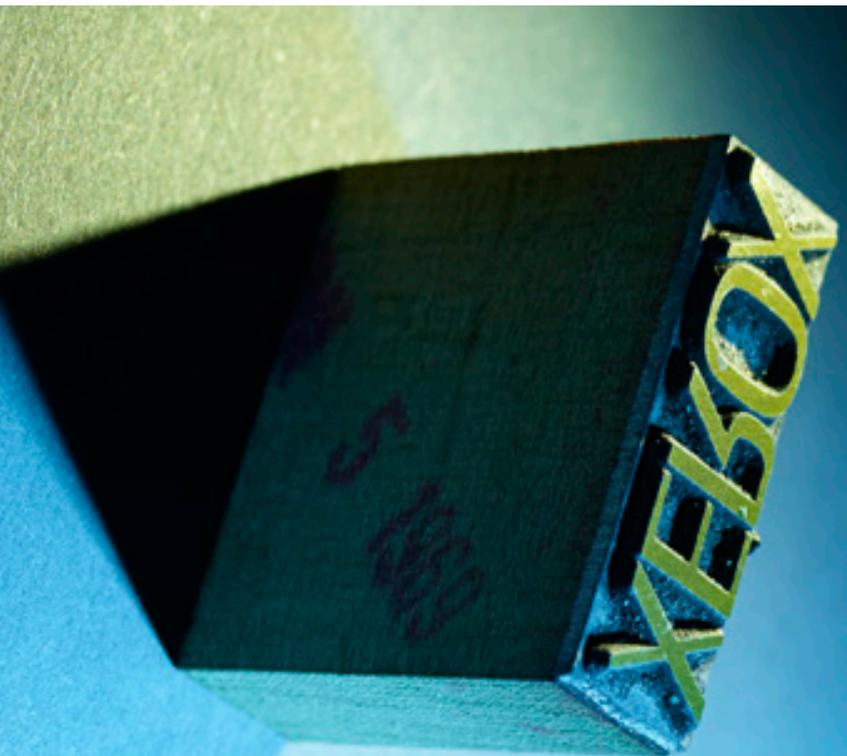


MAS Context
Issue 21 / Spring '14
Repetition



ESSAY BY ——— PATRICK SYKES

WE PRINT BECAUSE WE CAN



DESIGN DEVELOPMENT OF THE GROTTA BY HANSMEYER / DILLENBURGER

REMOVAL OF SURPLUS SAND / PHOTO BY DEMETRIS SHAMMAS / ACHILLEAS XYDIS



1:3 SCALE PROTOTYPE - WHITE / PHOTO BY HANSMEYER / DILLENBURGER



The room that surrounds you is pure ornament. Spires, fan-vaulting, pillars, lattices, and basins: recognizable geometric forms that suggest themselves amid an otherwise amorphous, pure white texture of facing walls. These features support nothing, lead the eye towards no single point of focus, and have no function beyond the aesthetic, yet the intricacy of their details could occupy your attention for hours. The room, dubbed Digital Grotesque and completed last year, weighs 11 tons and measures 16 square meters, but only a fraction of that is navigable, admitting just enough space for you to enter, admire, and move on. According to its designers, it is “the first human-scale immersive space entirely constructed out of 3D-printed sandstone.”¹ Though innovative, both their project and the many parallel advances in 3D technology are grounded in, enacted through, and productive of repetitive processes that could not only change the face of the built environment, but may also demand a new paradigm for even the most everyday forms of engagement with it.

The hype surrounding 3D printing has propelled it into many areas of design and manufacturing—from toys to firearms—but its role in architecture is only beginning to be imagined. So far, the few projects that have reached public awareness have been characterized by a combination of fantasy and novelty, from Foster + Partners’ speculations about the feasibility of using the technology to build on the moon² to Universe Architecture’s plans for their Möbius strip-like Landscape House.³ Behrokh Khoshnevis, director of the Centre for Rapid Automated Fabrication Technologies at the University of Southern California, has more humanitarian inclinations,

and hopes that his “contour crafting” technique can build “dignified” structures for the displaced (he claims it can erect a 2,000 square foot, two-story house in only 24 hours and at a fifth of the cost of traditional construction). “If you look around,” Khoshnevis says, “everything else we use is made automatically, like the pen you’re holding, the shoes, the cars. The reason we don’t have [automated homebuilding] is simply that we haven’t had the large-scale technology.”⁴ With funding from Caterpillar, the largest construction equipment manufacturer in the world, he is confident that this is only a matter of time.

It is telling that the first 3D-printed room was built to do little more than inspire awe—in complexity, yes, but more specifically in the possibilities offered by a fledgling technology. Though initiated by Swiss architects Michael Hansmeyer and Benjamin Dillenburger, the design process for Digital Grotesque was enacted by algorithms, which generated the geometric forms from simple shapes. The creators revel in this concession of human control. “Printing a highly detailed grotto costs the same as printing a primitive cube,” they write, justifying complexity on grounds of possibility: we print because we can.⁵ The construction of a grotto, with its religious resonance, seems an appropriate milestone in the development of a technology—a space in which to revere a power we do not fully understand. The difference is that the space is not the setting for devotion, but the very object of it, the embodiment of God in the machine. They also point out with pride that it is printed to such a high resolution (one tenth of a millimeter) that its intricacies

ABOVE: 1:10 SCALE PROTOTYPE GOLD / PHOTO BY DEMETRIS SHAMMAS / ACHILLEAS XYDIS

“PRINTING A HIGHLY
DETAILED GROTTO
COSTS THE SAME
AS PRINTING A
PRIMITIVE CUBE”



“exceed the threshold of human haptic or visual perception.”⁶ In other words, it is an invitation to appreciate what we cannot even experience.

Digital Grotesque is an extreme example, but at a time when interest in 3D printing and scanning is particularly high, it may set an influential precedent. Might the architects of the future be supervisors of autonomous digital processes? Neri Oxman, Assistant Professor of Media Arts and Sciences at the MIT Media Lab, suggested as much when she welcomed a new role for the designer as “an editor of constraints,” one who dictates the rules of the game and then allows it to play out.⁷ Whether this is an advance or a relegation is a question of

individual taste; what is clear is that additive manufacturing processes such as 3D printing offer a liberating paradigm shift insofar as they depart from traditional, inherently inefficient subtractive techniques such as drilling or cutting. When building layer by layer, Oxman’s “constraints” are in this sense remarkably unconstrained, in that there is no limit to the number or kind that kind be applied. Moreover, the products of architecture-by-algorithm can be repeated ad infinitum, either cost-effectively mass-produced or fed back into the mathematical function as a new raw material to be processed—an infinite loop of input and output, accumulation and disposal.

“IF YOU LOOK AROUND,” *KHOSHNEVIS* SAYS, “EVERYTHING ELSE WE USE IS MADE AUTOMATICALLY, LIKE THE PEN YOU’RE HOLDING, THE SHOES, THE CARS. THE REASON WE DON’T HAVE [AUTOMATED HOMEBUILDING] IS SIMPLY THAT WE HAVEN’T HAD THE LARGE-SCALE TECHNOLOGY.”



DESIGN DEVELOPMENT OF THE GROTTO / PHOTO BY HANSMEYER / DILLENBURGER

As costs are reduced and this latest, shiniest mode of production is further democratized, we will no doubt see benevolent low-cost projects (such as emergency shelters for displaced persons), but there will surely also be a proportional increase in architectural ambition (why not get more building for your money?). It is this latter megaproject impulse that is currently driving the technology forward, and likely to dominate it: though displaced persons have a fundamental need for shelter, they will often resist efforts by NGOs or governments to make their situation (closely tied as it is to a state of legal and humanitarian limbo) permanent; those at the other end of the spectrum will meanwhile be empowered to consume and dispose of buildings in a way that they have previously only done with Christmas presents.

If, as designer and critic Liam Young speculates, we are approaching a world of pervasive 3D printing in which “nothing is precious anymore and everything is a new object in waiting. Shape and form is just a temporary moment in the life of a material,” then what becomes of the “safe as houses” simile and all the associations of security and fixity that charge it with its figurative force?⁸ Cities have long been celebrated for their capacity to accommodate and instill social dynamism, but 3D printing could extend the scope of this organized chaos to the built environment, as an accelerated pace of building creates rhythms in urban time as much as fashions in space, and the planet’s famous skylines attract calls for preservation. Perhaps the nuclear families of 2050 will browse catalogues of the latest

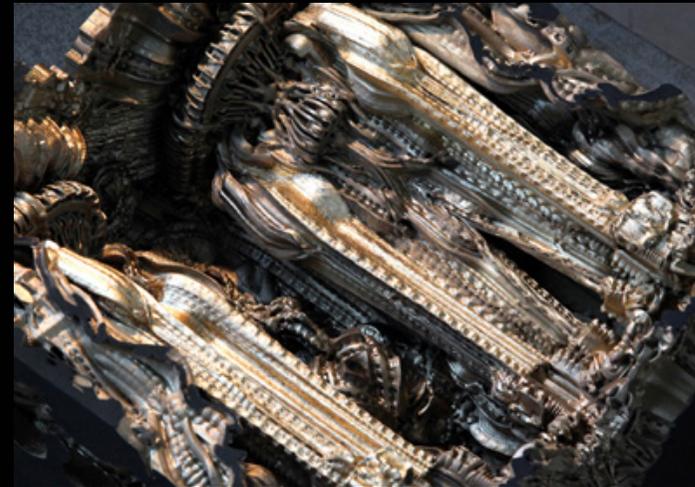
architectural blueprints in the same supermarket in which they buy their vegetables, ordering 3D-printed updates to their homes. Or maybe the passive-aggressive neighborly pressure to maintain the front lawn will extend to the house itself, as architectural elements become as replaceable as items of clothing.

Walter Benjamin distinguished between works of art that have been reproduced and works designed for reproducibility. He claims that in the latter case, most notably in photography, “to ask for the original makes no sense.”⁹ The photographic negative can produce multiple identical images, none of which is any more or less definitive than the next, yet is not itself an accurate representation of the image. Architecture has of course always involved reproduction, from the imitation of individual structural elements to the introduction of pre-fab buildings and more recently full-scale copycat towns in China. But in accelerating our capacity to conduct these repetitions, the development of 3D technologies completes the circuit and obscures any notion of a site-specific, “authentic” experience of a landscape. Moreover, it also opens the way for imperfect reproductions. Data may be expansive and precise, but it corrupts, and the point at which it emerges as physical matter—in this case from the nozzle of the printer—relies on the tolerance and quality of a given device for its fidelity to the abstract blueprint. The algorithmic excess of Digital Grotesque may in its own way be beautiful, but the cracks are conspicuously visible.



1:3 SCALE PROTOTYPE - WHITE / PHOTO BY HANSMEYER / DILLENBURGER

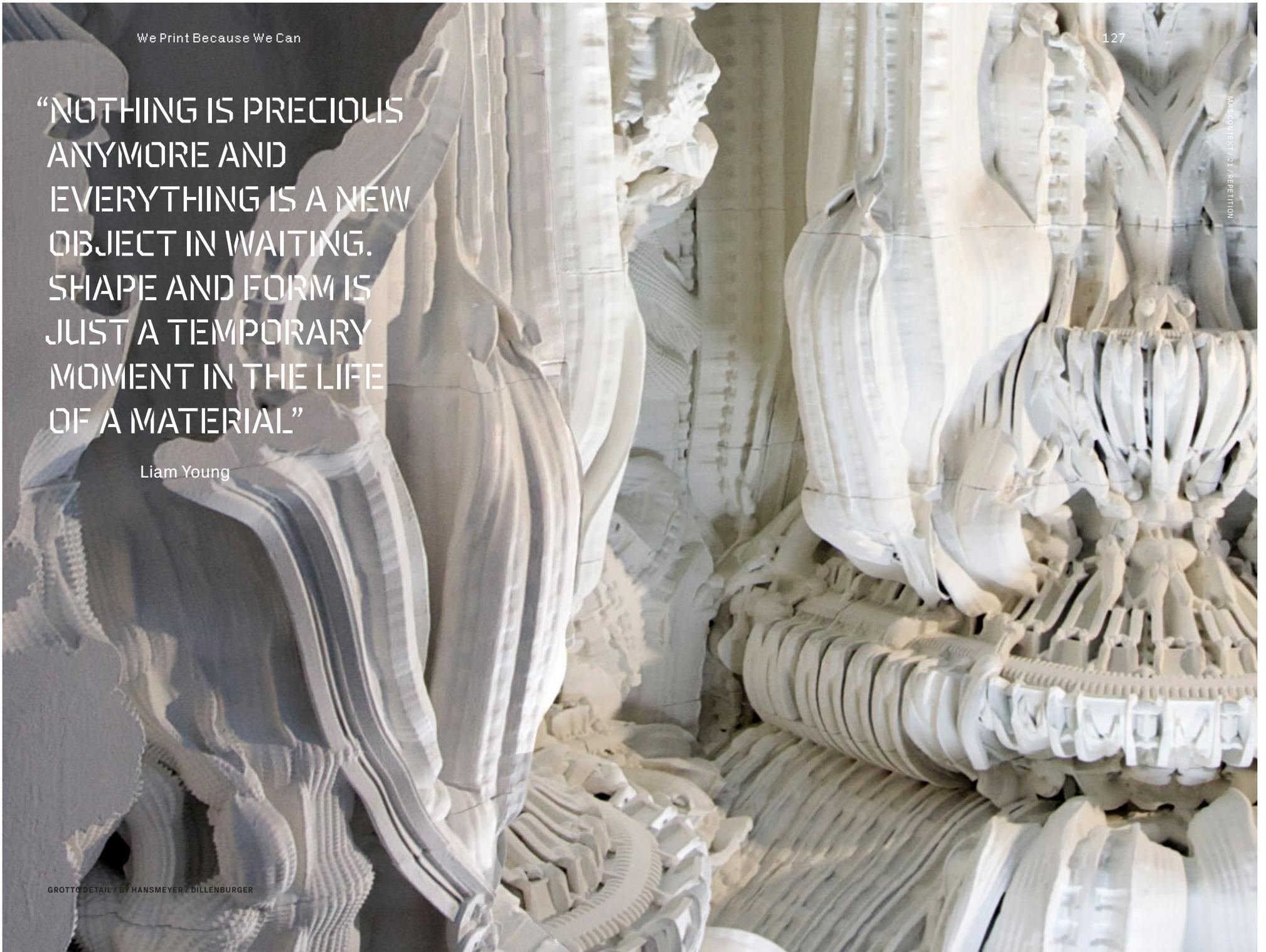
1:3 SCALE PROTOTYPE - GOLD / PHOTO BY HANSMEYER / DILLENBURGER



PRINTED ELEMENT / PHOTO BY DEMETRIS SHAMMAS / ACHILLEAS XYDIS

“NOTHING IS PRECIOUS
ANYMORE AND
EVERYTHING IS A NEW
OBJECT IN WAITING.
SHAPE AND FORM IS
JUST A TEMPORARY
MOMENT IN THE LIFE
OF A MATERIAL”

Liam Young



3D technology promises (or threatens) to bring its cycles of mechanical, urban, and psychological repetition to the very heart of the home, from its additive mechanics, in which nozzles and robotic arms trace and re-trace their steps layer by layer, to the power to scan and reproduce entire buildings (and perhaps eventually cities) in miniature or even at scale, and finally to an unprecedented extension of the logic of consumerism and disposability to the level of the previously solid, grounded urban landscape. Which of these forms of repetition dominates the others will depend on the kinds of projects that receive attention and investment—not necessarily in that order. What seems clear is that, as residents of cities whose site-specific characteristics are already blurred by the normalisation of multinational networks of communications and commerce, it will become harder still to form and retain a sense of what makes a place particular.

GROTTO SIDE 1 - TEST ASSEMBLY / PHOTO BY HANSMEYER / DILLENBURGER



- 1 "Detailing," *Digital Grotesque*, accessed May 5, 2013, www.digital-grotesque.com/design_detailing.html?screenSize=1&color=1.
- 2 "Foster + Partners Works with European Space Agency to 3D print structures on the moon," *Foster + Partners*, January 31, 2013, www.fosterandpartners.com/news/foster-partners-works-with-european-space-agency-to-3d-print-structures-on-the-moon/.

- 3 "3D Printed Mobius Strip Home by Universe Architecture," *designboom*, January 24, 2013, www.designboom.com/architecture/3d-printed-mobius-strip-home-by-universe-architecture/.
- 4 "How 3D Printing Will Change Our World," *ArchDaily*, July 12, 2012, www.archdaily.com/253380/how-3d-printing-will-change-our-world/.

- 5 "Printing Architecture," *Digital Grotesque*, accessed July 14, 2013, www.digital-grotesque.com/concept2.html.
- 6 "One Process—Infinite Scales," *Digital Grotesque*, accessed April 14, 2013, www.digital-grotesque.com/design_composition3.html?screenSize=1&color=1.
- 7 "Neri Oxman: On Designing Form," YouTube video, 20:42, uploaded March 10, 2010, www.youtube.com/watch?v=txl4QR0GDnU.

- 8 Liam Young, "Control + P," *Icon* 118 (April 2013), 74-81.
- 9 Walter Benjamin, "The Work of Art in the Age of Mechanical Reproduction," in *Illuminations* (New York: Schocken Books, 1969), 217.