SOFT TO HARD CANOPY

MAKING LARGE-SPAN TRIDIMENSIONAL STRUCTURES FROM SHORT TIMBER ELEMENTS

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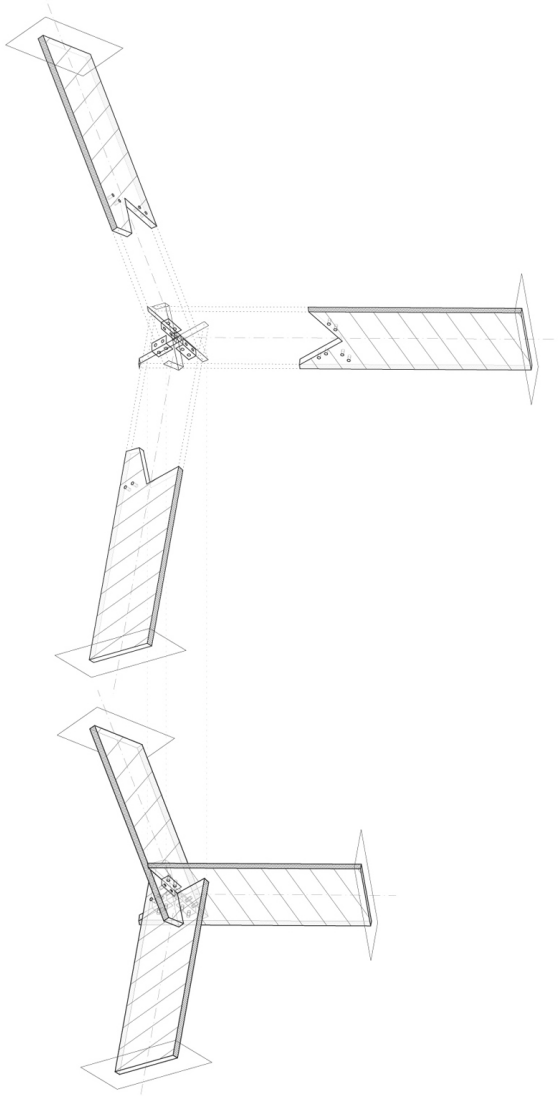
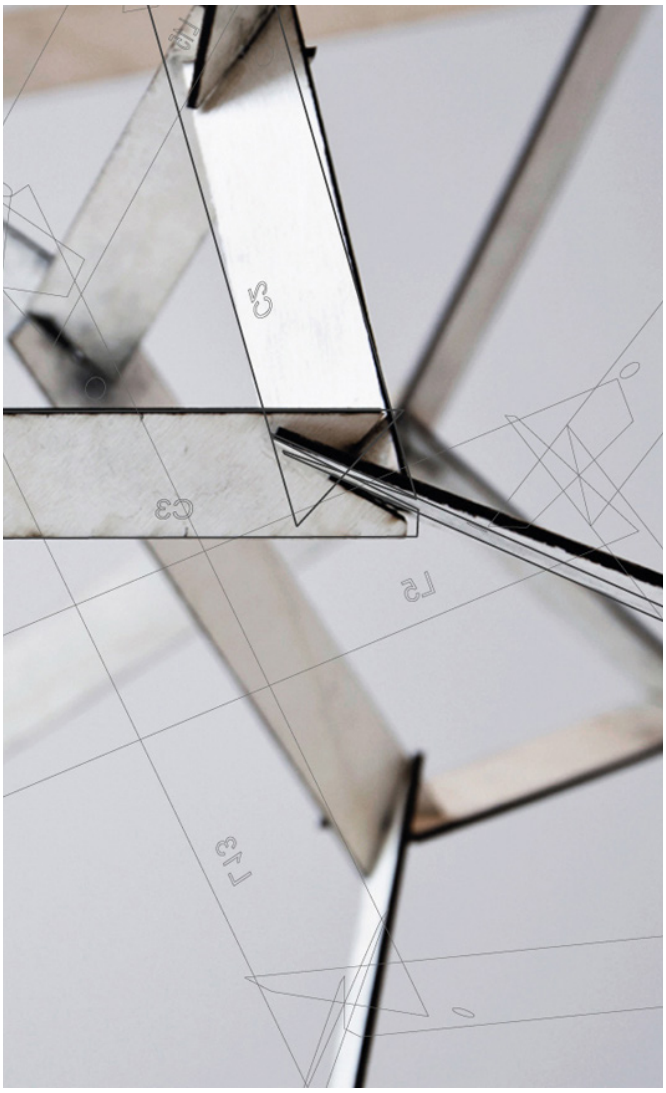
1 Previous experiments, part of the research project within an academic environment: Prototype "Inconsistencies v.04". Prototypical self-regulating structure - material: elastomer, size: 13x20x5m, location: Kula Nebojsa Belegrade, assembly team: first year graduate students, University of Belgrade (Dj. Stojanovic and Cerovic M., June 2012)

This project investigates the use of short timber elements in construction of three-dimensional structures bridging large spans. The approach relies on the use of custom developed computation tools for structural optimization. Proposed methodology probes into the use of elastic material properties within digital environment to allow for simultaneous adjustment of all structural elements, or system's ability to self-regulate. This poster documents our first attempt of construction using "hard" wood which comes after completing a sequence of large prototypical structures built with the use of "soft" rubbery materials.

While some of the exciting projects and current research in architecture develop from material to immaterial, from physical to digital, from solid to fluid, from mechanical to biological, from hard to soft, here we explore the opposite route. In continuation with the research project within an academic setting, we have developed a detailed and site specific proposal for a canopy titled "Soft to Hard." The design is highly adaptable and could be easily adjusted to any other locations while keeping its material, structural and organizational logic. The intent is to create a new public space as an environment within



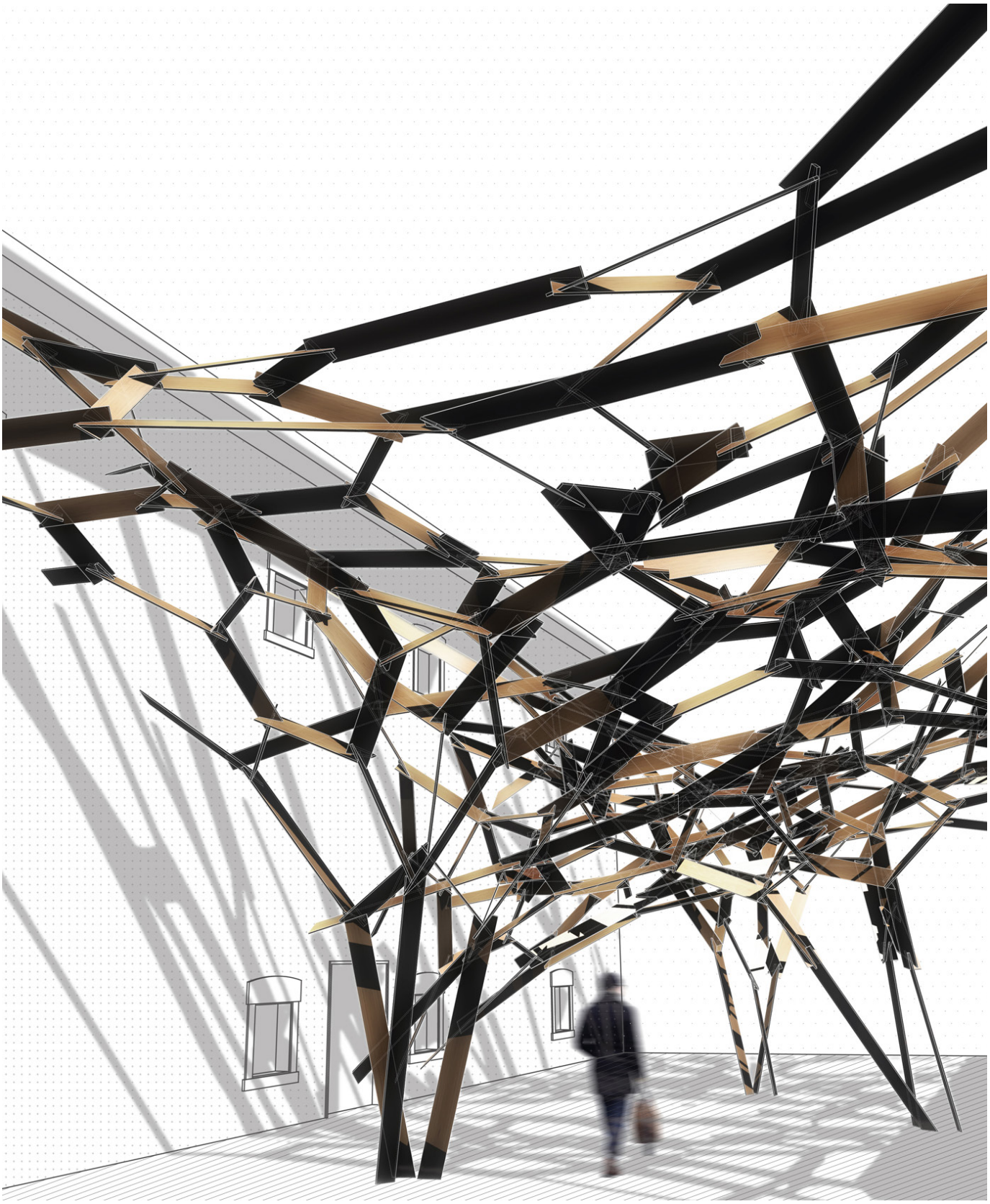
2 Detail – Interlocking timber joints



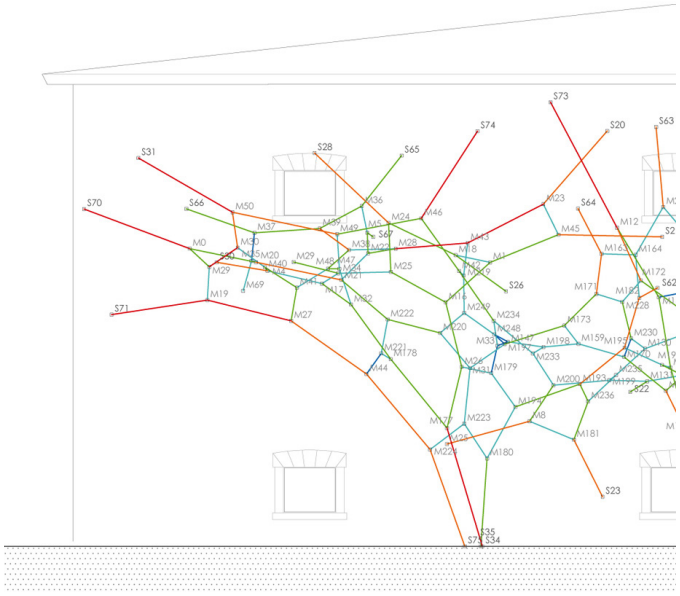
3 Isometric drawing and physical model

any existing context, which may be in the need of restructuring or reactivating. We hope that proposed architectural gesture, besides providing for shade, could be the trigger for many different patterns of use.

The formal logic of the design relies on the generative power of elastic material behavior. For the purpose of this project we have developed a custom computation tool to allow for geometric modeling with material properties now available for the Rhinoceros platform. In addition to better understanding of the building physics and structural analysis, this tool has also played part in netter visualization throughout the design process. Its purpose is to enable designers to maintain an indirect control of complex spatial models, based on the use of two parallel sets of algorithmic protocols which define: a. geometric logic and b. intrinsic material behavior. The tool enacts simulation of elastic material behavior throughout the process of geometric modeling and provides for more precise inclusion of material performance throughout the design process. It contains features for parametric control of reversible deformation range and elastic modulus, to allow iterative testing and enable parallel consideration of different building materials. Initial modeling strategy relied on the properties of building materials with a large deformation range, yet final and here exhibited proposal is made of steel and wood. Similarly to the programmatic logic of the project, its material, structural and formal logic are based on the transition from Soft to Hard.



4 Prototype “Soft2Hard v.01”. Perspective rendering of the tridimensional timber structure



5 Preliminary quantities and cost estimate plan. Color coding reveals length of timber elements

6 Comparison between the digital and analogue model.

7 Previous experiments, part of the research project within an academic environment

IMAGE CREDITS

Figure 1. Dj. Stojanovic and Cerovic M., 2012. Prototype "Inconsistencies v.04". Kula Nebojsa Belegrade.

Figures 2, 3, 5, 6. Dj. Stojanovic 2013. Prototype "Soft2Hard v.01". Belgrade: proposed.

Figures 4. Dj. Stojanovic 2013. Prototype "Soft2Hard v.01". Belgrade: proposed.

Figure 7. Dj. Stojanovic and Cerovic M ., 2011. Prototype "Inconsistencies v.04". O3one Art Space Belgrade.

DJORDJE STOJANOVIC is an Assistant Professor at the Faculty of Architecture–University of Belgrade and the founder of 4of7 Architecture*, the framework for integration between research, education and practice. He is teaching Design Studio Courses and Theory Seminars at Master Level with emphasis on the research-based approach to learning. In addition to the appointment at the University of Belgrade, he has also thought at the Architectural Association Visiting School in Tehran and Paris. His educational agenda is focused on the investigation of novel and versatile spatial organizations arising from the contemporary social, cultural, economic and environmental conditions.