

Architectural & Media Studies Reports

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I Introduction to graduation project

My graduation project is to design a transportation hub in the center of Shanghai aiming to rebuild the relationship between space and people. Space like airports, railway stations, hotel, supermarket are described as non-places by author Marc Augé on the contrary of anthropological place. Marc Augé describes a place that is itself not a destination but rather a place of everyday passing, a place of being in-between in which he critically claims we experience alienation. In my graduation project I want to reconstruct a metro interchange station into a transportation hub which is not a non-place, but a new connection between city life and everyday commuting. In this transportation hub, there are two kinds of function, fast and slow. The fast one means metro station and its auxiliary volumes. Due to the large traffic volume every day from three different lines, the fast functions require more efficient and safe space management. The slow function means commercial, entertainment, cultural and natural functions and other functions which already exist in the site and its surrounding. The idea is to combine these two kinds of function together but not to disturb the traffic flow by using two kinds of connections, one is directly connected by route, the other is indirectly connected by view, which means to control the accessibility and visibility of different functional space.

II Computation design study on form finding.

Computational crowd modelling technique via agent-based models makes it possible to conceive functional spaces in terms of dynamic patterns of social communication, rather than static accommodation. Agent-based modeling is an attempt at creating autonomous agents which move through their environment interacting and designing space over time. Agents within the environment have multiple behaviors which determine their actions and interactions. Behavior based investigations can lead to fundamentally new ways of approaching design and creative architectural and generative experience. The AADR research project "parametric Urbanism" of Zaha Hadid Architects provides a multi-system urbanism using agent-based modelling. The project used Maya fluid as tool for the initial generation of basic urban geometry. The tool simulates the dynamic of fluids and makes a fluid's typical characteristics subject to parametric control. The particle agent is sensitive to contextual features like boundaries and obstacles. Two fluids of agents flowing into each other form complex patterns of nesting and intermixing. The field of particles or vectors might be analyzed in terms of particle agent directions, densities and velocities, thus producing a data-set delivering input parameters for the scripted definition of geometry. The model contained four types of agents driving four spatio-morphological system. The programmatic layers were stipulated as residential accommodation (two typologies), public/cultural facilities and landscape/park areas. The shared underlying fluid system thus insures that these four systems are able to participate in a single, coherent, multi-layer urban field.

The self-organization of patterns of flow in social insect swarms is an example of how intelligent and efficient behavior of the whole can be achieved even in the absence of any particular intelligence. Such patterns can have functionality even without the awareness of the individual entities themselves. I study two kinds of swarm intelligence, flocking behavior and the organism of physarum polycephalum to understand swarm dynamics and self-

organization. I use a grasshopper plugin called Quelea created by software engineer Alex Fischer to do the flocking agents simulation. The algorithm is based on Craig Reynolds computer model of coordinated animal motion, Boids, swarm of sensing agents was created, each of them reacting to a geometrical environment through a collision detection algorithm and combining their actions through flocking. The second study is about stigmergy of physarum polycephalum. Slime mould physarum polycephalum is a giant single-celled organism which can usually be seen with the naked eye. P. polycephalum has been used as a model organism for many studies involving amoeboid movement and cell motility. For example, a team of Japanese and Hungarian researchers have shown P. polycephalum can solve the shortest path problem. When grown in a maze with oatmeal at two spots, P. polycephalum retracts from everywhere in the maze, except the shortest route connecting the two food sources. I use the grasshopper plugin Physarealm created by Ma Yidong to simulate stigmergy. These two experiments with swarm behavior can help me further generate computation progress on form finding in my graduation. First it is to find the shortest path using people agents through stigmergy. Then using space agent to locate different functional volumes based on social communication.

III Assembling and robotic building strategy.

The choice of material and assembling technique take local architecture as reference. This vernacular expression also deals with the problem of being non-places. There are four kinds of material according to different functions. For the diaphragm construction and core structure, concrete is used with the principle of additive. The site-cast procedure includes 3D printing with concrete and steel. The precast block includes 3D printing in the factory and robotic assembling on site. I also started a research on the assembling interlocking system during the firsts workshop in DIA. Further study would be carried on in the prototyping stage. The second material is EPS, mainly for integrated isolation, enclosure and furniture. The production principle is mainly subtractive, using robotic hotwire cutting. The research about EPS and hotwire cutting is based on the practice from Msc.2 project. During the second workshop in TUD, we tried to investigate the combination of EPS and other material, silicon as example. The third material is wood-based material, including recycled paper, industrial wood dust and plywood, using formative and additive techniques. Wood-based material mainly is used for functional and featured finishing, aboveground structure, enclosure and furniture. The functional finishing means finishing layers with acoustic, lighting, ventilation performance. The featured finishing means decorative layers with vernacular features. And functional finishing and featured finishing are not separated totally, they are merged and proportioned properly. The vernacular element I choose origins from the traditional Jiangnan architecture roof style, materialized with ceramic or clay tiles and decorated with delicate details. For this part formative production principle is used. Formative principle here means forces are applied to various points of a pliable material to give it a specific shape. And a research on possibility of 3D- printing with wood is also conducted. The other material maybe concerned for sealant, waterproofing, and fireproofing and so on.

IV Conclusion

A series of lectures and workshops provide me with inspiration and experiment on design and production process, directing my graduation project. Some of the study may not be adapted in the further design process, and some study may need to be conducted further.

References

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