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CONTROL AND EMERGENCE IN RESPONSIVE ENVIRONMENTS

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The exploration of new forms and materials and the speculation about the response to the resulting effect are becoming even harder in the generation of responsive environments. In design we must anticipate the consequences of the making and doing. Designers must balance intuition and premeditation to reason future behaviours and emergent phenomena, to see something that has not yet made. So how do we get from intuition to precision and from control to emergence?

The computation designs introduce higher levels of expression and control. But what abstractions can be used to represent, externalise and test the concepts involved? How we can materialize responsive environments? A continuous loop and feedback must be introduced between the screen (>digital model), the material model (>physical model) and the artefact (>manufactured responsive environment).

digital model <> material model <> manufactured responsive environment

Objects they lose their materiality and become information, energy and movement, trajectories, vectors and flows. We use abstract and generalized rules to see a series of relations through another series. The study of contents is replaced by the analysis of relations. The old dichotomies content-form and content-medium can be rewritten as content-interface. The interaction of simple rules leads to the emergence of complex global behaviours that they cannot be predicted and preconceived.

The notion of architecture in the past has been delivered as the creation of durability and stasis. Every transformation and change leads to new interpretations, to redesign and to replacement. The architectural model it cannot be considered any more as something static, but in the contrary we must think of it as a system that is dynamic and which embeds in its organization the ability to change, and to generate emergent phenomena. The new architectural model it is an open and operative system, which conveys and produces raw information. It is a responsive and interactive model, which performs as an operative medium, and as an interface between the user and the resulting effect – artefact.

The polymorphous and dynamic architectural models produce new interrelations between design processes and digital media. They are able to control unstable phenomena and continuous adjustments.

The new architectural model is a 'tool representation', because it is able to systematically map some characteristics of reality and it is capable to record and produce new raw information – data. By this way new relations emerge between the computer screen, the physical model and the final materialized object.

Architecture is not conceived anymore as a sculpture or as a drawing but as a flow of data and as a system that coexist in a dynamic field. In the design process knowledge and information is continuous produced. Information is transformed to a system that constructs and generates possible spaces. The architectural models operate as interface between the designer and the artefact, representing simultaneously the process, the form and the content. The designer defines the set of laws and the restrictions of the new architectural model, which subsist an independent system from the data on which it can be applied. In this sense the designer creates cultural, digital constructions (interfaces), codified in forms, which s/he is able to operate, and to generate multiple architectural affects.

By this way the industrialized architecture is transforming to a new digitised and information based architecture.. By embedding change in its substance this new dynamic and responsive architecture produce new relations between space, the environment and the user, and new temporal visual effects and aesthetics.

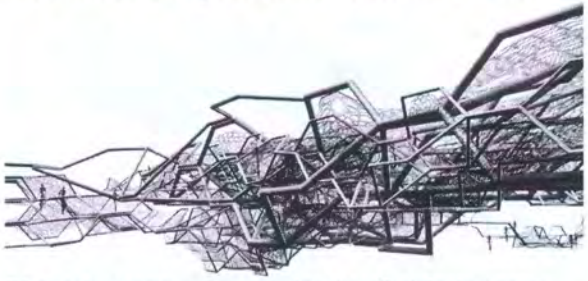

Photo 1 ***trans***_merge project by *T_4* design team

_ ***trans_merge*** is a field organisation of multiple, merged-scapes generated by an intelligent and responsive tectonic system.

_ **the merging system** although it raises questions concerning urbanism it is motivated more by the application of industrial design techniques, leading to

a bottom up design rather than urban planning or architectural syntheses, Fuller's urbanism and tetrahedron domes and the latest robotics research was a departure point for the project. This 'merge_scape', formed by an adaptive kinetic system, has the capacity to negotiate and respond to sequential spatial differences across various scales, in a more pliant organisation, resulting in non-Euclidian forms of component assemblies.

_ **the tectonic system and material research** was focussed on elastic material behaviours. The two primary operations of extension and rotation emerge global effects via the differentiation of local components, as discrete elements. The 7-sided lattice is controlled parametrically to as an active, interactive and intelligent tension structure. The distributions of differential densities install a range of material behaviours, from areas of rigidity emerging from greater material density, to greater elasticity/flexibility and, larger gaps in material. The elastic elliptical lattice has a varied depth of the circular extrusions and rings [laminated to others], forming a surface accumulated from components with gradients of sizes of radius and depth. The result is an environment with differential visual, circulatory and climatic permeability. Whereas the structural design of buildings is conventionally concerned with stasticity, we are inter-relating the load of the body onto the tectonic interface with gradients of flexibility.
Given the nodal accumulations of material, instability will be sought insofar as structural hierarchies are not expected to be continuous and equalised, but are rather concurrently redundant and insufficient. The charging of material surfaces with embedded technologies aims to saturate the visible and visceral field of micro-environments with information graphics, colour, lighting, translucency, reflectivity, material porosity, and sound. Effectively, these ambient devices are already immersed in urbanism and are controlled remotely and dynamically, and will inevitably collapse the disciplines of architectural and furniture design, environmental branding and, interface design.

_ **the Barbican Complex in London** was proposed as an operative field, which tests the elasticity of urbanism, negotiating the modernist blankness with iterative, serial microenvironments. The alien field space interconnects the existing sectional movement and visual connectivity of the podium level. The project adjust the urban scaled zoning of the barbican, in favour of a strategy of unleashing distributed, self-organised environments with specific functionalities and embedded forms of collective intelligence.

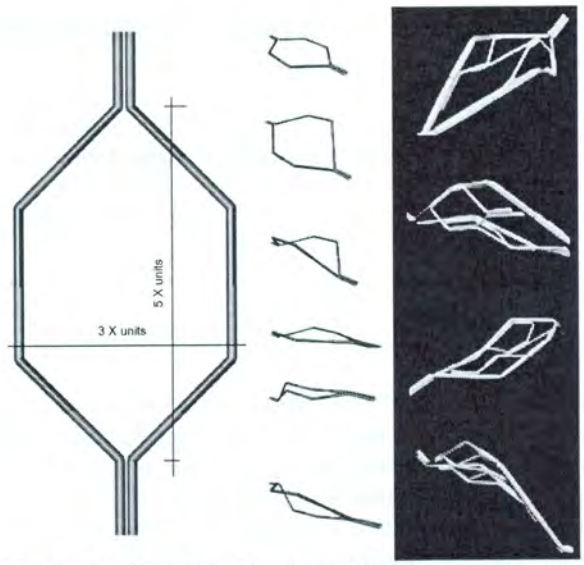

Photo 2 The combination of four components enclosed a space and forms a hexagon. The physical model studies deformation properties ran concurrent with digital studies and were a constant source of feedback through the development of the unit system.

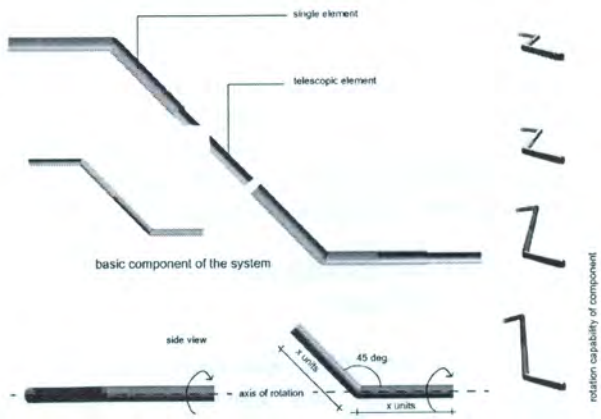

Photo 3 The basic unit of the system is an element bent at 135 degrees, which has the capacity of negotiating a 3d space on rotating around its axis. By adding a telescopic device between the two units we increased the level of complexity and flexibility.

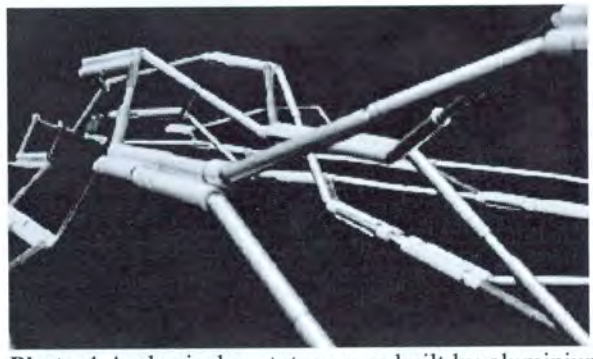

Photo 4 A physical prototype was built by aluminium tubes and PVC to test the actual behaviour of the kinetic tectonic system.

_ **multilevel urban flows are organised as temporal users scenarios** distributing self-organised time-variable responsive systems causing new urban

behaviours. The groups of users and populations are elastic to the extent that the activation of the smaller scale facilities operates differentially in space and in time. Cyclical pulses of activity and movement that vary across each day, week and season, installing time-variable responsive systems and, longer-term capacities for an environment to learn from and adapt to user-interaction. The dynamic user-interface is embedded with mechanical, electronic and load bearing capacities, which install local intelligence to the urban intervention.

_ **new routes and connections emerge** from the capacity of the system to form an array of variable continuous surface organisations between, beneath and through the existing Barbican infrastructure, which in turn leads to the emergence of new programmes engendering new visual, spatial and functional mixities. The peculiarity of the systems various scales generate a range of possibilities in responding to the different requirements of structural, spatial and ergonomic adaptability. It challenges the user's traditional notion of space, aesthetic values and their encounters, by means of generating alternate forms.

_ **the aim** was speculate on the digital materiality of the Barbican to extremise the sensorial experience of the user, thus engaging the user in an augmented form of spatial and temporal reality. Specific phase states of ambient behaviours may operate in durations of a few seconds to several hours, sent into transition as dynamic architectural atmospheres by the differential activation of arrays of sensors, actuators and components. The immersion of the user within these environments, and their mutual dependence seeks to operate as a form of non-organic life.

'Trans_merge' is a research project, which explores the interactive and responsive environments from concept to manufacture. It is a result of twelve months research, developed by T_4, a team of four architects working in the AA Design Research Lab at the Architectural Association School of Architecture, in London, following a three years agenda under the title: 'Responsive and Interactive Environments'.

T_4: Niraj Doshi, India / Vladimir Kalinowski, Peru / Abraham Koshy, India / Spiros I. Papadimitriou, Greece / Project tutor: Tom Verebes / Sept. 2001 – Jan. 2003

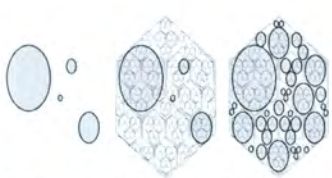

Photo 5 The elapses insertion within hexagonal cell.

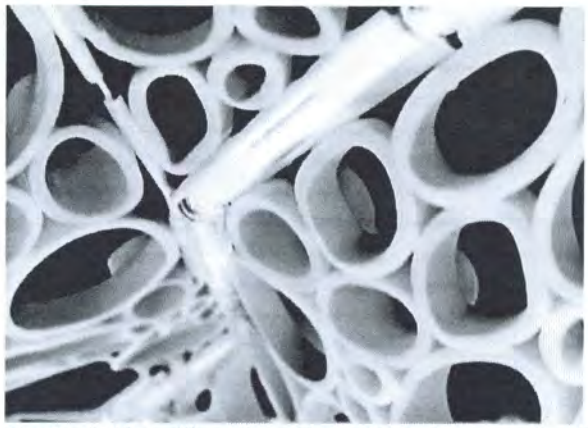

Photo 6 The ellipse insertion within hexagonal cell. Each different size of the of ellipses describe a variety of performativity responding to the requirements of the demanding types of surfaces and conditions of the activities which will take place. As the sizes of the ellipses vary in radius and height the range between flexibility and rigidity become the main output in terms of behaviour.

Photo 7, 8 digital models.

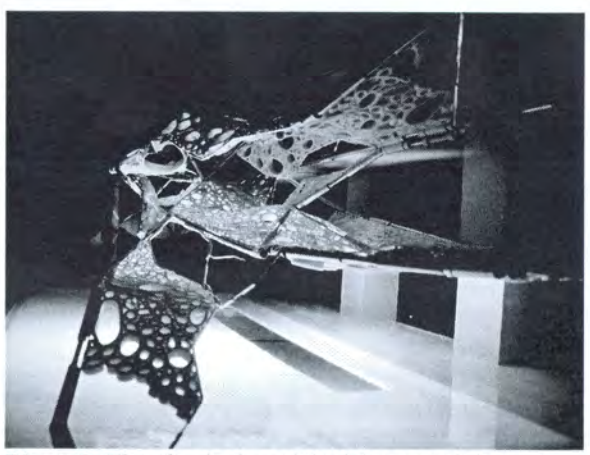

Photo 9 The physical model of the material system.