The future of Digital Construction

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Abstract
The future of Digital Construction is an idea and proposal for a cross-collaborative design effort where various technical experts have an equal design stake for an outcome that is unachievable without one another.

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ACM Classification Keywords
H.5.m. Miscellaneous

Introduction
Architecture today uses technology and building systems which parallel a construction method used over 50 years ago. The most common system is that of a steel or wood framed construction, insulated, then wrapped with an outer skin. Other industries such as the aviation, automotive and medical fields have used progressive digital technologies throughout their design and construction process; resulting in dramatic advances in customization and rapid changeability.

The goal of this research is to engage new technologies such as digital fabrication, in combination with material science, computer science and robotics, as a method for a new building system in architecture.

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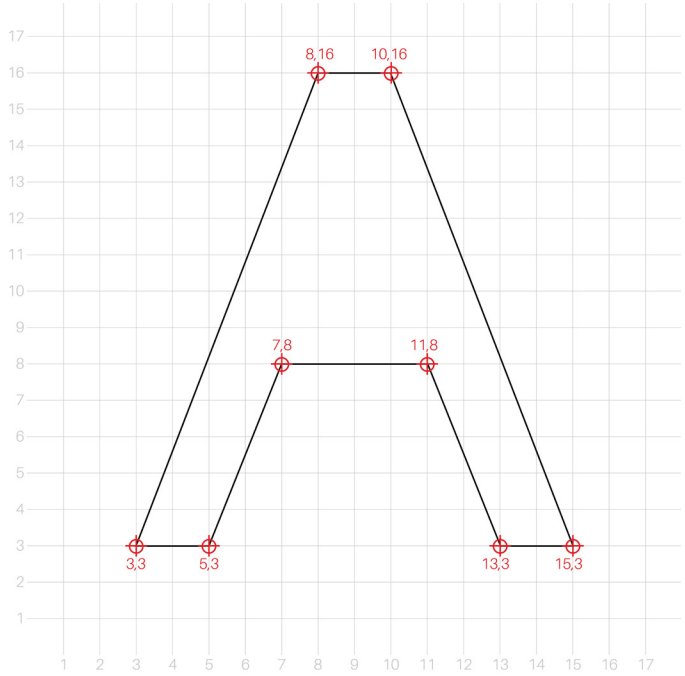


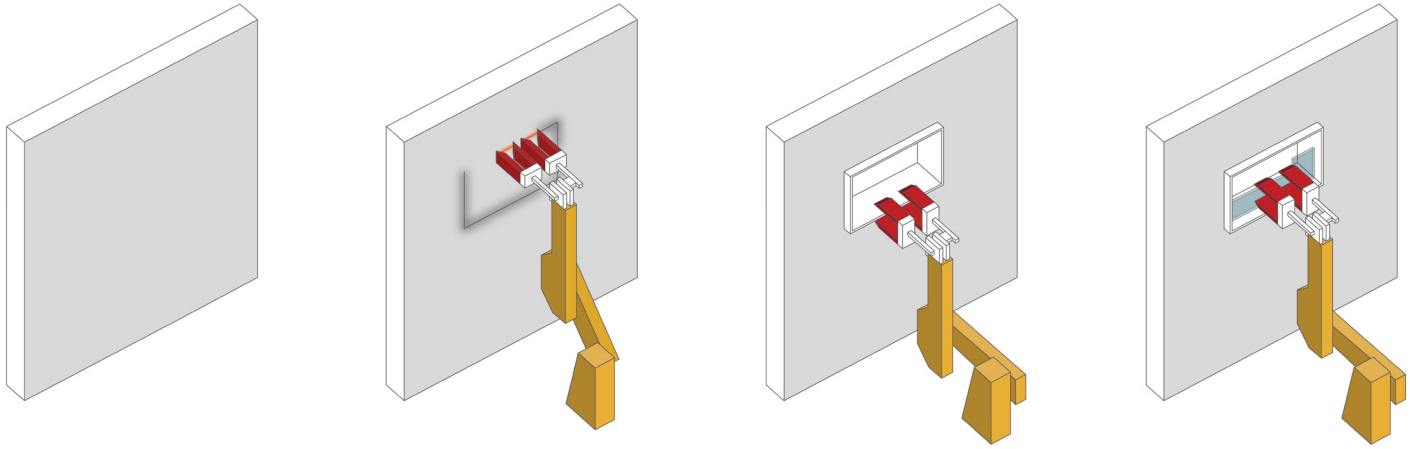
Architects and designers alike should be working to develop systems that respond in conjunction with our current technological advancements. This model of cross pollination currently doesn't exist as a mainstream approach within architecture, but it could.

In 2008, I started working professionally for a large architecture firm in Chicago. What I immediately noticed then, which is the same today, is how architects often design for the lowest common denominator - meaning this object / building / design must be successfully buildable by anyone who has the capacity to complete the job. Architecture should be an innovation approach, not a design model that relies on outdated construction types for completion.

As designers and innovators, we often have ideas that are unobtainable without the computer. Complex geometries, boolean subtractions, hyper-parabolic shapes, all possible because of the tools we use. "The new digitally-enabled processes of production imply that the constructibility in building design becomes a direct function of computability."[2]

Use technology as a tool.

The diagrams above are meant to represent the future of digital construction. The technical skills won't be troweling mortar onto a masonry row, it'll be writing a script for a robotic arm. That script will outline how and where to cut a custom shape into the side of a building. This is the future.

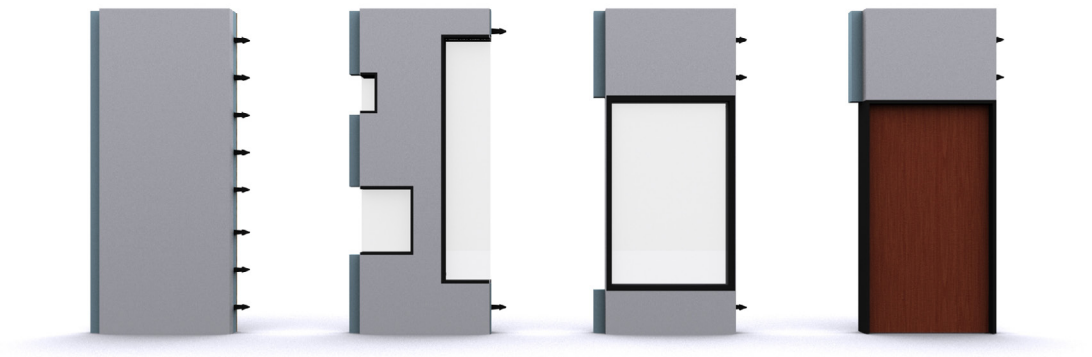


"The classic activity of the architect has been the creation of built space. Yet in recent years, the element that defines this space - the boundary - is steadily moving into the focus of architectural interest. New technologies and developments are continually expanding the design repertoire."[1]

This proposal is meant to be a conversation about how design and engineering disciplines can integrate as a single team to produce rich, creative outcomes that are only possible from this type of collaborative method. Architects only design what they know can be built, not what they don't know. The ones who are best, often ask a lot of questions and seek advice from all ends of the spectrum.

The axon diagram above is my vision for the future. The left side represents the starting point, the right, what could be possible. The blank, solid wall first has a laser cut hole taken out of it, based on a programmed script. Because the robotic arm knows the part it removed, it is able to create a sleeve, or what we call the window frame. The final step is the arm will then be able to 3d print glass inside of the window sleeve, creating an air tight envelope that is completely custom. This example is meant to be simple, but the true nature of what could be is far more impressive.

Technology has the power to make this happen, we just need to find the right people who are willing to collaborate on the idea.



1. Solid: the entire panel is whole, allowing customization in its exterior.
2. Perforate: provides holes within the exterior face, giving the panel variety in openings.
3. Puncture: provides light / views through an opaque wall by way of clear (3d printed) glass.
4. Passage: allows for openings where users can pass through the opaque wall; threshold, barrier, opening.

Discussion

Our current construction methodology has become stagnant and there is an obvious lack of desire for progressiveness. The process neglects the utilization of modern manufacturing techniques by which the systems would benefit. Integrating such systems could enhance speed, precision, energy efficiency and decrease embodied energy, pollution and cost. It is up to the innovators, the big thinkers, and the big dreamers to change this.

References

1 Beylerian, George and Andrew Dent. Material Connexion. Hoboken: John Wiley & Sons, 2005, pg 54.

2 Kolarevic, Branko. Architecture in the Digital Age: Design and Manufacturing. New York: Spon Press, 2003, pg 33.

3 Silver, Pete. Fabrication: The Designer's Guide. Boston: Architectural Press, 2006.