
AD
Guest-edited by
ALI RAHIM and
HINA JAMELLE
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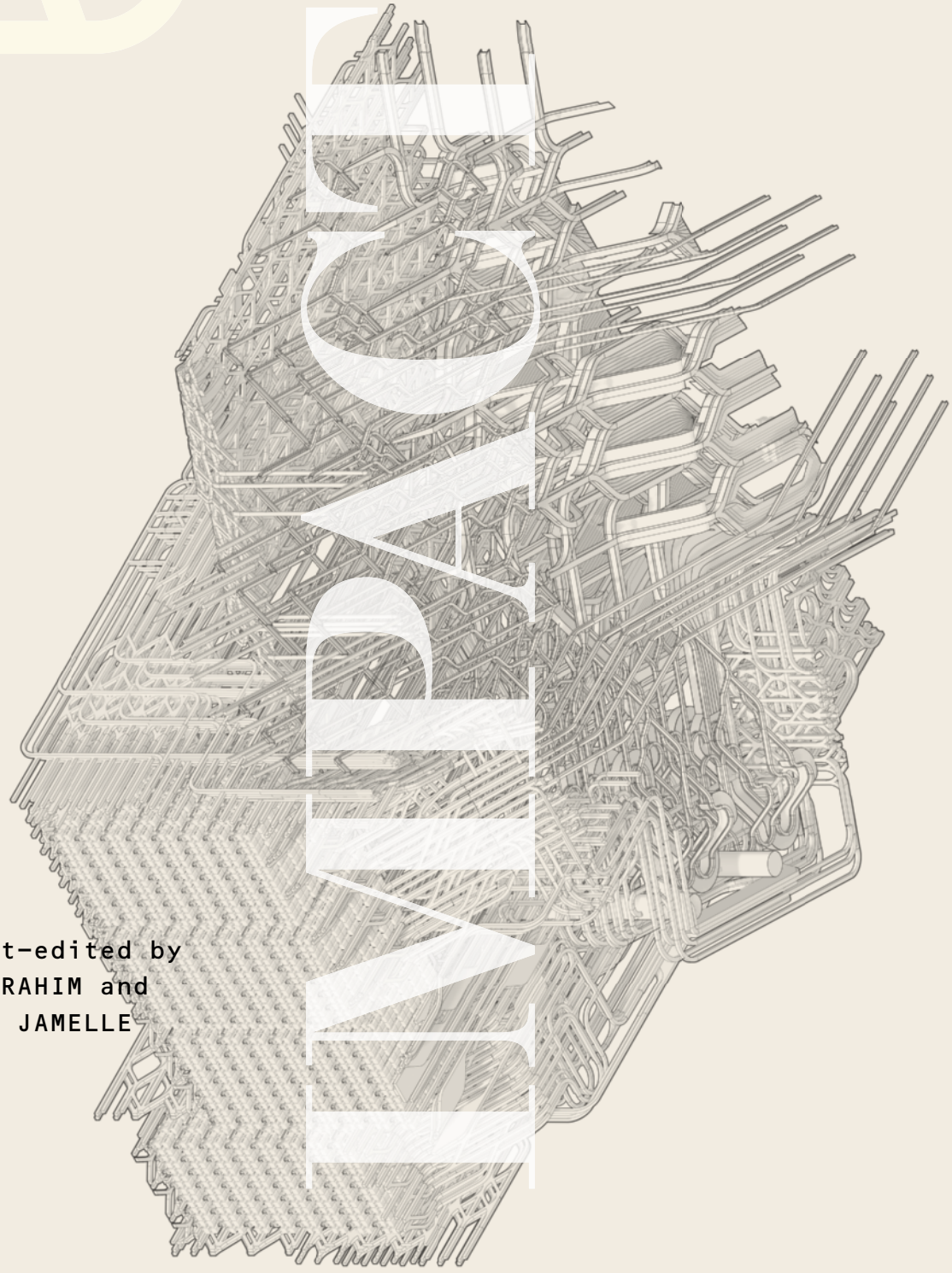
IMPACT



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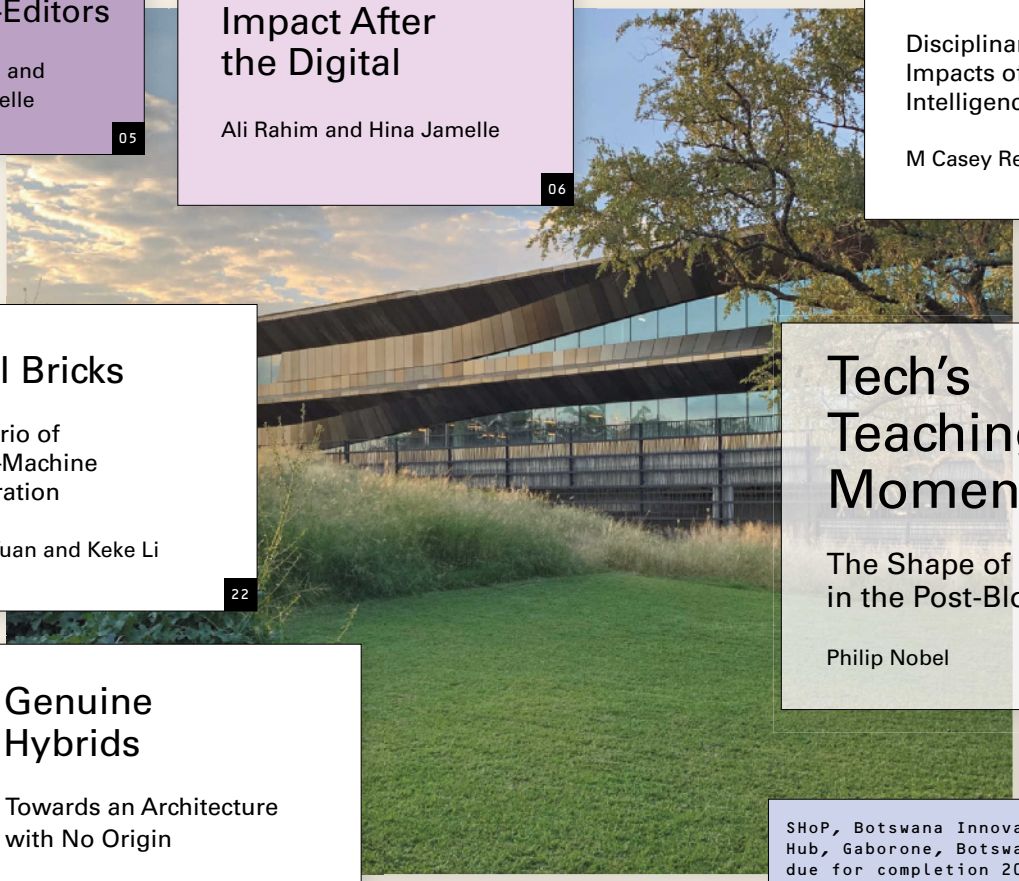

SHoP, Botswana Innovation Hub, Gaborone, Botswana, due for completion 2021

Young & Ayata with Michan Architecture, DL1310 apartments, Mexico City, 2020

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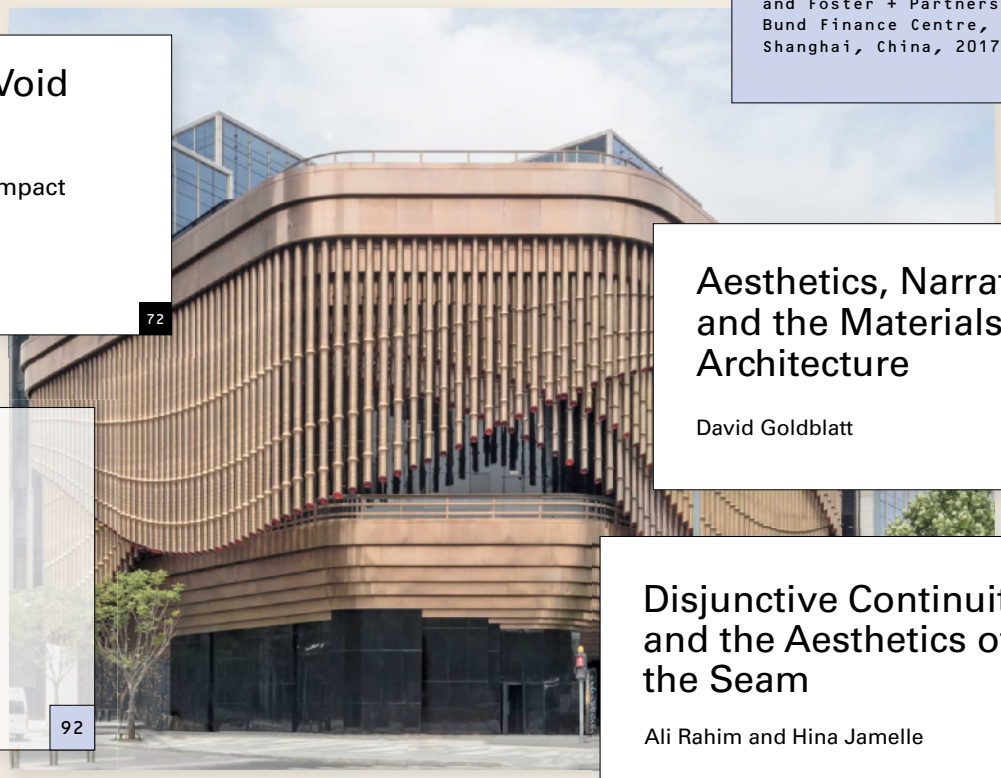
Guest-edited by **Ali Rahim and Hina Jamelle**



Heatherwick Studio and Foster + Partners, Bund Finance Centre, Shanghai, China, 2017

Institute for Computational Design and Construction (ICD) and Institute for Building Structures and Structural Design (ITKE), ICD/ITKE Research Pavilion 2016-17 (detail), University of Stuttgart, Germany, 2017

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Front cover: Caleb White and Leo Yi-Liang Ko / Contemporary Architecture Practice, Style-transfer techniques using machine learning, 2019. Image Caleb White and Leo Yi-Liang Ko. © Ali Rahim and Hina Jamelle / Contemporary Architecture Practice

Inside front cover: Zaha Hadid Architects, Leeza SOHO Tower, Beijing, China, 2019. © Hufton + Crow

Page 1: Agata Jakubowska and Shi Zhang, Future Airports, MSD-AAD Post Professional Studio with Ali Rahim, University of Pennsylvania Weitzman School of Design, Philadelphia, Pennsylvania, 2018. © Ali Rahim

05/2020

ARCHITECTURAL DESIGN

September/October
2020

Profile No.
267

We would like to thank Dean Fritz Steiner of the University of Pennsylvania Weitzman School of Design for his support, and David Goldblatt, Emily Foster, Patrick Monte, Leon Yi-Liang Ko and Caleb White for their valuable contributions in making this issue possible.

ABOUT THE

GUEST-EDITORS

ALI RAHIM AND
HINA JAMELLE

Ali Rahim and Hina Jamelle's academic research and practice explores the intersection of architecture, technology and contemporary culture. Both teach at the University of Pennsylvania Weitzman School of Design, where Rahim is a full professor and director of the Advanced Architectural Design Program, and Jamelle teaches final-year Graduate Option Studios and directs the Graduate Program's Urban Housing Studios. Rahim has also served as a Studio Zaha Hadid Visiting Professor at the University of Applied Arts Vienna, Louis I Kahn Visiting Professor at Yale University, and as a visiting architecture professor at Harvard University and the Southern California Institute of Architecture (SCI-Arc). Jamelle has held the Visiting Schaffer Practice Professorship at the University of Michigan. They are co-directors of New York- and Shanghai-based architectural firm Contemporary Architecture Practice.

Rahim has published extensively, including the books *Catalytic Formations: Architecture and Digital Design* (Taylor & Francis, 2006), *Turbulence* (WW Norton & Company, 2011), *Asset Architecture* (OROS Editions, 2014), *Asset Architecture No 2* (2015) and *Asset Architecture No 3* (2016). His upcoming books *Future Airports* and *Catalytic Formations 2* will be published this year. He was also the Guest-Editor of *AD Contemporary Processes in Architecture* (Sept/Oct 2000) and *AD Contemporary Techniques in Architecture* (Jan/Feb 2002), and with Jamelle of *AD Elegance* (Jan/Feb 2007). Jamelle's forthcoming book *Under Pressure*, on urban housing, will be published by Routledge in 2021. Both have lectured widely in the US, Europe and Asia.

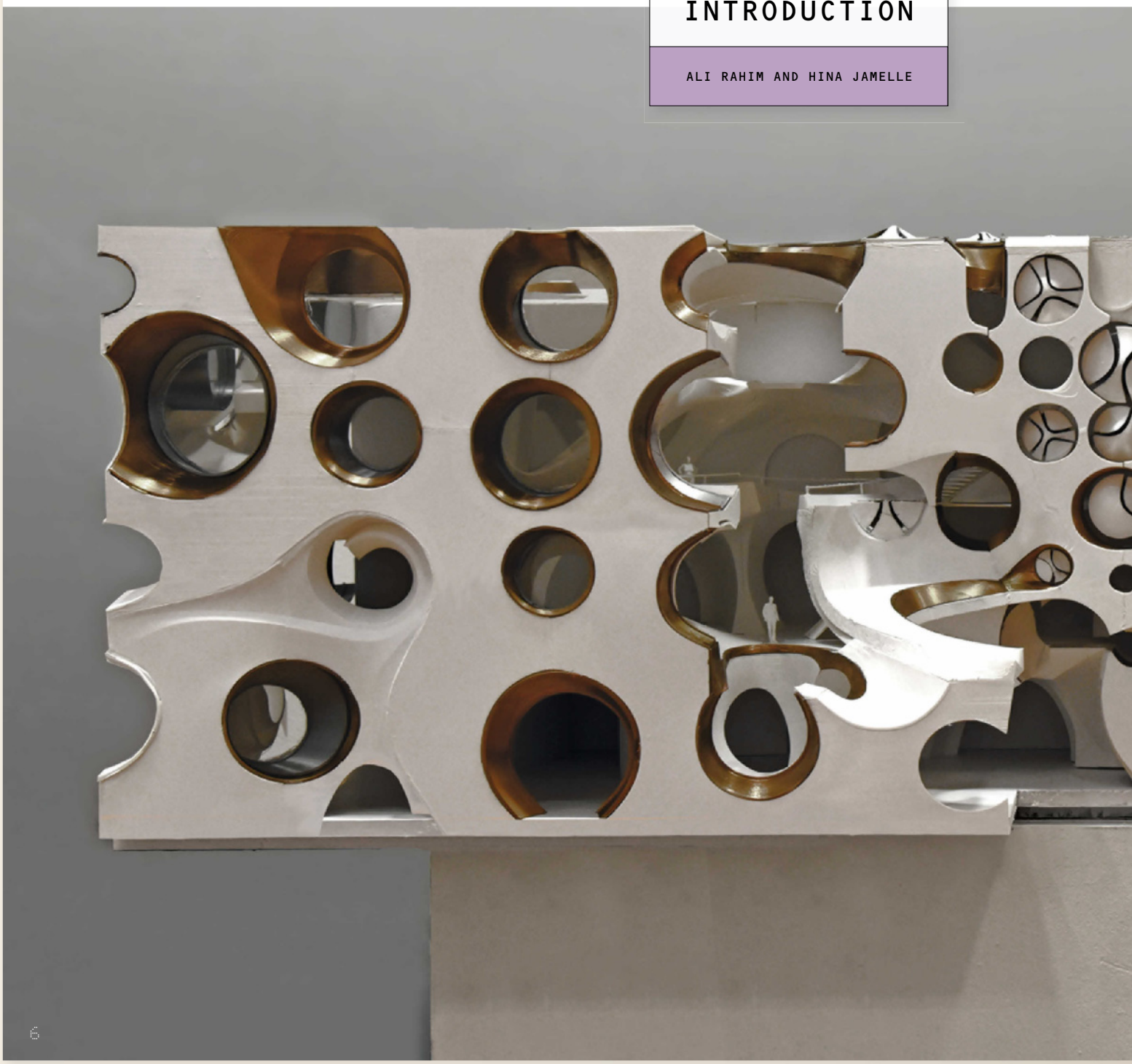
Founded in 1999, Contemporary Architecture Practice has been known for its futuristic designs using digital techniques and the latest technologies for the design and manufacturing of architecture. The practice's research projects have been funded by organisations including Dupont, Arup, Z-Corporation, ABT Manufacturing and the Wharton Business School. Commissioned projects include the Lutron Tradebooth (New York, 2009), Wall for the Future for the Museum of Modern Art (MoMA) in New York (2008), Reebok flagship store (Shanghai, 2004), Wenjin Hotels VIP Club (2017), NJCTTQ Pharmaceutical Company headquarters (Nanging, 2019), AMEC Technologies headquarters (Shanghai, 2020), Viceroy Hotel (Abu Dhabi, 2009), Samsung Housing Masterplan (Seoul, 2012) and IWI Orthodontics (Tokyo, 2011).

The practice's work has been exhibited at MoMA, the London, Beijing and Shanghai biennales, and the Tel Aviv Museum of Art, among others, and featured in major publications around the world. The firm was awarded the Architecture Record Product of the Month for the Opale light fixture for Lutron's Ivalo Collection, as well as the Outstanding Award for Far Eastern Digital Architecture Design (FEIDAD) for their flagship store. Rahim and Jamelle have also won the Architectural Design Vanguard Award (2004) and in 2005 were featured in Phaidon's *10x10x2* as one of the world's top-100 emerging architects. Their IWI Orthodontics project was featured in Phaidon's *ROOM* (2014) as one of the most creative interior design projects of the century, and they have also been featured in *Fifty Under Fifty: Innovators of the 21st Century* (Images Publishing, 2015). AD

ARCHITECTURAL IMPACT AFTER THE DIGITAL

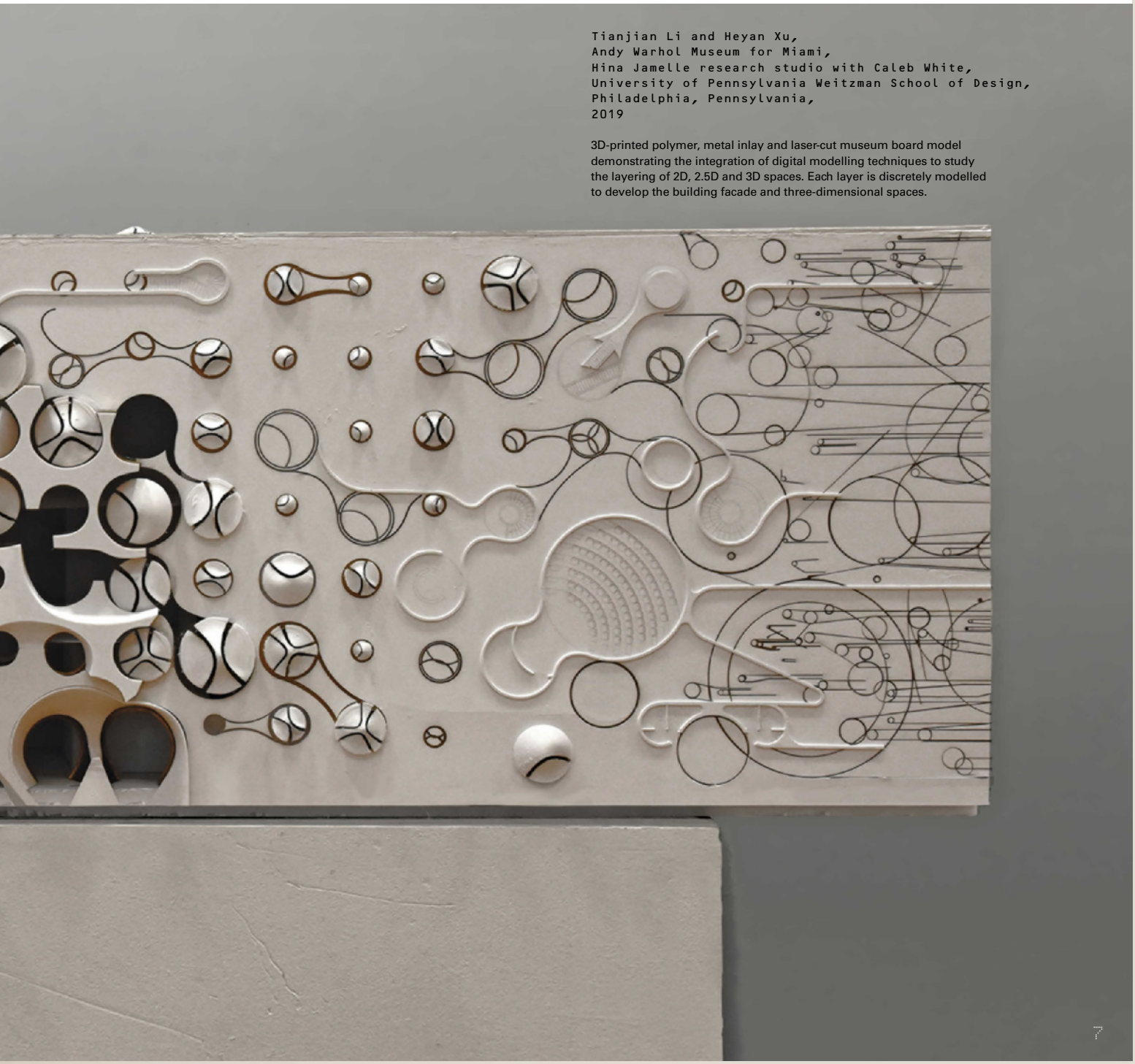
INTRODUCTION

ALI RAHIM AND HINA JAMELLE



This issue of Δ signifies an expansion of the digital discourse that foregrounds the discipline of architecture and its cultural context. When first introduced to architecture in the early 1990s, the digital brought with it a bifurcation of theoretical interests: the material and the immaterial. Design, traditionally guided by the qualitative underpinnings of philosophy, science and the fine arts, was faced with rapid changes in technology conversely guided by quantitative technical measures. Architectural designers borrowed from other disciplines and most neglected their own, while technologists marched towards ever greater efficiency. Efficiency drove architectural discourse towards optimisation and quantitative models often irreconcilable with more robust measures of design intent. Terms like 'blobs', 'nonstandard', 'parametric' and 'organic' all describe the forms that were being generated, which led to a fascination with surface continuity and consolidated in a totalising movement.

However, the success of the digital cannot be measured by its widespread use alone. Commonplace can often become stultifying and it is now time to place impact elsewhere. Over the last 30 years, the digital has been divorced from most of the core issues of the discipline of architecture: how are buildings made in material and detail, what are their spatial configurations, what do they look like, and how do they address and participate in the culture in which they locate themselves? Δ *Impact* chronicles projects that bring the extremes of qualitative design and quantitative technologies into close cooperation in service of the discipline. The way to achieve this goal is to implement discrete modelling precision in building design and construction and apply it to disciplinary questions at every level.



Tianjian Li and Heyan Xu,
Andy Warhol Museum for Miami,
Hina Jamelle research studio with Caleb White,
University of Pennsylvania Weitzman School of Design,
Philadelphia, Pennsylvania,
2019

3D-printed polymer, metal inlay and laser-cut museum board model demonstrating the integration of digital modelling techniques to study the layering of 2D, 2.5D and 3D spaces. Each layer is discretely modelled to develop the building facade and three-dimensional spaces.

Embracing Material Discourse

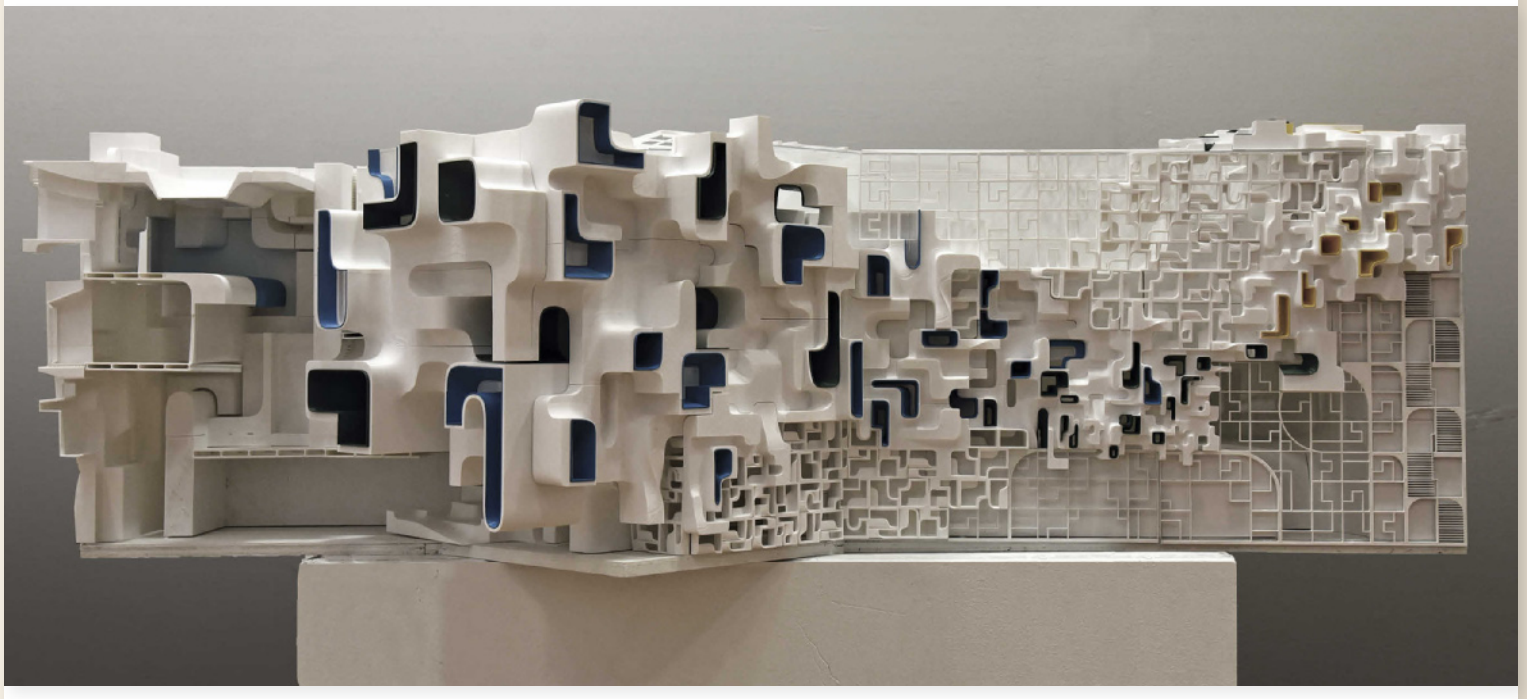
The issue focuses on material architectural discourse – the things, places, buildings and respective contexts of architecture in the world. There have been two prevalent avenues for disciplinary development of the digital – architecture schools and practice – both of which have at times de-emphasised, overlooked or outright neglected architecture's material reality in favour of advancing technical possibilities and efficiencies. Digital experimentation has had a momentous impact on education. In the predigital modern era, architects were taught to clarify a concept through the design process until it manifested in a building. With the digital turn, this method shifted to an iterative process broadly known as 'design research', which engages making and conceiving simultaneously. In the early 1990s, 3D motion graphics software initially developed to create animation films in Hollywood was introduced in architecture schools. This was the first time that generative computer tools became available to students of architecture, and the shift from the static to the temporal incited a phase of tremendous experimentation.

Architectural design was reconceptualised from the physical site drawn on paper to digital motion vectors modelled in the computer. Serial section projects proliferated and resulted in forms created by interpolating continuous surfaces between sections using Bézier curves, parametric curves introduced in the 1960s for the design of Renault motorcars. Additionally, non-Euclidean (hyperbolic and spherical) geometry led to the exploration of topology – a mathematical concept used in computer script algorithms that replicate natural growth systems using point clouds. Design techniques also transformed in relation to how projects are built. With new modelling, analytic and fabrication techniques available, including discrete modelling, computational fluid dynamics, CNC machining and 3D additive printing, projects within schools of architecture developed into sophisticated proposals for architecture. The possibilities unleashed by these techniques initiated a paradigm shift wherein the building could be viewed not as a complex composition of discrete parts and assemblies, but rather as a monolithic entity unto itself; a new formalism prevailed.

Developments in architectural education were folded into architectural practice along with automation in the construction industry. Large software companies have disseminated standardised techniques for building design and construction based on construction industry products and standards. CATIA, originally developed by Dassault Systèmes for the aerospace industry, was rewritten by Gehry Technologies for Microsoft Windows and enabled contractors to compete in the bidding of complex projects. Building information modelling (BIM) streamlined design and construction processes with automated features and libraries, and powerful BIM tools like Autodesk's Revit became industry standards. Detailing became an automated function of design software rather than a defining feature of architectural design. Broadly speaking, the results have been a sameness in work implementing the same software. Perhaps more significantly, digital architecture has become detached from its materiality and its material consequences in the world. The digital has exhausted its own development and now needs the discipline of architecture as an active partner to develop new material strategies and move beyond quantitative frameworks.

Yingxin Zhang and Lingyun Yang,
Andy Warhol Museum for Miami,
Hina Jamelle research studio
with Caleb White,
University of Pennsylvania
Weitzman School of Design,
Philadelphia, Pennsylvania,
2019

3D-printed polymer and laser-cut museum board model demonstrating the seamless integration of multiple materials to develop a new museum proposal.



Material Strategies for Digital Design

There are five compelling means by which digital design should materially address core issues of the discipline. First, techniques which are hallmarks of digital processes, if borrowed from other fields, should be narrow in their scope and tested against the discipline of architecture to determine whether or not they have potential for enhancing it. For example, artificial intelligence (AI) and its techniques of machine learning are based on chances of success and accuracy; machine learning trains software to become more efficient at what it does. Applications of AI in urban planning have likewise been efficiency based, aiming to move people around cities in ways that meet the least resistance or enable driverless cars to operate smoothly. Instead of accepting AI at face value for its technological potential, as designers, we should explore qualitative aspects of AI that have greater potential to have material impacts on the discipline.

One such example is the narrower area of AI known as 'style transfer'. Style transfer uses machine-learning algorithms to break an image into two parts: content, the underlying organisation or hierarchical structure of the image, and style, the aesthetic quality of the image. With these two features separated, a designer can apply the aesthetic quality

Xiaoyi Peng and Suwan Park,
Machine-learning image,
Hina Jamelle research studio
with Caleb White,
University of Pennsylvania
Weitzman School of Design,
Philadelphia, Pennsylvania,
2020

Machine-learning style transfer algorithms with a focus on colour and luminosity used to produce a new chromatic figuration.

ROBOTIC TECHNOLOGY BASED ON MACHINE LEARNING SHOULD EXPLORE THE REFORMATION OF TOOLS AND TECHNIQUES OF MAKING

of almost any image to another. Though this machine-learning process was initially developed as a tool to maximise image compression efficiency, it has much greater potential to be a qualitative design research tool. This moves machine learning and artificial intelligence from the insulated domain of the computer scientist to the purview of those interested in aesthetics and design. The style transfer technique develops a sensibility for the designer that transcends earlier digital methods, as it harnesses a specific element of AI and focuses it on disciplinary precedents. Such curated architectural applications of AI are investigated by M Casey Rehm in his article in this Δ issue (pp 14–21), among others, and show that, rather than just creating infinite variations, robust AI databases can work to deepen architectural knowledge of composition in the building plan, section, elevation or hybridised outcomes and be mined for their architectural usefulness. Likewise, robotic technology based on machine learning should explore the reformation of tools and techniques of making as well as establish new partnerships between digital design and intelligent construction, as exemplified by Philip F Yuan and Keke Li's explorations in robotic masonry (pp 22–9).

Ali Rahim and Hina Jamelle/
Contemporary Architecture Practice,
Machine-learning study for the Wenjin Hotel,
Beijing, China,
2019

Machine learning was used to deepen the practice's exploration of spatial qualities for the project. Continuous discontinuity of colours, textures and materials informed the final design.

Second, advanced digital techniques should be used in such a way that material assembly supersedes the use of digital tools. When transferring a technique from a different field, if the technique is reflected in the geometry of the project, we as designers are relinquishing our responsibility for how that design impacts material discourse. Our responsibility is relinquished to other fields, particularly to computer programmers, who determine the mathematics that generate a surface. If the algorithmic logic of a preprogrammed surface is used to create the material connections and joints of a building, then critical decisions on building construction and core questions of the discipline are relegated to the default software, not the designer. Prescribed operations yield prescribed results. Software defaults should be avoided; they build a precarious discourse for the discipline of architecture.

When the design architect takes control and moves beyond the defaults, their projects have a greater opportunity to benefit the wider culture – to participate in their own materiality – and are not confined as exercises in digitality. How does the architect design the form, space, openings, materials and their assembly, and, overall, how does the building communicate and respond to the culture in which it is situated? These are all disciplinary questions that elude quantitative methods irrespective of advancements in computational modelling. To this end, Ferda Kolatan (pp 40–49) speculates on how architecture might be conceived without origin through entanglement strategies resulting in hybrid entities. Conversely, Hernán Díaz Alonso embraces the constraints of typology through exaggeration in shoe design (pp 50–57), while Kutan Ayata challenges aesthetic assumptions through techniques of material and tectonic estrangement (pp 58–65).

Third, digital design should take on the building at full scale in all its complexities. Until now, projects have been formally and materially bound by restrictive conventional methodologies. The digital project has now moved from the scale of temporary installations and pavilions to that of permanent three-dimensional building-sized fabrications. It should be apparent from 30 years of designing with digital tools that some techniques are not scalable. Much of our time has been spent using digital techniques to design and fabricate pavilions in order to test the veracity of such techniques. While focus on pavilions has advanced design techniques, buildings themselves have been neglected. Buildings have loads, dead and live, and need to be firmly grounded. Buildings require different techniques of making, assembly, detailing, and whole logistical processes that should benefit from the fully fledged experimentation and attention of the digital project. Insular digital projects and their reliance on process to support their vision have created an inflated discourse of architectural imagery that needs to be counterbalanced by a culture of making and material discourse at the building scale. Paolo Pininfarina and Paolo Trevisan's experience in scaling between automotive design and manufacturing and building design are insightful in this respect (see pp 66–71). Further, Patrik Schumacher offers a reconceptualisation of the skyscraper atrium through the realisation of 'the mega-void' in Zaha Hadid Architects' Leeza SOHO Tower project in Beijing (pp 72–81).

Yuanyi Zhou, Wenjia Guo and Qiao Mu, The Contemporary Detail, Ali Rahim research studio with Angela Huang, University of Pennsylvania Weitzman School of Design, Philadelphia, Pennsylvania, 2019

Full-scale research model built to develop the aesthetic of metal folding details and tightly nested metal components. The project developed from the detail to surface to volume, and, ultimately, to a building proposal.

MATERIALS THEMSELVES CAN BE TREATED WITH A WIDE ARRAY OF FINISHES AND TEXTURED IN MULTIPLE DIFFERENT WAYS

Paul McCoy, Molly Zmich and Maria Jose Fuentes,
Design Innovation,
Ali Rahim design seminar,
University of Pennsylvania Weitzman School of Design,
Philadelphia, Pennsylvania,
2019

This multiple-material fabricated prototype questions the role of materiality in the design of a detail or an assembly. Though the model is made of three different materials – CNC-milled foam, 3D-printed polymer and laser-cut MDF – the seams move across these materials to achieve overall coherence.

Fourth, architectural detailing should be reimagined through a contemporary framework. While we attempt to move beyond the aesthetics of the early digital project and re-engage with the intricacy of assembly and materiality, we should be careful not to revert to predigital architectural assumptions. We do not need to adhere to past models of building; the unit of material itself can be modulated, and joinery can be engineered in ways that were previously impossible. Seams can be used to suppress or heighten the tectonic reading of form rather than standardised material sizes and off-the-shelf joinery. Material assemblies can be detailed in ways that differ from area to area, creating highly nuanced multitudinous readings of form. Contemporary fabrication methods allow materials to be assembled and cut in ways that allow for multifaceted orientations. Materials themselves can be treated with a wide array of finishes and textured in multiple different ways. Just as we look to remove the generic digital signature from architecture, we should also remove the generic industrial signatures imposed by manufacturing necessities rather than design intent. Contributions from Thomas Heatherwick (pp 92–99), SHoP's Ascan Mergenthaler (pp 110–117) and the work of Contemporary Architecture Practice (pp 100–109) establish a spectrum of nuanced approaches to architectural craft, materiality, assembly, intricacy and detailing that test and demonstrate new scope for digital design processes.

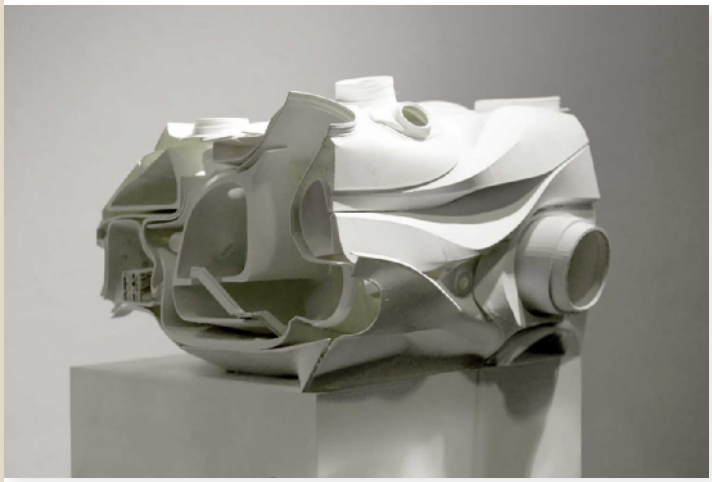
Fifth, digital architects need to expand their own field of design research to engage with factors including climate change, health, the nonhuman, political economy, racism, sexism, ecology, energy and scarcity of resources – all of which impact material architectural discourse. Antoine Picon's article (pp 118–25) frames the split between technologically motivated digital avant-gardes focused on virtuosity and environmentally concerned factions grounded in sustainability as part of a global shift in the materiality of architecture, which he claims can and must be dissolved through a new ecological view. Broader contextual concerns need to participate in the development of designs in order for projects to be viable. Digital practices would benefit in this respect from the expansive approach required by buildings. Buildings in the public and private sectors are always shaped by many forces, including the monetary capital and institutional structures that fund them. UNStudio's Ben van Berkel outlines ways in which 'disruptive technologies' and user data can be utilised to create new ways of mapping and responding to context (pp 26–33). As a discipline, we can be smarter in the ways we achieve occupant and stakeholder goals as well as our own. Building reuse and the intelligent recycling of buildings are promising examples. Another is the reformulation of asset architecture to provide an investment vehicle for investors while contributing towards city planning goals. Digital designers should further evaluate how their techniques can create new innovative solutions with material impact.

A New Culture of Making

Unless architects turn to a new culture of making, architecture shaped by innovative digital technology will become irrelevant. There are already threads of this argument being made by certain factions of academia.

Atelier Deshaus,
Long Museum West Bund,
Shanghai, China,
2014

Located in the Xuhui District of Shanghai along the Huangpu River, the museum site was once a coal dock. The reuse of the existing coal hopper and unloading bridge became central features of the project and also informed the concrete materiality of the museum.



Yuanyi Zhou, Wenjia Guo and Qingyang Li,
Future Airports,
Ali Rahim Advanced Architecture Design studio,
University of Pennsylvania Weitzman School of Design,
Philadelphia, Pennsylvania,
2017

The composite polymer section model shows the aesthetic of a future airport terminal proposal as well as its sectional strategy. The Modernist airport typology is questioned to allow the movement of automated logistics systems through the cargo terminal while also enabling passengers to circulate through these spaces on their way to their gates.

Critics of digital design at worst seem to assume that we can naively return to the predigital, and at best appropriate philosophical concepts rather than dealing with the discipline of architecture and its material realities. Nostalgic evaluations should be foregone; the cultural milieu we live in is digital, and one cannot underplay its impact or undo what has been done. At the same time, architecture's complex material interrelations should ground theoretical positions and be embraced. Digital is where we are, and the way in which the discipline remains culturally relevant is by embedding innovations firmly in the culture of making.

This points towards addressing the specific ways in which buildings are built. The discipline has become increasingly complex; architects need to grapple with many materials, structural systems, building systems and their associated codes. The ability to integrate these into designs, question their relationships, and shape their flow through buildings will instantiate a new level of sophistication in architecture. This can be achieved by using materials, developing new concepts and means of joinery, and embracing the discourse's material registration, its impact in the world. Projects that are more subversive in how they are created and that eschew their digital signatures have a greater significance to the discipline's new materialisations. This issue of Δ illustrates these ideas and their architectural impact. Δ