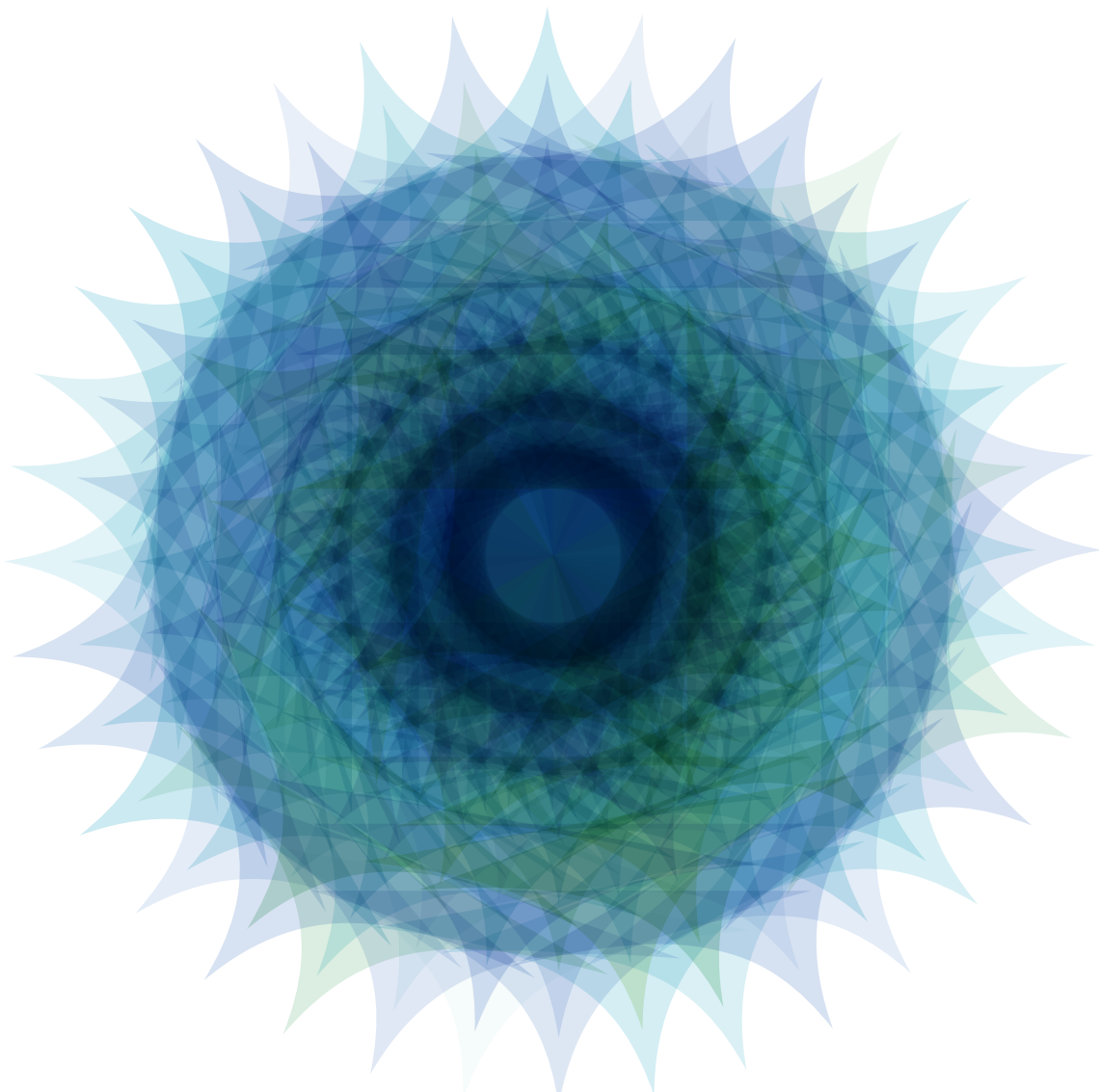
HABITS OF THE ANTHROPOCENE



Projects Catalog of the 43rd Annual Conference for the Association for Computer Aided Design in Architecture

University of Colorado Denver

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PROJECTS

HABITS OF THE ANTHROPOCENE: SCARCITY AND ABUNDANCE IN A POST-MATERIAL ECONOMY
PROCEEDINGS OF THE 43RD ANNUAL CONFERENCE OF THE ASSOCIATION
FOR COMPUTER AIDED DESIGN IN ARCHITECTURE
VOLUME I: PROJECTS

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HABITS OF THE ANTHROPOCENE

FABRICATED TRANSITIONS

The projects in the Fabrication Transitions approach the idea of making and embodying architecture through a sort of logic reversal; a turning inside-out of accepted approaches. What we can typically agree upon is, in this scholarship, challenged to the point of peculiarity. That peculiarity then allows us to recognize our own under-scrutinized assumptions. And this is not merely difference for the sake of difference. Instead, it offers meaningful insight into how we construe, construct, and comprehend our built environments.

Three themes emerge across the eleven projects: 1.) physical and virtual collapsed perception, 2.) fabrication process rearrangement, and 3.) re-engagement with tradition through emergent technology.

In our first theme, projects leverage augmented reality in surprising ways. For example, a built structure is left unfinished for users to imagine its final form as a virtual overlay. Another unfinished structure offers a physical reference, then is mapped inside a space virtually as speculation. A third project replaces traditional drawing with a virtual model, to guide the maker through its assembly logic.

In our second theme, projects offer eye-opening contradiction in their approaches, like using a dynamic, robotically controlled base in lieu of moving a 3D print nozzle, or starting with hand-sculpting a form, but then algorithmically determining variation, or replacing the most important part of a structure with a thin and delicate knuckle, or using thin and short wood scraps to create a robust, surprisingly tall structure.

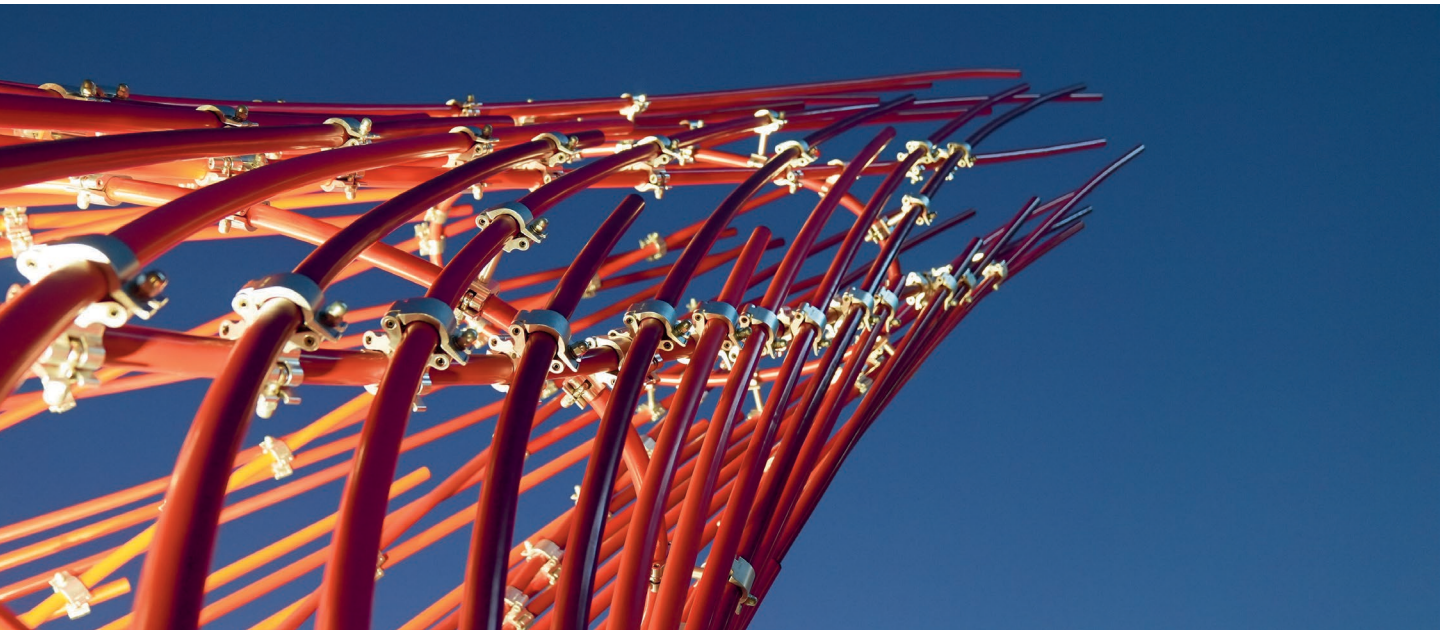
In our third theme, projects start with the traditional, but then reexamine their value through contemporary, technological contexts. One project uses salvaged stone to yield an impossibly thin, elegant enclosure, only made possible through computational analysis. Another project merges a cultural tradition with artificial intelligence to speculate on new meanings and readings.

Marc Swackhamer
University of Colorado Denver

Resonance-In-Sight: Fabrication of a Mixed-Reality Art Installation

Kristof Crolla
The University of Hong Kong

Garvin Goepel
The University of Hong Kong



1 Detailed photograph of artwork by night [Laboratory for Explorative Architecture & Design Ltd. (LEAD), 2021 ©].

Project Description

The integration of mixed reality technology is facilitating significant changes in how we perceive and engage with our surroundings. "Resonance-In-Sight" is a public art installation by Kristof Crolla, Garvin Goepel, and the Laboratory for Explorative Architecture & Design Ltd. (LEAD) made for the Hong Kong Museum of Art (HKMoA). It responds to the challenges to social interaction imposed during the recent global health pandemic by playfully engaging the public in augmented reality-driven (AR) interactions with the museum's rich art collection during times of its extended closure (see Figure 1).

"Resonance-In-Sight" is defined by a dramatic pair of elegantly curved and brightly colored steel structures, placed several meters apart to create a tangible tension between them (see Figures 2 and 3). A virtual element is overlaid on top of the structures, made possible through superimposed graphic holograms that are designed and curated to echo the museum's collection (see Figures 2 and 4). This is made visible through bespoke AR applications visitors can download onto their own hand-held electronic devices (Crolla and Goepel, 2022). This project paper describes the strategies to simplify the fabrication of the artwork's geometrically complex physical component.

Design

The swooping geometry of the project's two steel structures is designed to fray at the tip to suggest geometric continuity between the sculptures. Both are symmetrical and have

PRODUCTION NOTES

Artwork: Resonance-In-Sight

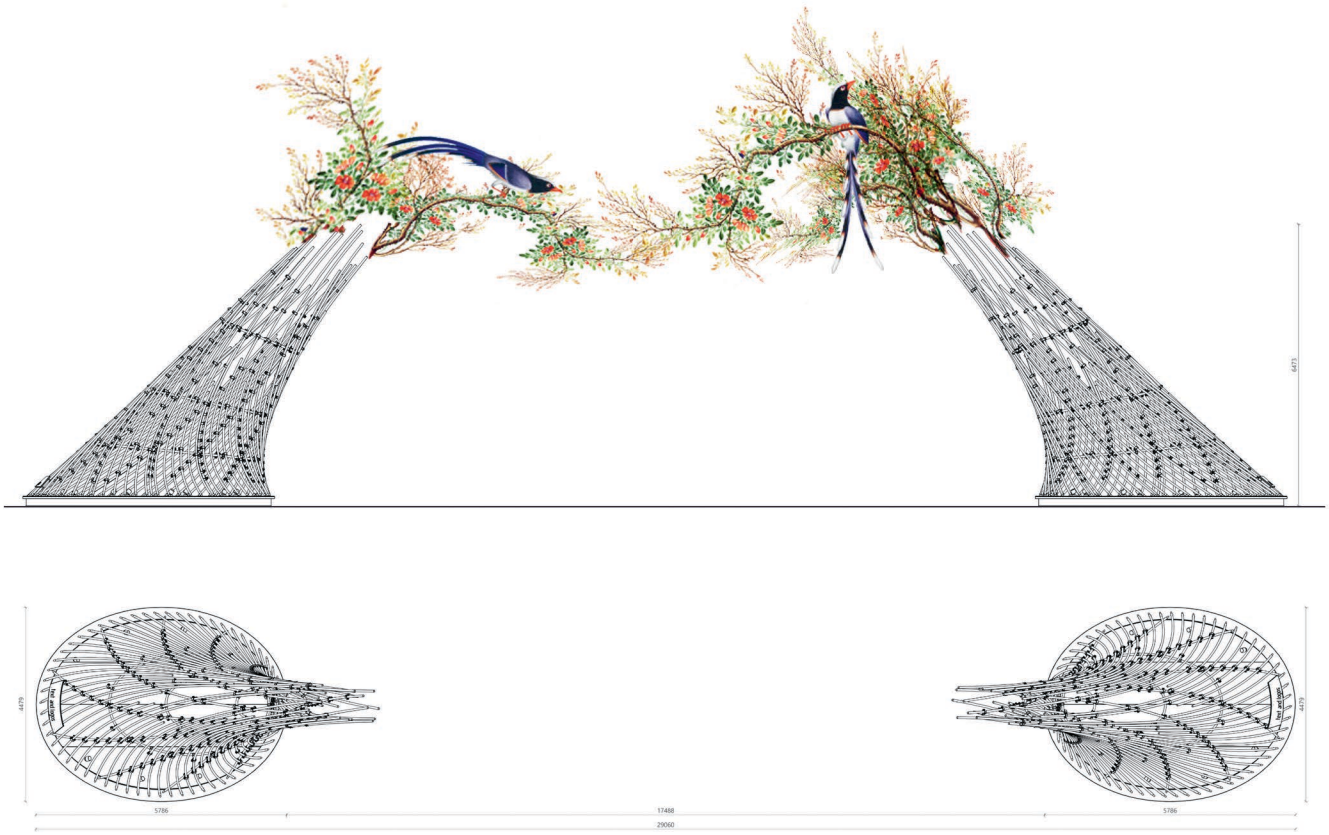
Exhibition: Redefining Reality

Client: Hong Kong Museum of Art

Location: Art Square at Salisbury Garden, Hong Kong

Exhibition period: 12.2021 - 11.2022

Project Video: https://vimeo.com/659238642



2 Elevation with Augmented Reality overlay (top), Plan (bottom) [Laboratory for Explorative Architecture & Design Ltd. (LEAD), 2021 ©].

been developed to be fabricated from manually bent steel pipes and standard swivel shackle connections (see Figure 5). Their doubly curved geometry is developed to minimize material use under structural performance requirements. Inspired by fibrous light-weight structures found in nature, the structure is built up of interconnected layers made from the thinnest possible, three-dimensional curved steel pipes that swoop in opposite directions. Assembly and disassembly strategies are optimized through the use of reusable installation molds.

Fabrication

The doubly curved pipe geometry is fabricated through a combination of manual craft and strategic digital fabrication technology. Computer-numerically-controlled (CNC) cut molds from thin sheet metal are used as guides for craftspeople to manually bend the pipes using traditional tools, like blowtorches and standard analogue pipe benders (see Figures 6 to 8). This simple system provides the necessary control to fabricate the geometry accurately, as overall geometries were developed to connect all pipes with one single standard connector: an off-the-shelf swivel shackle. For this, all pipe interconnections needed to be spaced at precisely the same distance, and perpendicular to the crossing curves' axis. Assembly was simplified through a set of reusable CNC-cut molds that guide the exact placement of each doubly curved pipe, one by one, allowing quick onsite assembly and disassembly (see Figures 9 to 12).

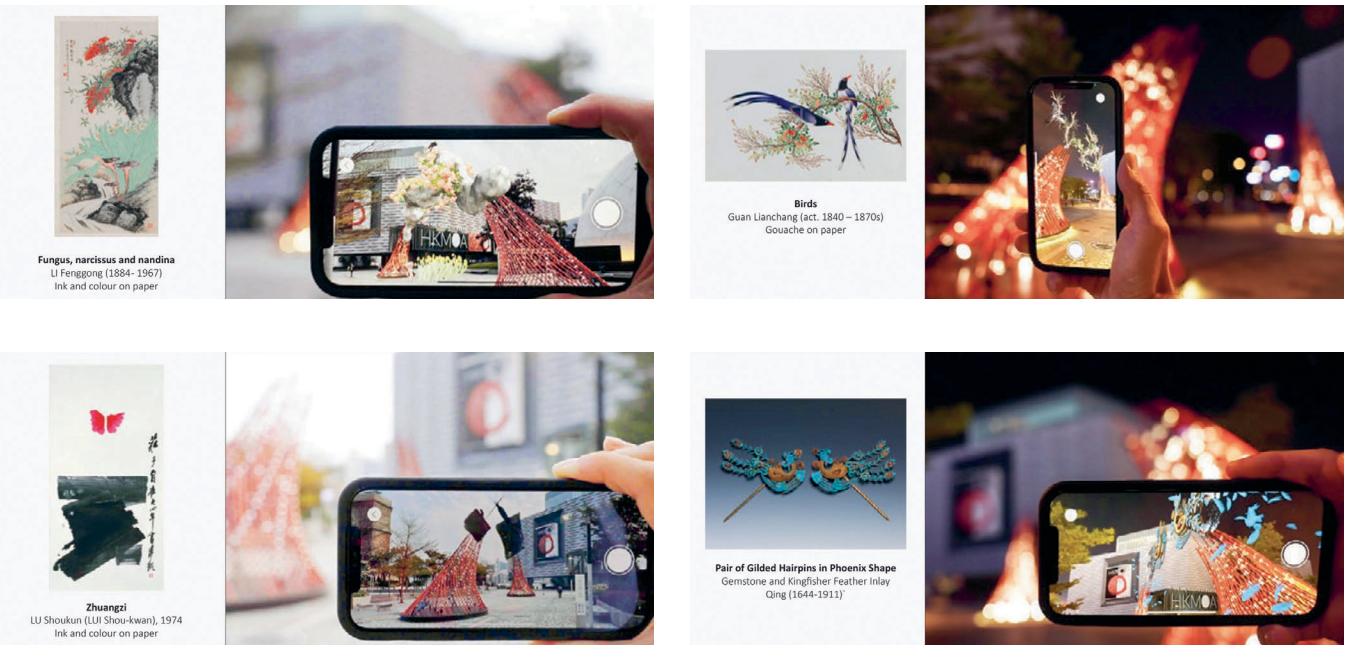
Conclusion

"Resonance-In-Sight" demonstrates that the strategic integration of local craft restrictions and opportunities from computation into the design process allows for highly complex, non-standard geometries to become part of the practically accessible, local construction solution space.

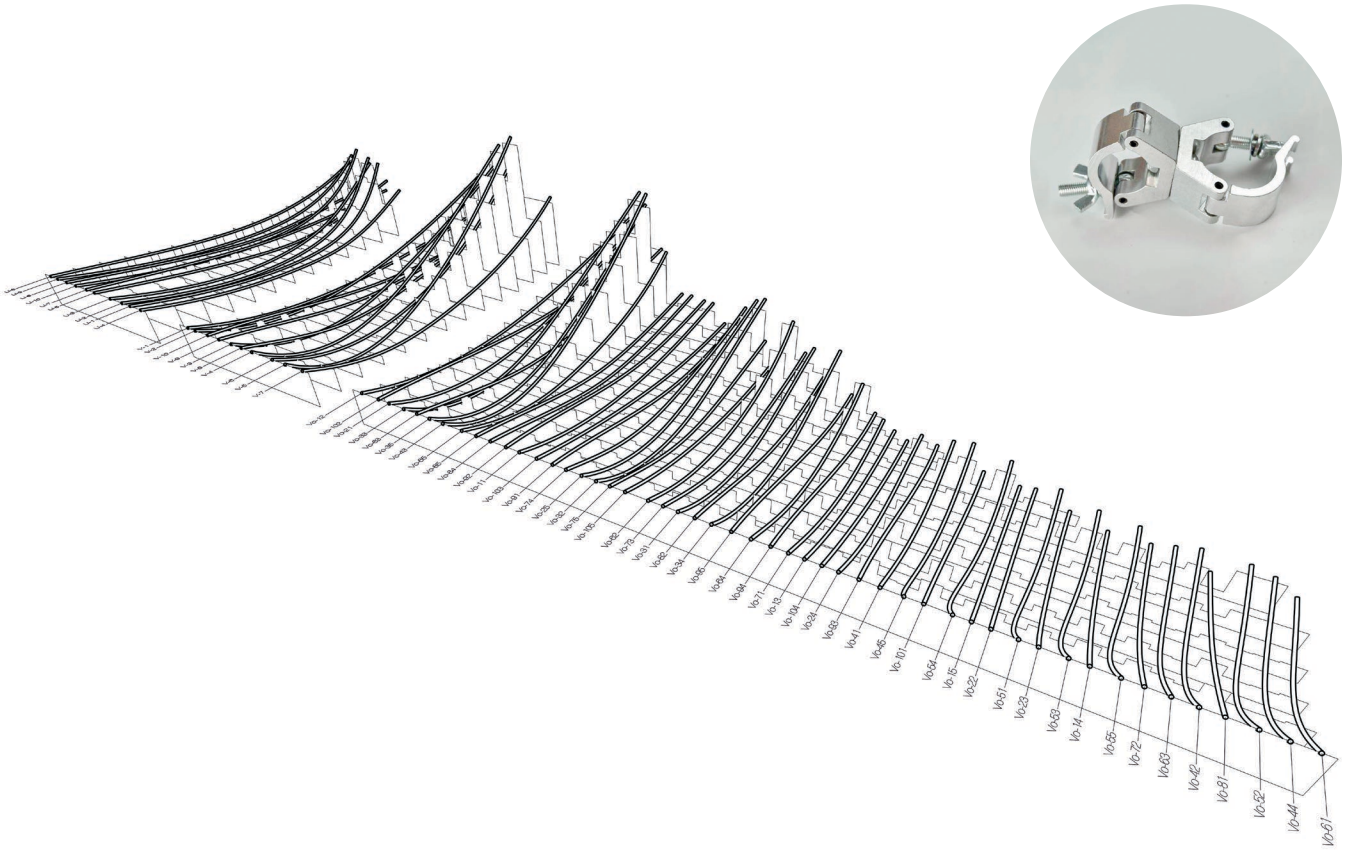
ACKNOWLEDGMENTS

Artists: Kristof Crolla and Garvin Goepel; Project Design: Laboratory for Explorative Architecture & Design Ltd. (LEAD); Design Team: Kristof Crolla and Julien Klisz (LEAD), Garvin Goepel;

3 Daytime perspective (Kris Provoost, 2021 ©).



4 Visitors can use a bespoke Augmented Reality application for handheld mobile devices to access the project's holographic content inspired by museum artwork [Laboratory for Explorative Architecture & Design Ltd. (LEAD), 2021 ©].



5 CNC-cut jigs, cut from thin recyclable metal sheets, are used as guides to three-dimensionally bend pipes. Top right: Standard, off-the-shelf swivel shackle used to fix all pipes [Laboratory for Explorative Architecture & Design Ltd. (LEAD), 2021 ©].

Graphic & Augmented Reality Design: Daniel Lam and Ester Wong; Augmented Reality Experience Design & Implementation: Joy Aether Ltd.; Structural Engineering: Buro Happold International (Hong Kong) Ltd.; Manufacturing & Installation: Program Contractors Ltd. (PCL); Photography: Kris Provoost; App Download Link: iOS: https://apple.co/3rLBgAf, Android: https://bit.ly/3I-NCsPL; Instagram Filters: https://bit.ly/3IE5zyM, https://bit.ly/3rSMXVJ; Project Video: https://vimeo.com/659238642.

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Crolla, Kristof and Garvin Goepel. 2022, "Entering hyper-reality: "Resonance-In-Sight," a mixed-reality art installation". Frontiers in Virtual Real. 3:1044021. doi: 10.3389/frvir.2022.1044021

IMAGE CREDITS

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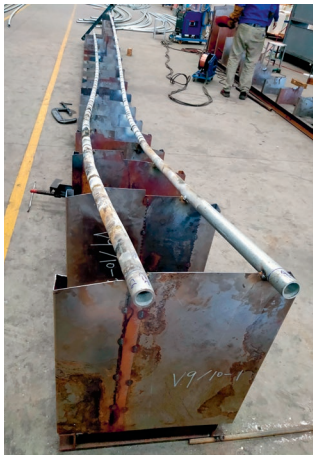
Figures 3 and 13: © Kris Provoost, 2021

Figures 6, 7, 8, 9, and 10: © Program Contractors Ltd. (PCL), 2021

6 Two-dimensional bending using manual pipe-benders of pipes according to approximative planar curve projections [Program Contractors Ltd. (PCL), 2021 ©].



7 Three-dimensional bending using blowtorches of two-dimensionally bent pipes according to waterjet-CNC-cut steel jigs [Program Contractors Ltd. (PCL), 2021 ©].

8 Three-dimensional bending using blowtorches of two-dimensionally bent pipes according to waterjet-CNC-cut steel jigs [Program Contractors Ltd. (PCL), 2021 ©].

9 Offsite test assembly using CNC-cut recyclable metal sheet guides to accurately position and fix pipes with swivel shackles [Program Contractors Ltd. (PCL), 2021 ©].

10 Offsite test assembly using CNC-cut recyclable metal sheet guides to accurately position and fix pipes with swivel shackles [Program Contractors Ltd. (PCL), 2021 ©].

11 Onsite reassembly using CNC-cut guides to position pipes [Laboratory for Explorative Architecture & Design Ltd. (LEAD), 2021 ©].

12 Onsite reassembly using CNC-cut guides to position pipes [Laboratory for Explorative Architecture & Design Ltd. (LEAD), 2021 ©].

13 Nighttime perspective of completed project (Kris Provoost, 2021 ©).

Dr. Kristof Crolla is an architect who combines his architectural practice Laboratory for Explorative Architecture & Design Ltd. (LEAD), with his position as Associate Professor and Associate Dean (Special Projects) at the University of Hong Kong (HKU)'s Faculty of Architecture. He is based in Hong Kong, where his work has received numerous design, research, and teaching awards and accolades, including the RMIT Vice-Chancellor's Prize for Research Impact—Higher Degree by Research. He is best known for the projects "Golden Moon" and "ZCB Bamboo Pavilion," for which he received the World Architecture Festival Small Project of the Year award in 2016.

Dr. Garvin Goepel is a designer and researcher specialized in the field of combining Augmented-Reality (AR) with generative architecture. He pursued his PhD at the Chinese University of Hong Kong (CUHK) as an awardee of the Hong Kong PhD Fellowship Scheme (HKPFS), received his MArch degree, with distinction, from dieAngewandte, Vienna - Studio Greg Lynn, and gained professional experience working with several practices including Coop Himmelb(l)au in Vienna. He is currently holding a Lecturer and Postdoc position at the University of Hong Kong (HKU). His research advances studies in collaborative holographic-driven construction and expands opportunities for technology-infused craftsmanship.