omnipresence in our everyday lives. With their work, both artists manifest a hybrid condition between the virtual and the physical. By using virtual aesthetics as aesthetic politics, as means to an end, they tease out the political dimension of the current predominance of simulations. Furthermore, they draw attention to the presence of this development in our built reality, in which design and architecture have been inscribing virtual aesthetics into materials and forms since the beginning of the century.

38   Frieder Nake, "We Find the Aesthetics in Between: A Remark on Algorithmic Art," *Zeitschrift für Ästhetik und Allgemeine Kunstwissenschaft* 59, no. 2 (2014): 287–88, here 288.
39   Ibid.

Three-Dimensional Images, Two-Dimensional Bodies

Looking at designs in the early 2000s, the growing impact of 3D design software on forms, materials, and surface textures becomes evident, enhanced by new digital production techniques such as 3D-printing. In this process, the spatial qualities of the physical objects are also subject to a transformation in the direction of their digital (two-dimensional) template, so that they now move between image and object.[40] This phenomenon of visually flat three-dimensional objects, forms made of mesh-like structures, and materials with surfaces that appear to be simulated, I suggest, is part of a new condition of the physical resulting from feedback loops that occur when physical bodies are imitated first by means of simulation technologies and then by transferring these simulated bodies back to the physical world as materialized objects. Like a pendulum swinging back and forth, the different worlds it oscillates between are reciprocally influenced.

As early as 2001, the French designers Ronan and Erwan Bouroullec designed the *Console with Vase and Bowl* made of Corian (fig. 4). Corian is a mineral-synthetic composite material, originally developed in the 1960s, which has experienced an upswing at the beginning of the twenty-first century. Indeed, its properties meet the requirements of the time: it has a homogeneous, smooth surface that can take on translucent qualities and it can be processed like wood or thermally shaped two- or three-dimensionally. Objects made of Corian appear optically seamless, as unified entities. Taking advantage of these features, the vase and bowl are integral parts of the sculptural object, appearing to grow out of the surface of the table. This "impression of a single, carved block" in combination with the shiny white surface of the material flattens the three-dimensionality of the object and visually transforms it into a silhouette.[41] "Virtual spaces have an elusive quality which comes from their status as being both no-place and yet present via the technologies that enable them," so Shields.[42] Displaying this oscillation between 2D and 3D, it is difficult to tell whether the image of the console is a photograph of a physical object or if it is the computer rendering of the digital design.

While the *Console with Vase and Bowl* appears flat and schematic, like a sketch, and thus as a two-dimensional "body," British designer Julian Mayor creates objects that manifest as three-dimensional computer images. The project *20 Years 20 Chairs*, which he started in 2000, explores the multiple sculptural options offered by digitally generated designs and their transfer into physical, handcrafted objects. It plays with the various possibilities of

40   At this point it is important to note that not all designs or architectural projects that exhibit virtual aesthetics must necessarily have been created with the help of 3D software. During my research, I have come across quite a number of design and architectural projects that display virtual characteristics, even though they were designed using analogue methods. I suggest that the disciplines of design and architecture, as early adopters of various types of software that have enabled 3D-modeling and digital image production since the 1970s, have long integrated these aesthetics as part of their visual culture.

41   "Erwan & Ronan Bouroullec, Corian Console 2001," https://www.bouroullec.com/?p=44 (accessed December 15, 2021).
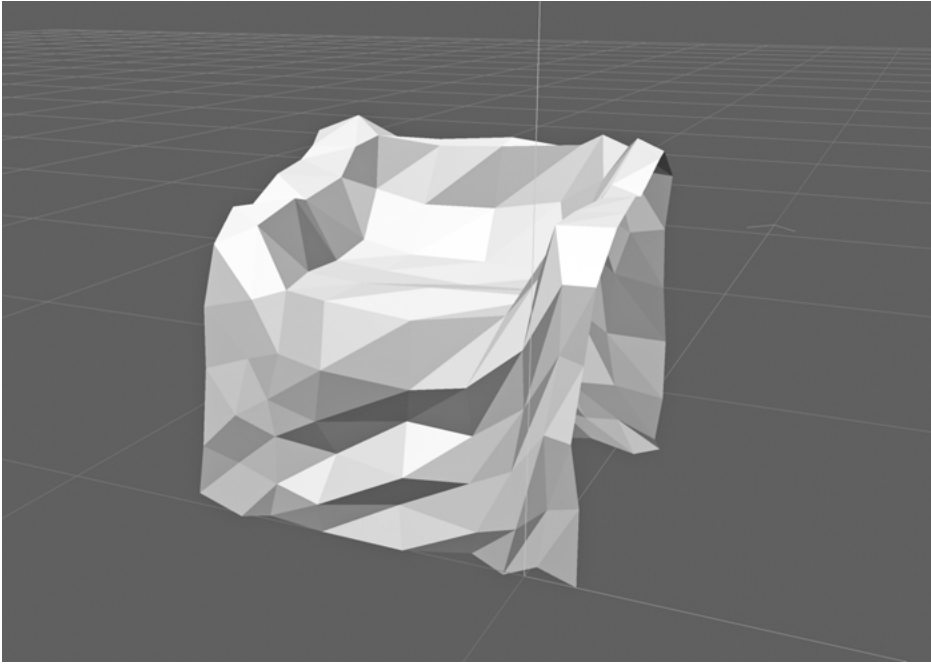
42   Shields, *The Virtual*, 2003, p. 50.

4   Erwan and Ronan Bouroullec, *Console with Vase and Bowl*, 2001 for Italian design company Cappellini.

generating forms resulting from the technical features of computer graphics software. Part of this series is the *General Dynamics* chair designed in 2004, an armchair based on the parameters of modeling freeform three-dimensional shapes using polygonal meshes. Since the development of computer graphics in the 1970s, 3D models have been created on the basis of mathematically computable surfaces to which a texture can be added.[43] With the help of a polygonal model that uses geometric faces, Mayor created a multifaceted surface, which forms the chair (fig. 5a). As a result, surface and form are one, an actual body does not exist, only its outline. The digital design's physical counterpart is handcrafted from fiberglass (fig. 5b). The shiny white faceted surface oriented to the viewer (while the "subface" remains untreated) explicitly addresses the object's digital origin: "The chair was created to look like a three-dimensional sketch, with the idea of technology having a character of its own. Like a computer visualisation, the form gives clues, but it needs the viewers

43   Computer graphics technology dates back to the first half of the 1970s when the University of Utah—where Sketchpad creator Ivan Sutherland was teaching—became an important center for research on computer graphics. In 1975, computer graphics researcher Martin Newell created the first 3D image, the *Utah Teapot*, using a wire frame to which a surface texture could be added, which became a benchmark model for all subsequent 3D software. The original data set of the Utah teapot can still be freely downloaded from the internet. For the history of software see, for example, Manovich, *Software Takes Command*, 2013, p. 63.

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5a   Julian Mayor, 3D-computer rendering of the *General Dynamic* chair, 2003–04.

5b   Julian Mayor, *General Dynamic*, 2004.

imagination to complete the surfaces."[44] With the use of polygon structures for the *General Dynamics* chair, Mayor refers to the basic features of digital design software. He is thus one of the first designers to reflect on the radical changes caused by the transfer of the design process from analog to digital. The virtual aesthetics of the chair, however, are created by the interplay of the color white, with its ability to reflect light, and the glossy surface, with its ability to shine.[45] Shine creates a hybrid state between two conditions; it "oscillates between the material and immaterial, the sensual and transcendent, the present and absence"—in our case, between digital data and factual materiality.[46]

It is "only in the beginning of the 21st century that data leaves professional domains to become of interest to society at large," notes Lev Manovich, pointing to the fact that "visualizations of data" also enter exhibitions of major museums such as the Museum of Modern Art (MoMA) in New York.[47] Here, he refers to the exhibition *Design and the Elastic Mind*, showcased in early 2008. The show highlighted the role of innovative technologies and its future potential and positioned design as a "bridge between the abstraction of research and the tangible requirements of real life."[48] The exhibits ranged from nano devices, appliances, and interfaces to objects designed and manufactured using the latest digital technology. One of the most visually striking design projects of the latter category was *Sketch Furniture* by the Swedish design collective Front Design, first prototyped in 2005 (fig. 6b). A set of furniture consisting of chairs, tables, and lighting was generated completely digitally: in a "happening" performed by the designers, they sketched the single objects in the air with their fingers as if with a pen, while their movements were recorded with motion-capture video technology. They then digitized the objects into a 3D computer model and materialized them through rapid prototyping (fig. 6a). A video of the project shows how during the 3D-printing process, in which a laser beams ultraviolet light into a bath of liquid resin to harden it layer by layer, three-dimensional objects grow out of the milky surface of the bath, making their way from the virtual to the physical world.[49] The completely digital data materializes in fluid, tubular forms, the surfaces shining in glossy white, as if the light beam

44 "Julian Mayor, 20 Years 20 Chairs 2000–2022, General Dynamic," http://www.julianmayor.com/20-years-20-chairs/ (accessed January 20, 2022).

45 In the beginning of the twenty-first century, the color white plays a key role in contemporary design. It is therefore no coincidence that all the design works discussed are white. The other important color of this period is gray, or rather the grayish-silver color of metal, as seen in the artworks discussed and in the building of the New Museum. See also Weigand, "Virtual Aesthetics—Contemplating Images," 2008, p. 37.

46 Antje Krause-Wahl, Petra Löffler, and Änne Söll, "Introduction," in *Materials, Practices, and Politics of Shine in Modern Art and Popular Culture*, ed. Antje Krause-Wahl, Petra Löffler, and Änne Söll (London/New York: Bloomsbury, 2021), pp. 1–19 , here p. 1.

47 Manovich, *Software Takes Command*, 2013, p. 30.

48 Glenn D. Lowry, "Foreword," in *Design and the Elastic Mind*, exh. cat. the Museum of Modern Art (New York, 2008), pp. 4–6, here p. 4. The show was on display from February 24–May 12, 2008, and curated by Paola Antonelli.

49 Front Design, *Sketch Furniture by Front*, YouTube video, 3:24 min., uploaded by "frontfilm," April 18, 2007, https://www.youtube.com/watch?v=8zP1em1dg5k (accessed December 15, 2021).

6a   Front Design, *Sketch Furniture*, 2005, design process.

6b   Front Design, *Sketch Furniture*, 2005.

with which the objects were digitally mapped had solidified into matter. Presented against a neutral background, the exhibits appear familiar and alien at the same time. We would rather expect them to appear on a screen than in our material surroundings.

"Computer screens, currently our portals to cyberspace, will grow, and they will continue to absorb the surfaces and volumes of the rooms, in which we live," wrote artist and "trans-architect" Marcos Novak already in the early 1990s.[50] His investigations into the potential of computer-generated architectural designs had led him to what he called "liquid architecture": immersive and virtual three-dimensional formations that had no counterparts in the physical world. Limited to the canvas of the computer screen at that time, these fluid forms and simulated surfaces have since left the confines of the screen.[51] The mutual permeation of virtual and physical spaces increasingly manifests itself in our everyday lives: "With the advent of digitally generated image forms, the medial preconditions of perception have changed. Familiar forms of perception have been expanded by new ones and the established categories of description have to be reconsidered. One aspect of these new types of images is always particularly striking: throughout, there is a new emphasis on spatial image parameters and perceptual values."[52] Designs as discussed embody these new parameters by combining forms that result from the features of digital software with surfaces that evoke virtual aesthetics. As a consequence, the perceptual values of image and body merge to form objects that oscillate between spatial depth and visual flatness, showing that "aesthetic encounters are actually 'mediated' on the surface."[53]

Unmonumental Monumental

As you make your way through New York's Lower East Side on your way to the New Museum, you are brought to a stop the very moment the museum appears in front of you. It

50 Marcos Novak cited in Weigand, "Virtual Aesthetics—Contemplating Images," 2008, p. 38. The quote was taken from Novak's website www.centrifuge.org, which is unfortunately no longer available.

51 For "liquid architecture" (and design), see for example the work of the late Iraqi-British designer and architect Zaha Hadid, who was among the first to use 3D visualization for an architectural design approach termed "parametricism." The realization of these digitally generated fluid architectural designs, however, would start only in the first decade of the twenty-first century. See, for example, Patrik Schumacher, "A New Global Style (2009)," in *The Digital Turn in Architecture 1992–2012*, ed. Mario Carpo (Somerset: John Wiley and Sons, 2012), pp. 240–57. Buildings realized in this period are, for instance, the science center Phæno in Wolfsburg, Germany (2005), the installation *Lilas* for the Serpentine Gallery London, UK (2007), and the art museum MAXXI in Rome, Italy (2010).

52 Gundolf Winter, Jens Schröter, and Christian Spies, "Vorwort," in *Skulptur – zwischen Realität und Virtualität*, ed. Gundolf Winter, Jens Schröter, and Christian Spies (München: Wilhelm Fink, 2006), pp. 7–10, here p. 7: "Mit dem Aufkommen digital erzeugter Bildformen haben sich die medialen Voraussetzungen von Wahrnehmung verändert. Vertraute Wahrnehmungsformen wurden durch neue erweitert und die etablierten Beschreibungskategorien müssen überdacht werden. Ein Aspekt dieser neuartigen Bildformen fällt dabei immer wieder besonders auf: Durchweg kommt es zu einer neuartigen Betonung räumlicher Bildparameter und Wahrnehmungswerte." Translation by the author.

53 Giuliana Bruno, *Surface: Matters of Aesthetics, Materiality, and Media* (Chicago: University of Chicago Press, 2014), p. 3.

7   SANAA, *New Museum*, New York, 2007. View of the museum building at 235 Bowery.

towers over the surrounding buildings, shimmering strangely, like a projection. Composed of seven rectangular boxes that are irregularly stacked on top of each other (fig. 7), its shape—"no-frill white cubes not only inside, but outside too"—suggests the use of the building: the museum for contemporary art was built by Kazuyo Sejima and Ryue Nishizawa of the Japanese architectural studio SANAA and opened in December 2007.[54] In order to

54   Roberta Smith, "Art Review 'Unmonumental: In Galleries, a Nervy Opening Volley,'" *The New York Times*, November 30, 2007, https://www.nytimes.com/2007/11/30/arts/design/30newm.html (accessed December 10, 2021).

understand the immaterial appearance of the building, it is (again) necessary to take a closer look at the materiality of its surface: "The New Museum is clad in a seamless, anodized expanded aluminium mesh chosen by SANAA to emphasize the volume of the boxes while dressing the whole of the building like a strong body in a delicate, filmy, softly shimmering skin."[55] Anodized aluminum was widely used in the 2000s and the same material Messner chose for his installation. Anodizing is a surface treatment to prevent corrosion in which a fine-pored oxide layer is created on the metal surface that is also completely transparent and invisible, thus preserving the metallic character of the material. The micropores create a pixel-like effect on the surface, causing a diffuse scattering when light is reflected, almost as if the surface were illuminated from the inside rather than from the outside. The result is surface that appears simulated—just as the surfaces of 3D designs displayed on a computer screen that is homogeneously illuminated by the monitor's backlight.

This effect is further enhanced by a layering effect of the façade. Aluminum panels were fixed to the building first and then covered with the expanded aluminum mesh, so that the pixel-like effect created by anodization on the micro level also replicates on a macro level. The resulting screen-like texture triggers the effect of backlighting when exposed to (day) light. In the "age of virtuality," cultural critic and media theorist Giuliana Bruno notes, "[t]he language of the screen has become an actual material condition of our existence, for its geometry is not only ever-present but also manifold."[56] She observes that "[t]here appears to be a widespread 'superficial' movement engaged in uncovering the strata and thickness of surface, and in creating deep, textured, layered surfaces."[57] This also counts for the New Museum's architecture, whose textured façade becomes a contemporary screen that, according to Bruno, "far from representing any perspectival ideal, is no longer containable within optical framings, and cannot be likened to a window or a mirror, but is to be reconfigured as a different surface."[58] In case of the museum's façade, the difference lies in its ability to "animate": "With windows just visible behind this porous scrim-like surface …," as the museum's website explains, "the structure appears as a single, coherent und even heroic form that is nevertheless mutable, dynamic, and animated by the changing light of day."[59] It is not a media façade in the sense of digital displays that are familiar to us from our urban surroundings. It is rather a surface with a simulated character, animated by and sensitive to changing weather and lighting conditions, exploiting the façade's particular fabrication of reflecting light that follows the virtual object's ability to shine from within. "In surface encounters," states Bruno, "novel dynamics are generated, including an innovative form of materiality that is light, diffuse, flexible and permeable."[60] This also affects the perception of time: "[T]he experience of light as it is mediated on the surface becomes an

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55 "New Museum Building," https://www.newmuseum.org/building (accessed December 10, 2021).
56 Bruno, *Surface*, 2014, pp. 2 and 7.
57 Ibid., p. 81.
58 Ibid., p. 5.
59 "New Museum Building," https://www.newmuseum.org/building (accessed December 10, 2021).
60 Bruno, *Surface*, 2014, p. 5.

environmental experience that incorporates the movement of observation and the sensing of time as an atmosphere," resulting in an experience of space and time that becomes increasingly permeable and fluid.[61] These tendencies toward dissolution can also be found at the edges of the façade. Here, the cut expanded aluminum mesh forms a blurred, pixelated line as in the gridded structure of digital images, causing the blurry fuzziness addressed earlier by Manglano-Ovalle.[62] This play with virtual aesthetics leads to a paradoxical effect: the monumental building negates its own monumentality.

Strikingly, the inaugural exhibition of the new museum building was titled *Unmonumental: The Object in the 21st Century*. Curated by Richard Flood, Laura Hoptman, and Massimiliano Gioni, the show draws attention to "fragmented forms, torn pictures and clashing sounds" reflecting the unstable and fractured condition of our fast-changing world.[63] In this context, the curators also drew on the war in Iraq, observing a shift in dealings with facticity: "As the twenty-first century moves forward, it is being forced to barrel through masses of relative 'truths,'" which results in replacing "the tentatively real with something else that is probably less real."[64] The works presented are assemblages characterized by the lack of expensive materials or industrial "fabrication processes that result in shiny (read lulling) surfaces," as well as the absence of well-made manufacturing, heavy machinery, and computer tech.[65] Although at first glance the exhibition appears to be diametrically opposed to the new museum architecture with its minimalist, withdrawn form and shimmering façade, a second glance reveals the uniting factor: "If the term 'monumental' connotes massiveness, timelessness and public significance," states Hoptman, "the neologism 'un-monumental' is meant to describe a kind of sculpture that is not against these values (as in 'anti-monumental') but intentionally lacks them."[66] The dissolution of monumentality and the resulting experience of matter as "unmonumental" and time as unstable and fluid is found in both, in analog form in the exhibits and in virtual form in the museum building. In that sense, the exhibition as well as the architecture of the building, show that sculpture, or rather the sculptural in the (post-)digital age, "complicates space and viewer perception much more than any other medium."[67]

61 Ibid., p. 87.
62 In this context, Martin Warnke speaks of "staircasing lines" ("Treppigkeit" von Linien), see Warnke, "Aesthetik des Digitalen," 2014, p. 278. Mitchell points to the "gridded microstructure" of the digital image made of pixels that "retain their crisp, square shapes." See Mitchell, *The Reconfigured Eye*, 1992, p. 6.
63 "Unmonumental: The Object in the 21st Century," https://archive.newmuseum.org/exhibitions/918 (accessed December 10, 2021). The exhibition displayed eighty works by thirty artists, among them Alexandra Bircken, John Bock, Martin Boyce, Tom Burr, Aaron Cury, Isa Genzken, Sarah Lucas, Manfred Pernice, Anselm Reyle, and Rebecca Warren to name but a few.
64 Richard Flood, "Not about Mel Gibson," in *Unmonumental: The Object in the 21st Century*, exh. cat. New Museum New York (London/New York: Phaidon Press, 2007), pp. 10–13, here p. 11 and 10.
65 Smith, "Art Review 'Unmonumental: In Galleries, a Nervy Opening Volley,'" 2007.
66 Laura Hoptman, "Unmonumental: Going to Pieces in the 21st Century," in *Unmonumental: The Object in the 21st Century*, exh. cat. New Museum New York (London/New York: Phaidon Press, 2007), pp. 128–38, here p. 138.
67 Flood, "Not about Mel Gibson," 2007, p. 12.

Tangible Virtuality

The works discussed in this essay reflect on the changed conditions caused by a medium "that privileges fragmentation, indeterminacy, and heterogeneity."[68] They reveal a new set of possibilities and perceptual offers that are "subject to the laws of rastering and quantisation"[69] and in which "representation is displaced by another practice, simulation."[70] In the field of art, these perceptual offers underline critical approaches that aim to dismantle constructed realities and post-truth conditions by means of a materiality that points to simulation and thus its virtual origin. The fictitiousness of facticity is intended to be experienced via the perceptual experience of the virtual in the physical space. The field of the sculptural is thus expanded toward a new spatial experience, that of a materialized, walk-in "virtual" space. In this regard, our attention is drawn across material surfaces that we previously only encountered on our screens. The screens function not only as "a representation of digital universes but also a manifestation of how the digital can reinvent a surface condition that is a form of materiality."[71] As a result, we are confronted with objects that tempt us to speculate about them and that we encounter not only in art but also in architecture and design. In the process of imitation of simulated objects for physical production, the qualities of the virtual manifest themselves in materials, surfaces, and forms, affecting our perception of objects, space, and materiality. The resulting feedback loops superimpose two-dimensional images and three-dimensional spaces and illusorily dissolve the solidity of objects, which manifests itself in an aesthetic flatness of bodies and spaces. The surface of the materials plays a key role, as it can now appear "simulated" or "animated" or turn itself into a screen. It "no longer has the status of decorative element but becomes an entity in itself."[72] Inherent in these new surfaces is an ephemeral quality that is determined by lighting conditions such as daylight, as in the façade of the New Museum, or by the respective position of the viewer, as with Messner's installation. Surfaces mediated in this way have the effect that "[w]e no longer face or confront a screen only frontally but are rather immersed in an environment of screens."[73] From this perspective, the sculptural at the beginning of the twenty-first century points not only to the increasing presence of virtual aesthetics in our everyday world, but also to simulation beginning to overlay reality. Therefore, in confronting the virtual in the physical world as an increasingly seamless condition, we are challenged to relocate our position in relation to object, materiality, and space.

68 Mitchell, *The Reconfigured Eye*, 1992, p. 8.
69 Warnke, "Aesthetik des Digitalen," 2014, p. 278: "Die Wahrnehmungsangebote … unterliegen den Gesetzen der Rasterung und der Quantisierung." Translation by the author.
70 Lister, Dovey, Giddings, Grant, and Kelly, *New Media*, 2009, p. 6.
71 Bruno, *Surface*, 2014, p. 99.
72 Ibid., p. 93.
73 Ibid, p. 102.