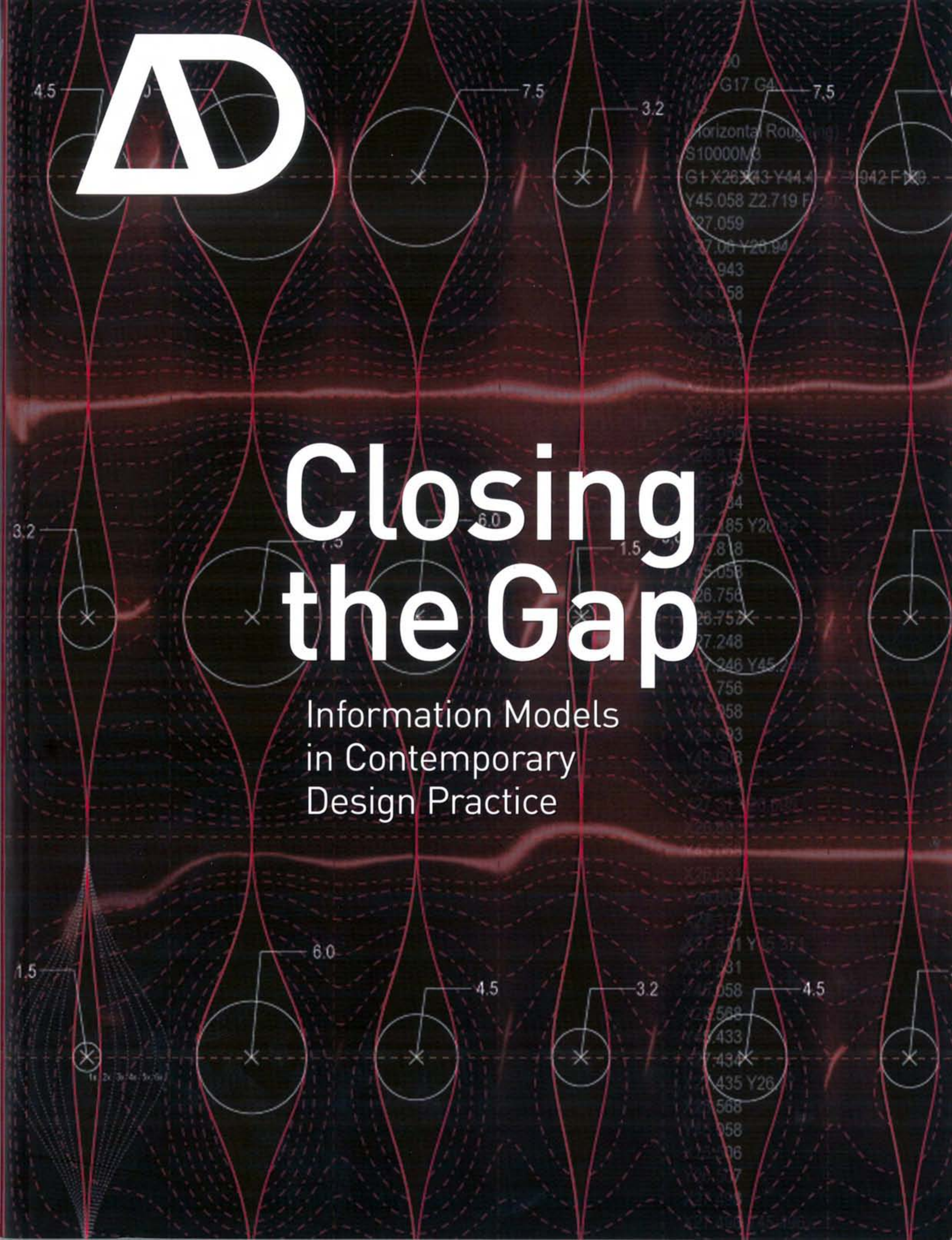
AD



Closing the Gap

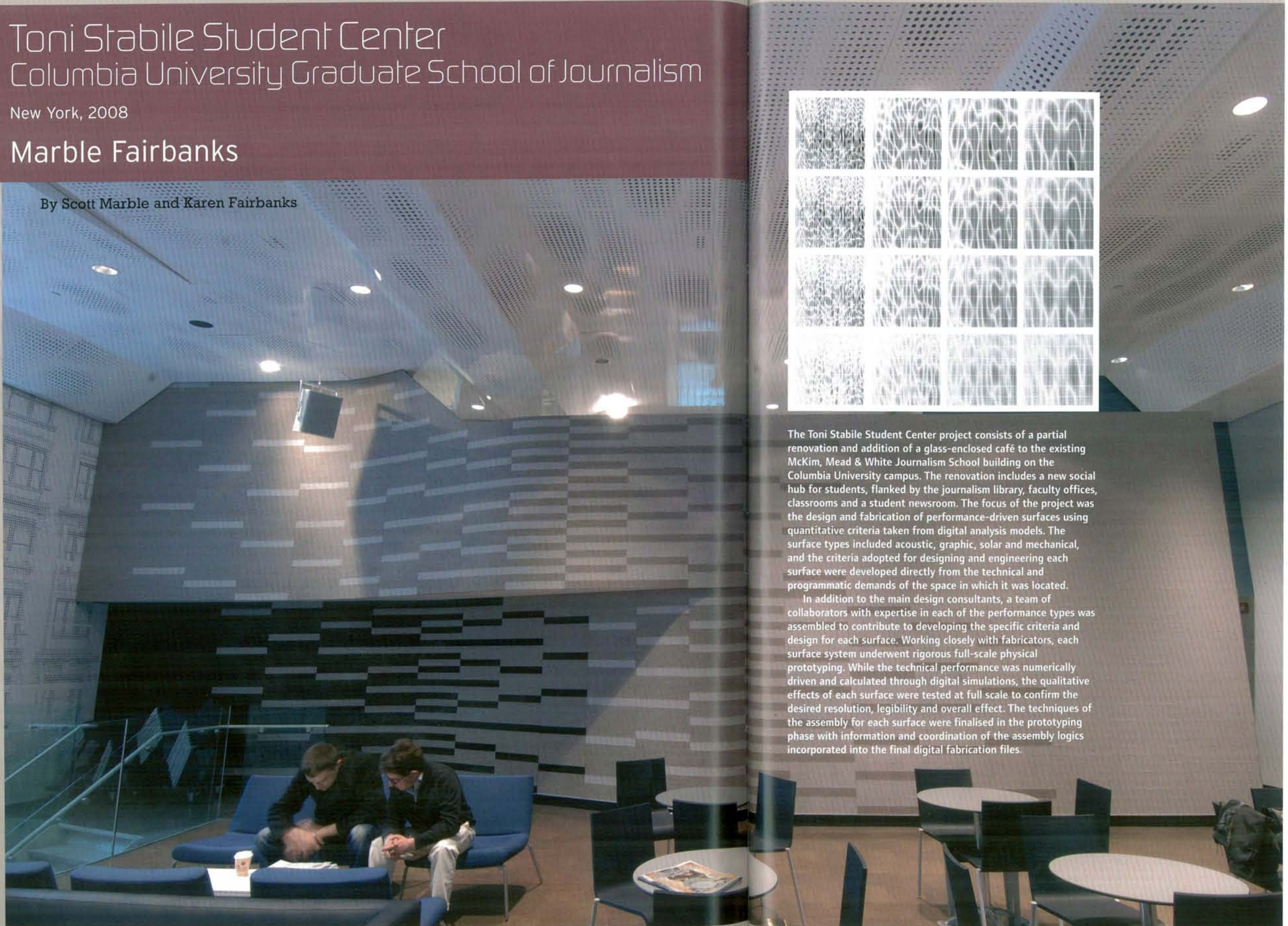
Information Models in Contemporary Design Practice

Toni Stabile Student Center
Columbia University Graduate School of Journalism

New York, 2008

Marble Fairbanks

By Scott Marble and Karen Fairbanks

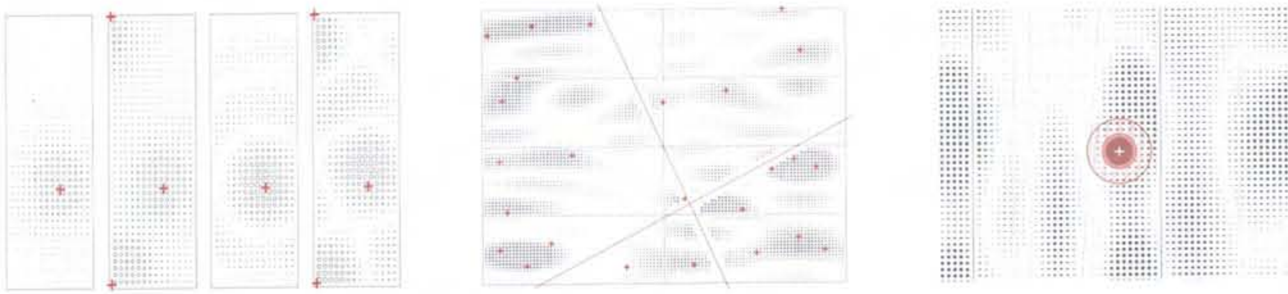


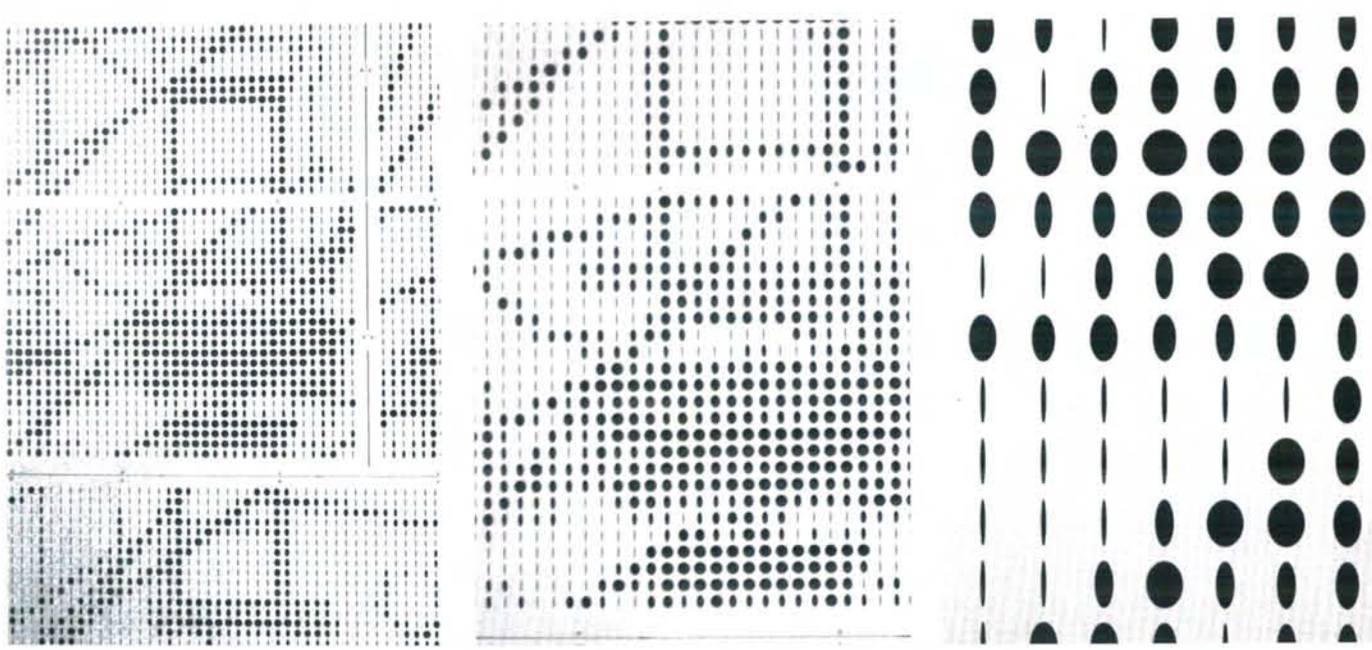
The Toni Stabile Student Center project consists of a partial renovation and addition of a glass-enclosed café to the existing McKim, Mead & White Journalism School building on the Columbia University campus. The renovation includes a new social hub for students, flanked by the journalism library, faculty offices, classrooms and a student newsroom. The focus of the project was the design and fabrication of performance-driven surfaces using quantitative criteria taken from digital analysis models. The surface types included acoustic, graphic, solar and mechanical, and the criteria adopted for designing and engineering each surface were developed directly from the technical and programmatic demands of the space in which it was located.

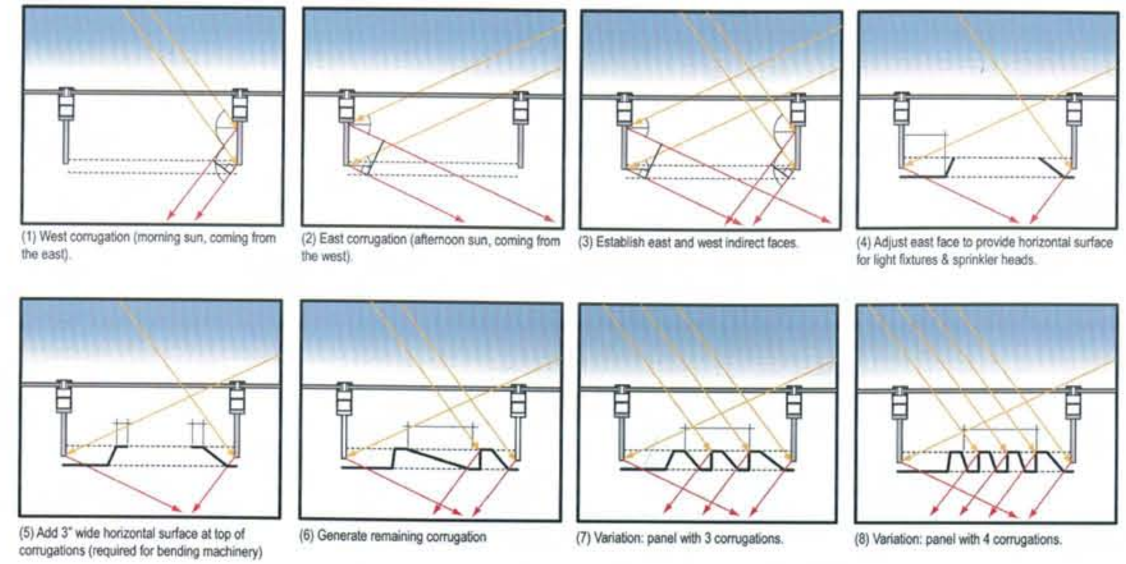
In addition to the main design consultants, a team of collaborators with expertise in each of the performance types was assembled to contribute to developing the specific criteria and design for each surface. Working closely with fabricators, each surface system underwent rigorous full-scale physical prototyping. While the technical performance was numerically driven and calculated through digital simulations, the qualitative effects of each surface were tested at full scale to confirm the desired resolution, legibility and overall effect. The techniques of the assembly for each surface were finalised in the prototyping phase with information and coordination of the assembly logics incorporated into the final digital fabrication files.

The ceiling of the social hub, comprised of perforated 16-gauge steel panels backed with acoustic insulation, provides an acoustically absorptive ceiling for a room that accommodates a wide range of uses that require sound control. The geometry of the ceiling wraps tightly to the existing Journalism School building to increase ceiling height where possible. The perforation pattern was developed through a two-phase process: first, an acoustic model of the space was developed to drive the density of perforations, and a second subsequent scripting process integrated geometry, lighting and sprinkler layout within the pattern generation.

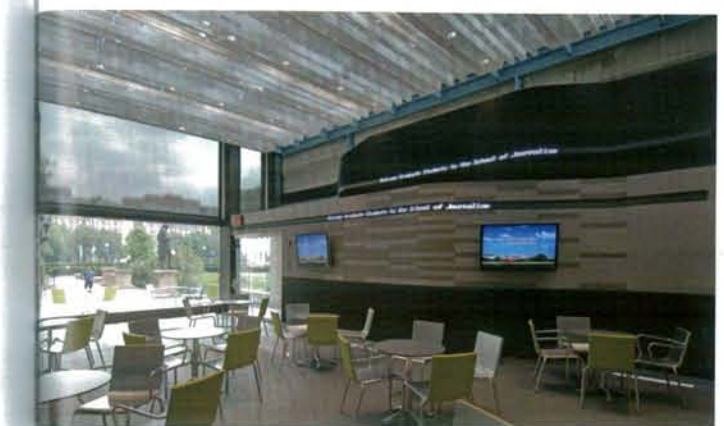
An acoustic model of the social hub was developed to establish the performance criteria for the ceiling's perforation pattern. Several scenarios were generated within the software to identify the zones of the ceiling that, through increased acoustic transparency, would reduce and eliminate the effects of reverberation in the space. These points then became 'zones of intensity', or 'attractors', for the pattern-generation script – areas where the perforations would become larger and provide more acoustic absorption. The pattern script was developed to generate a series of unique iterations, each of which relied on the attractor points and thus satisfied the acoustic performance criteria. The iterations were evaluated both for the density of perforations (which translates directly to fabrication time and cost) as well as overall qualitative effect.

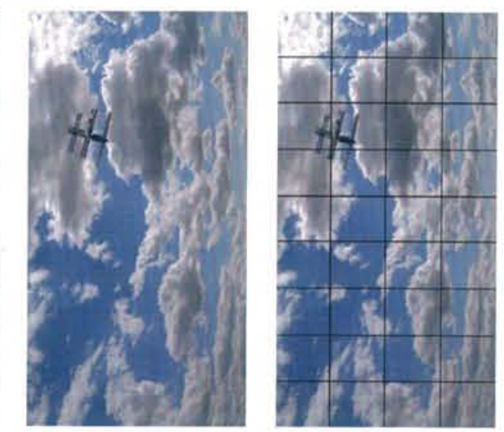


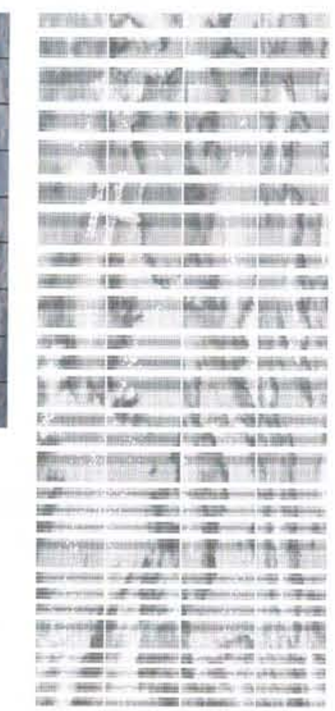




Information on the angle of the sun was fed into an algorithm that generated the bend profiles of the ceiling panels. The basic principles of the algorithm involved using the corrugations to block direct sunlight, while letting indirect light bounce and filter down to the space below. The top row of diagrams establishes the rules for the corrugation algorithm, and the bottom row plays out the rules over a single panel.







opposite top: The perforation pattern design involved calibrating the scripting process to respond to the pre-existing conditions in the ceiling, as well as various forms of infrastructure that would be integrated into it. Rules were developed to establish 'buffer zones' adjacent to light fixtures, sprinkler heads, edges of panels and the break/bend lines of the panels. Through a digital scripting process, the pattern generated from the acoustic analysis was modified accordingly to accommodate these rules.

opposite centre: The pattern for the west wall of the social hub was developed by filtering a photograph of the view outside the west wall of the Journalism School (a view across Broadway) through a digital process that converted it into perforations to be cut out of steel panels. The intention was not only to project the image of the outside on to the inside of the wall, but to also allow for different perceptions and readings of the wall depending on the viewer's proximity. The pattern was calibrated to 'snap' into focus at a specific distance of 12 metres (40 feet) – the point at which one walks into the social hub.

opposite bottom: The pixilation scripting process uses an alphabet of six discrete characters, each corresponding to a specific range of tonal values within the black-to-white spectrum. Through a simple algorithm, the script converts the image into a perforation pattern by replacing the raster information with characters according to tonal value. The characters consist of a perforation gradient from zero (0) to one (1) – the most basic forms of digital information.

above left: The ceiling for the new café addition is a sunscreen that hangs below a glass roof, and was designed and engineered to reduce heat loads. Two patterning techniques – corrugation and perforation – were used on the panels to develop the most efficient means of solar shading. Both techniques were developed in tandem through a solar analysis and scripting process to optimise solar shading and reduction of solar heat gain inside the new building, while also achieving the qualitative effect of being under a canopy of trees.

above: Once the corrugation pattern was determined, the resultant geometry was fed back into the energy analysis software. Each face of the corrugated surface was then assigned a maximum allowable percentage of perforation that would satisfy the solar heat reduction requirement. The pattern itself was derived from an image of the sky as if looking straight up from the café through the roof. The size and geometry of the perforations were determined by balancing the need for a resolution that would allow the image to be legible with the cost of laser-cutting the holes in the panels. ⌂