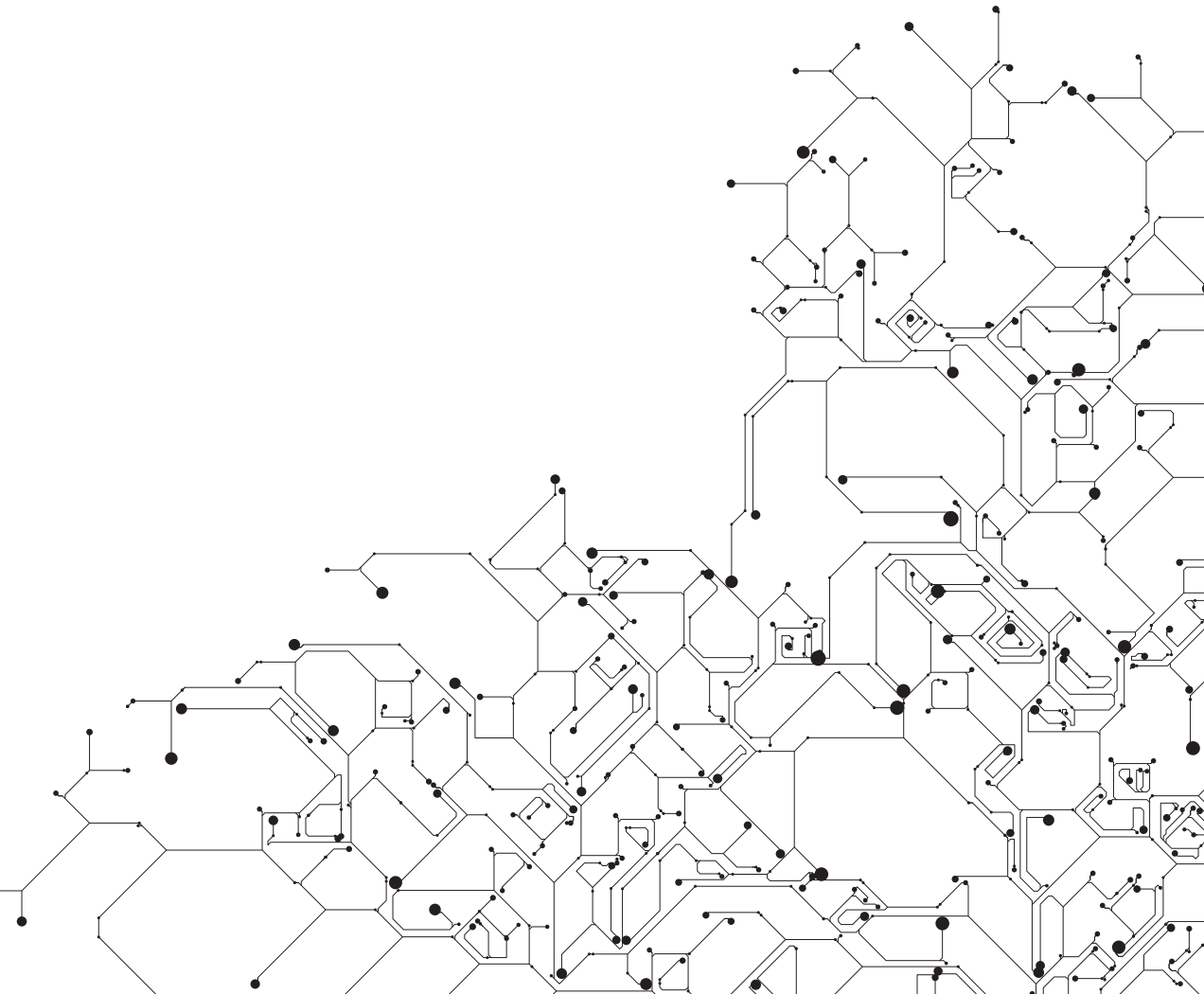
[En]Coding Architecture

THE BOOK

Edited by Liss C. Werner



LA VOÛTE DE LE FEVRE

Wes Mcgee, Taubman College University of Michigan, Matter Design
Brandon Clifford, Massachusetts Institute of Technology, Matter Design

La Voûte de LeFevre is a mashup of ancient stereotomic vault construction with contemporary computation and advanced fabrication. The vault is a compression-only structure calculated through a custom particle-spring physics simulation program to determine how large each unit's opening should be in order to adjust its volume, and therefore mass, in relation to its neighbors. This project exemplifies Matter Design's dedication to translating past (and often lost) methods into contemporary culture. We are truly conflicted. We are pre-occupied with computational design and digital fabrication - commonly assumed to be rapid, fashionable, and surfacial, though simultaneously pre-occupied with volume - thick, heavy, ancient, and permanent. We also maintain an emphasis on speculation, and yet our dedication to reality resists this claim. We intend to innovate and transform the future of architecture, yet we look to history in order to do so. Somewhere in this *milieu of confusion and confliction* is the kernel that defines us. Marc Jarzombek recently suggested one could determine how well a society is doing by their ability to precisely carve stone. We like his metric for its simplicity, but also for its assumption that we must not be doing so well today. So much of the discussion surrounding the digital in design has focused on the surface. We are not immune. Much of our previous research has dealt with the economically friendly sheet material, while maintaining a common thread of a dedication to volume. This dedication originally manifested in volumetric occupation through bending from 2D to 3D. More recently this desire has formalized into *stereotomic* (the art of cutting solids, most typically stone) research with such projects as Periscope: *Foam Tower* and *Temporal Tenancy*.

These projects mined the past knowledge of stereotomy as a way to robotically carve foam for temporary installations. The irony of these projects is the transfer of knowledge from heavy stone construction to an application for light temporary projects that require tensile cables to stabilize. While the irony exists, these exercises in carving solids could also be applied to materials with significant

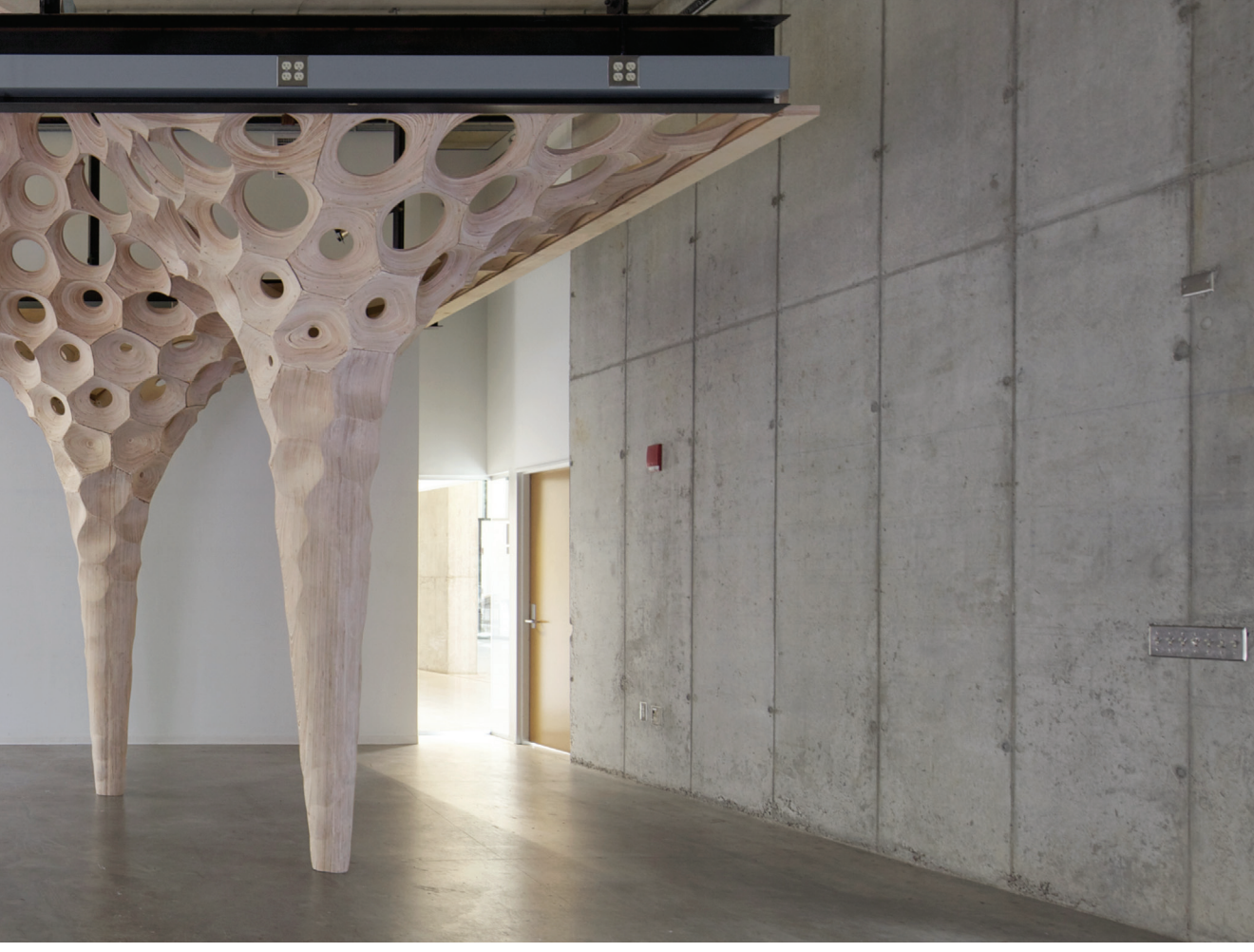
We also maintain an emphasis on speculation, and yet our dedication to reality resists this claim.

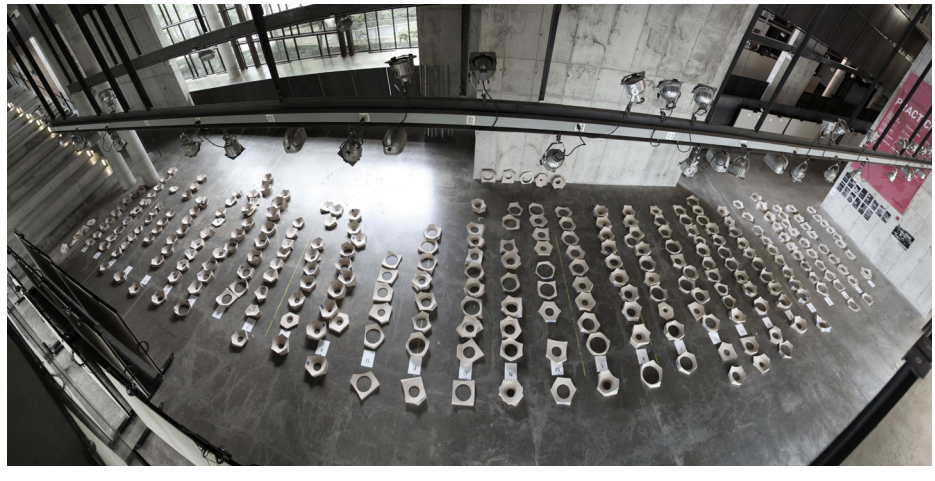
These projects mined the past knowledge of stereotomy as a way to robotically carve foam.

mass as a way to re-engage the thick, heavy, and permanent compression-only architecture of the past. La Voûte de LeFevre is the result of a proposal dedicated to constructing a contemporary compression-only structure. This proposal is intended to rarify some of the claims surrounding re-inserting mass and volume back into our discourse. When posited the task of building a full-scale project with heavy and volumetric process, two obstacles emerged—assurance and ambition. How can we guarantee a vault with significant mass will stand, and how can we build a project of such volumetric scale on budget and schedule? The answers existed in these two words - *computation and fabrication*. The vault is computed with a *solver-based model* that elicits a compression-only structure, from a non-ideal geometry. The model requires a fixed geometry as input, and opens apertures in order to vary the weight of each unit. This dynamic system re-configures the weight of the units based on a volumetric calculation. If unit A contains twice the volume of unit B, then unit A weights twice as much. The computed result produces a project that will stand *forever* as there is zero tension in the system precisely because of the weight and volume of the project, and not in spite of it. The vault is composed of Baltic Birch plywood sourced in three quarter inch thick sheets.

The purpose of this research is not to revert to 'antiquated' architecture. It is intended to re-engage in a problem unfamiliar to our contemporary culture.

Each custom voussoir is sliced and cut from the sheets, and then physically re-constituted into a rough volumetric form of their final geometry. These roughs are indexed onto a full sheet and glued, vacuum pressed, and re-placed onto the 5-axis CNC router. The tool-paths (swarfs) used are dedicated to removing the most material with the least effort. Instead of requiring the end of the bit to do the work, this path uses the edge of the bit to remove much more material. Because this method traces the geometry with a line as opposed to point, it requires the units be constituted of ruled surfaces, hence the conical-boolean geometry. As these units transition down to the column (below the calculation as the columns contain only vertical thrust vectors) the rhetoric of the units continue as if to say the weight is increasing. The purpose of this research is not to revert to *antiquated* architecture. It is intended to re-engage in a problem unfamiliar to our contemporary culture. This unfamiliar terrain produces a new monster. An architecture that is somehow ancient yet contemporary, heavy yet light, familiar yet alien.





PROJECT TEAM

Jake Haggmark, Maciej Kaczynski, Aaron Willette

BUILD TEAM

Edgar Ascaño, Kristy Balliet, Katherine Bennette, Beth Blostein, Jenna Bolino, Chris Carbone, Tim Cousino, Anthony Gagliardi, Brian Koehler, Darwin Menjivar, Paul Miller, Tony Nguyen, Bart Overly, Aaron Powers, Steve Sarver, Katy Viccellio, Sean Zielinski

ACKNOWLEDGEMENTS

Project funding by the Howard E. LeFevre '29 Emerging Practitioner Fellowship
Fabrication support by the University of Michigan TCAUP FABLab
Nesting Software provided by TDM Solutions

ILLUSTRATIONS

p.120: View of the installation
pp.122-123 top: Elevation view of the installation, La Voûte de LeFevre 2012
p.123 bottom left and right: Column Details
p.124 top: 5-Axis Swarf Milling
p.124 centre: Tools in sequence
p.124 bottom: Array of unique construction units
p.125 top: Rough Approximation of Units in 5-Axis Mill
p.125 bottom: Assembly Process

CREDITS

Matter Design - Brandon Clifford, Wes Mcgee