Resonant Surface

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BUILDING BEHAVIORS

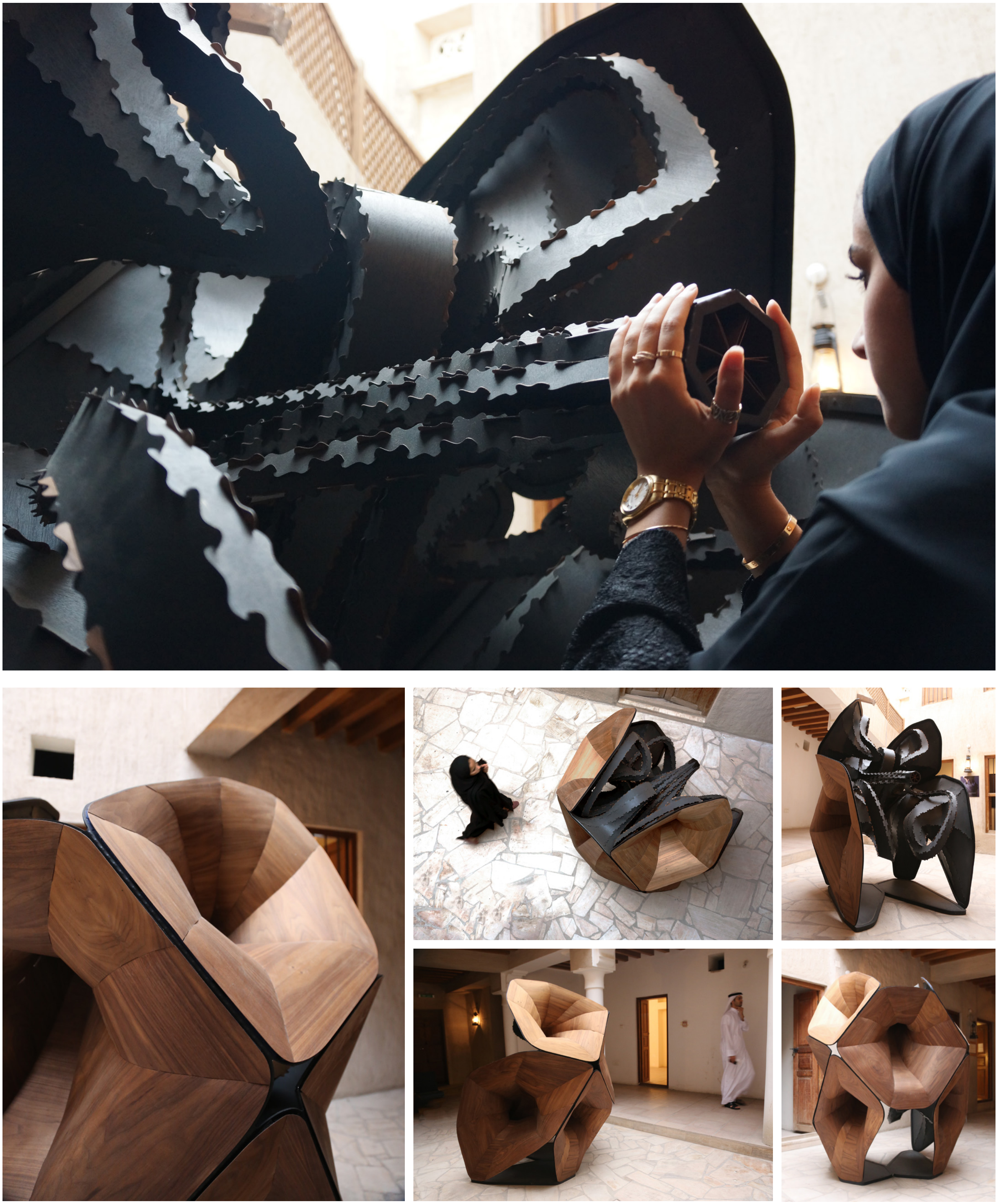
Designed for the context of the Al Fahidi cultural district, Dubai's oldest settlement, Resonant Surface combines acoustic performance and contextual aesthetics through a study of musical instruments and Islamic geometry. Inspired by the loudspeakers on top of Minarets the piece lends spatial and aesthetic character to devices that are typically seen as undesirable but necessary hardware. The installation acts as a proof-of-concept model for an active resonance device which is simultaneously an ornamental architectural surface.

Referencing both the complex tiling and vegetal arabesques of Islamic architecture the piece combines planar mesh tiling with spiraling, interlaced curves. Convoluted to fit into a 1.5m x 1.5m x 1.7m volume 7 three-meter-long horns mediate the space between the exterior of the volume and its center where they coalesce at a mouthpiece. Designed to resonate in response to the human voice the horns accommodate the length of sound waves ranging from a bass tone with length of 3 meters to soprano or even higher tones less than 3 centimeters in length.

Along their length the horns evolve from mouthpiece to tube to cone and finally flare section. Each section of the horn affects the sound waves it contains, initially compressing then expanding and directing the sound. Curvature like that in musical instruments allows the sound to travel smoothly through this transition. In contrast to the smooth length of the horns the cross section is faceted to rationalize the geometry into ruled surfaces. This formal typology allows the horns to mediate between the crystalline geometry of the exterior frame and the curvilinear geometry needed for acoustic performance.

Derived from a composition of 7 octagonal tiles wrapped around a cylinder the exterior frame is distorted to respond to the ground and sky. Inscribed within each tile the frame is filleted to soften the mesh geometry creating a secondary porosity. The outer layer of the thin aluminum frame is cold folded between tiles using a custom undulating tool-path. Velcro connections between the frame and outer edges of the horns prevent acoustic dampening allowing the resonant surfaces to vibrate independently. Laser cut strips of thin veneer plywood comprise each of the horns which expand from 4 strips to 8. Bespoke tabs were designed to allow for tight, tool-less assembly of the wood strips. Rationalized using the Grasshopper plugin for Rhino the convolutions, surface patterns and connections can be modified in a single script allowing the complex assembly to be iteratively modified to accommodate performance and fabrication criteria.

Deep, porous twisting surfaces are created from the juxtaposition between the faceted horn profiles and their curved trajectories. This formal intensity is aesthetically calibrated but emerges from acoustic performance criteria. These exuberant effects show how replacing formal tropes with more contemporary,



RESONANT SURFACE IN AL FAHIDI DISTRICT COURTYARD HOUSE

Top Row: Mouthpiece. Middle Row: Detail of Horns; Plan view; Back view. Bottom Row: Side view; Front view.

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DESIGN RESEARCH IN THE STUDIO CONTEXT