

ROBOTIC BUILDING | D2RPA

iN-FLOW.

An inside look into Kumbh-mela's extreme form of temporary urbanism

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INTRODUCTION

The thesis is initiated with a context driven research into the unique ephemeral nature of the temporary pop up city in India. The site is situated in the northern city of Allahbad at the confluence of two river, Ganga and Yamuna respectively. The site facilitates the gathering for religious festival called "The Kumbh Mela". It is the largest public gathering in the world, drawing 150 plus million pilgrims over the course of three months. The site functions on a set of temporal cycles. The site is under water during the rainy/monsoon season. When the water subsides after the monsoon, the site materializes in the form of the reclaimed river bed. Construction commences on site by December with a complex layer of road/sanitation/services and other infrastructure. The festival is dismantled after three months leaving behind the gridded city remains etched into the banks of the Ganga. . Farmers use these residual lines from the once sprawling metropolis to cultivate wheat and rice. Herds of cows and goats graze while water buffalo plunge into the river. The ephemeral metropolis is transformed into an agropolis.

The Thesis deals with a system where the site goes through various differential states and hence leads to flow of architecture and material structure from one state to another. This reversibility could serve as a rich case study to examine the working behind a temporary pop up city. Understanding the spatial, social, and logistical elements of the Kumbh Mela can lead to understanding and deployment of these systems in a variety of places and situations, in particular camps for refugees of war and natural disasters.

The thesis is carried out at the Robotic Studio, with emphasis into the various robotic tools available to form a design intervention which adheres to the social and material culture of the site. The specific research question raised here is: Can Innovative tools (Robotic fabrication) further the craft of local construction principals around the site?

RESEARCH & DESIGN

Research and design, historically they have been considered as two discreet linear process. Renaissance architect Leon Battista Alberti made a clear distinction between the designer and the builder hence abstracting architecture away from the construction. Contrary to this model anthropologist Tim Ingold argues that masonry techniques during medieval times was an iterative process. A research which grew with the building in the form of theory design and construction experiments. The thesis amalgamates both these aspects advocated by Ingold involving the synthesis of research, design and making (techniques and tools). The thesis is initiated with a context driven research into the unique ephemeral nature of the site due to its positioning at the confluence of two rivers which renders it usable for a few months during the year due to variable water depths throughout the year. Contextual research like figure ground mapping of previous iterations was done to understand how the festival fits together with the existing urban fabric. At the architectural level, historical research led to different findings on the development of shelter, its use and functional distribution throughout the festival's history.

Material culture theories by Tim Ingold and I. Hodder made me sensitize to the way material was used at the site. Realizing that "material culture is inseparable from culture and human society", I started gathering literature data on local temporary shelter, typology to form a material catalogue to work with. The data collected via historical literature precedent and interviews with users gave an informed view on the type of space and material needed by the users which opposed the conventional mass-produced system of plastic and fabric tent settlement system found across the globe irrespective of location, environmental and social conditions. The research and data led to an informed decision to use old vernacular earth (clay and sand) material by replacing the old construction technique with new tools like robotic fabrication. This system acknowledges the various theories of material culture like material cycle were in the material is procured from the site i.e.-clay and sand, and moulded according to the needs of the site environmental and social needs. Once the site function is no longer in use the material mix disintegrates in the water which covers the site during rainy season.

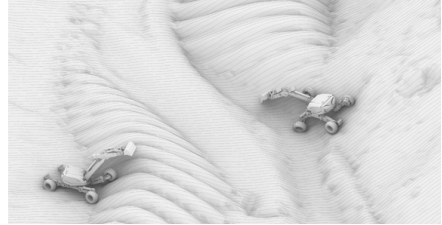
RESEARCH METHOD & APPROACH

Relationship to Robotic Building & the Architecture Track

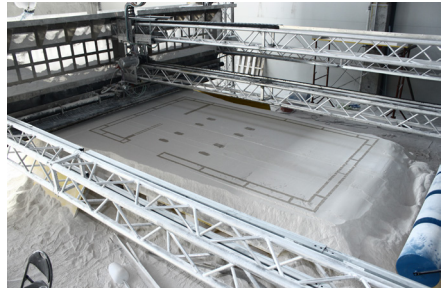
The Thesis stresses on using research via practice based system in order to come up with a design scheme. The architectural engineering track gives me this opportunity as great stress is put on coming up with a detailed scheme which is an amalgamation of research, design and building technology. Robotic Building pushes this idea of research based practice with computation tools and an active lab to test our ideas.

In order to change the archaic design systems currently being employed at the site, it was important to integrate a computational pipeline throughout the design and construction system which gives the designer greater role in achieving parity at all levels of design [macro to microl. A procedural framework is applied at the master-plan level for fragmentation of the site into smaller units based on local contours data and public movement simulations. This meso data is combined with material investigation to propose a design to robotic production process using local materials for printing the building.

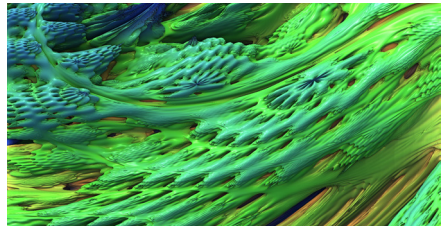
Robotic pipeline [macro -meso -micro]



macro: Robotically molded landscape.
ref: Robotic Landscape, ETH,Zurich



meso: Sand 3d printing particle bed system
ref: Enrico dini, D-Shape



micro: using subdivisional techniques to extract detailing from sand models.

THESIS RELEVANCE & ETHICAL ISSUES

All-though the thesis is context driven and takes the example of an Indian city, the design pipeline includes the contextual parameters and material and social culture to come up with a design system that can be used in different conditions. It strives to demonstrate how these systems can be used for low impact and economical urban design systems. The design systems caters for a large population and hence can be case study for other disaster camps or even large scale festivals. My-role as a designer here is to make this procedural system available which can be used as a template to produce different design systems using the same core system replacing the contextual parameters.

Using local materials instead of using plastic tents [as can be seen in any temporary system like a refugee, disaster or festival camps] arose from ethical issues as seen at the site in India. The plastic tents are not insulated enough for the cold conditions neither do they give privacy for the inhabitants. Using earth as construction material was a way to include reversibility in the design system which i feel is very important in the professional framework these days. The sand buildings provides better insulation and stability compared to the plastics tents. This constriction system goes back a long way in India and the middle east. Incorporating this whole system in a procedural framework ensures proper transferability of the thesis for different purposes.

Important links for further thesis information:

<http://100ybp.roboticbuilding.eu/index.php/project02:Main>

<https://www.youtube.com/watch?v=DWOp5YRCm3Q>