



Outstanding potential of 3D sand printing in architecture

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3D printing is meant to change the world. Specialists have already predicted the technology as the third industrial revolution. During the last years we saw how the architectural community has had a long-running engagement with 3D printing, from using the technology to print entire buildings, to creating highly complex architectural models.

However, what the current situation tells us is that many construction workers are still dealing with old building processes that involve not the best working conditions and are not sustainable. Of course, there is a light at the end of the tunnel: the latest research on integrating digital fabrication technologies within construction processes enables totally new forms of architecture, and promises major contributions to productivity, efficiency and sustainability. Until now, disciplines like robotics, structural design, architecture, material research and computer science were separated, but in order to truly test the potential of digital fabrication in real-life circumstances, an institutional and funding environment of solid and interdisciplinary research is necessary.

During the last years, the advances made in digital design have been outstanding. Nowadays we are able to gather enough information within the additive manufacturing (AM) world for both machines and techniques. To answer which next steps should be made and what challenges have to be overcome, it is important to understand how 3D printing is impacting architecture today and where it is being used.

Architecture Scale Models

Every architectural project starts with a concept scale model. It is a fundamental tool that helps architects, clients and the public to visualize the architect's vision of the design. 3D printing simplifies and improves the production process in multiple ways:

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- Cost efficiency & productivity: AM saves a huge amount of time and money compared to classical scale models.
- High level of precision and capacity of printing highly complex structures.
- High customisation and many different materials to use.
- Easy updates and copies reproductions.

3D printed buildings

The race to build the first 3D-printed house has started several years ago. Now, teams of architects around the world are competing to produce usable printed structures, using technology that could transform the way buildings are made. Although they all have the same objective, the investigations are made with very different materials and fabrication techniques.

Automated construction was one of the very first hypes once 3D printing made itself a place within the most potential technologies. It can lead to saving high costs in every possible direction and faster building.

The investments are huge, regulations are tough and people that have been years in the industry still do not fully trust in the invention. E.g. the concept of 3D printing a whole building usually requires a bigger 3d printer.

Robotic printers and mobile printers were thought to be a feasible solution to fix all the problems that printing a building involves. However, there is still a long way to go before a final reasonable solution is affordable.

Print more than walls

Interior design has always been challenging and time-consuming for architects. 3D printing enables creating complex furniture and detailed parts much faster than before. Also smaller objects can be manufactured quickly and without wasting expensive materials or workforce. The customer's selections can be customized without additional costs or delivery delays. After the architectural scale models, interior design is the background which embraced 3D printing in a more efficient way.

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3D printing in other worlds

NASA and other institutions are devising ways to use 3D printing to build habitable structures on the Moon or Mars. The general idea is that a team of robots will be sent to the destination years long before humans arrive. The team would consist of a collector who would mine and deliver raw materials, a converter of these materials into printing materials, and a mobile 3D printer to do the rest. This would eliminate the need to send tons of building materials and a variety of tools on the long and expensive journey to their destination. Just send the robots, the CAD plans and perhaps some chemicals for the conversion process.

Next Steps and how Sandhelden contributes

One of the main topics in the discussion of possible materials for 3D printing is their resistance and durability. The material used by Sandhelden has a proven load compression resistance comparable with steel concrete, being cheaper in the manufacturing and way more efficient regarding precision. Sandhelden is currently conducting research studies to classify quarz sandl for its use in construction.

Computational design methods enable a non-destructive, procedural modelling work-flow, which can create infinite variety in parts, but also multiple configurations within their assembly. Inherent in this process is the ability to add more criteria and parameters to the system as the parts are tested and refined throughout the research process.

The partner network and clients of Sandhelden are formed mainly by creative minds within the world of art and design, as well as by some of the best computer architecture professionals in the world.

Modular design is also definitely a key factor in case that 3D printing will be integrated into construction. A proper modular design will save costs in assembly, shipping, production, transportation, versatility, reparation, maintenance, etc.

When it comes to organic design, which is nowadays a trend in both 3D design and architecture, the current digital fabrication methods of natural geometries undermine their qualities.

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The reading of linear joints between parts leads to their primary perception as something that is artificial manufactured. This contradicts perceptive design theories that stipulates for spaces to be appreciated as natural, the structures which enclose them must employ the same aesthetic qualities as nature, in this instance, continuous and complex.

This is shown by the research done with the architect Barry Wark which transforms the methodology, working with bottom up assemblies of intricate components, in which the legibility of the structure and its joints dissolve to return its perception to a natural entity.

The importance of sustainability in the future of construction is - and will be even more - an important topic. Sandhelden is ready to support every partner with intention to push this technology forward.

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