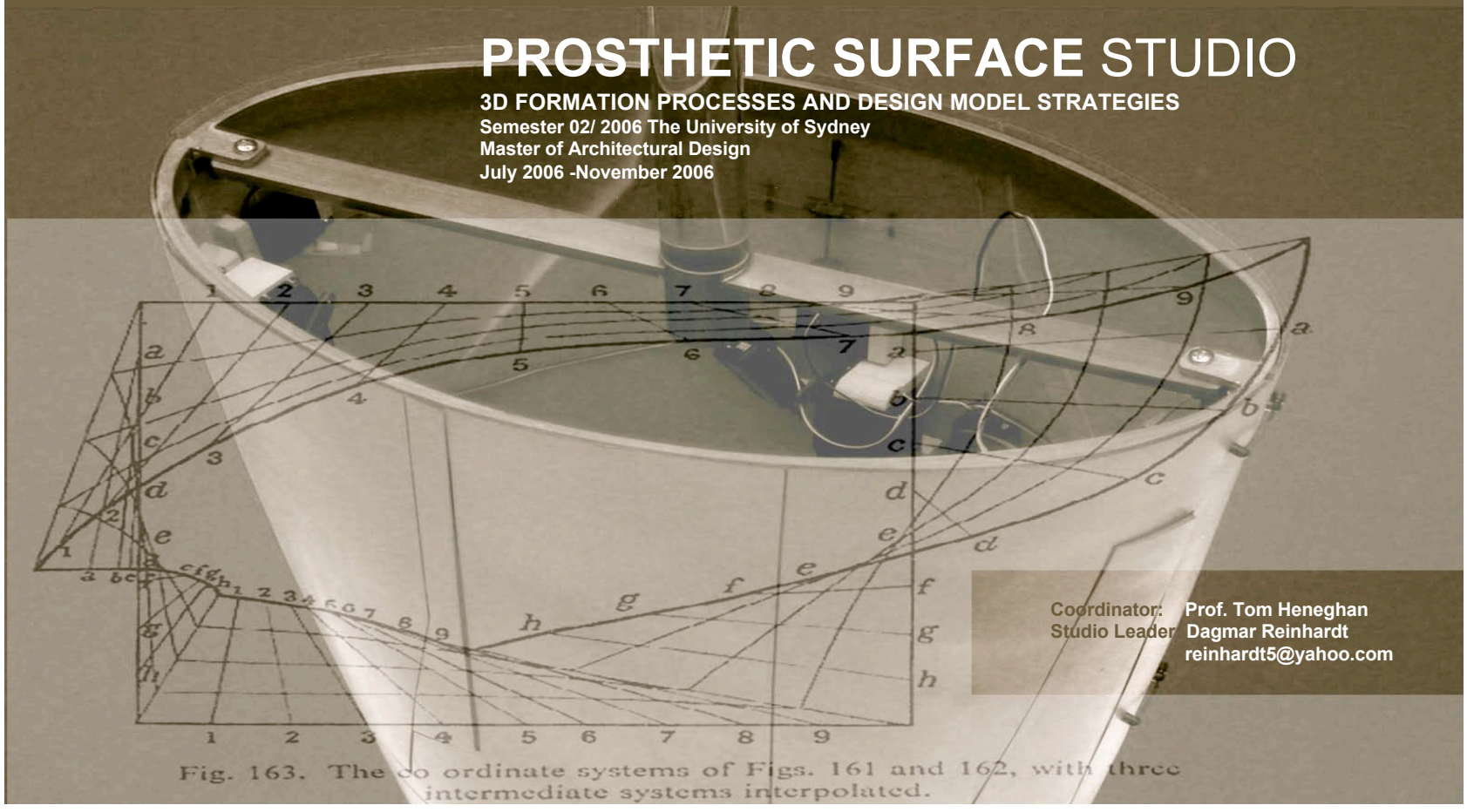
PROSTHETIC SURFACE STUDIO

3D FORMATION PROCESSES AND DESIGN MODEL STRATEGIES

Semester 02/ 2006 The University of Sydney
Master of Architectural Design
July 2006 -November 2006



Coordinator: Prof. Tom Heneghan
Studio Leader Dagmar Reinhardt
reinhardt5@yahoo.com

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SEMESTER 02/ 2006 THE UNIVERSITY OF SYDNEY
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DAGMAR REINHARDT

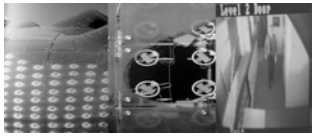
PARTICIPANTS
BN_BHASALI, NEHA (India)
CHA_CHEN, HU - ANDY (China)
FRH_FU, RHUI HUA - RENEE (China)
JSC_JOUNG,SHIN YOUNG – CINDY (China)
PN_PATANKAR, NINAD (India)
PV_PATEL, VIMALBHAI (India)
RLC_RAMIREZ LOPEZ, CARLOS ANDRES (Mexico)
SSE_SUN, SI YUE - ELLEN (China)
TS_TAHIR, SHOAIB (India)

architecture moves.

we occupy the shifting spatial parameters of transitional environments. architecture is a substantial part of a culture that is enacted and embodied, and regulated by a number of interplaying abstract and factual variables. similar to other cultural expressions - language, fashion, art - architecture changes repeatedly, it is part of a dynamic process. we understand architecture as an evolutionary tool with a demand to regenerate itself in order to ensure the survival of the species. the most successful prosthesis may not be the one, which is able to answer the largest number of challenges, but one which itself undergoes a process of learning, self-modification, differentiation — in short, a process of evolution. yet architecture is considered static once it is erected. hence, the prosthetic surface studio profiles architecture as a prosthetic tool, an extension of man, another highly profiled supplementary skin with a reflective ability to address a change in context and value systems. in which way then can a dynamic system in architecture be conceptualized and designed, and provide an interactive, responsive, behavioural and continuously changing environment for its occupants?

ANDY WARHOL, TANGO
CUTTING SCHEME

E-NET
MARCEL BREUER,SELF
PORTRAIT
MINORITY REPORT



PETER COOK, GRAZ
MUSEUM
SURVEILLANCE CAMERA
DISPLAY

[COMPONENTS AND PARAMETERS]

1 **TIME- PROGRAMME INTERSECTION**
Time charts, occupational groups, continuity-discontinuity, duration/process, age and memory Sequence or storyline, narrative intent

2 **MOVEMENT [TRAJECTORY]**
Personal trajectory/ traverse, trespassing (self-) organizational structures/ patterns, behaviour

3 **INDIVIDUAL [USER PROFILE]**
Individual inhabitant, perception, habitual body, personal narrations, Social groups, friend/family relations

3.2 **BODY COUNTERPART**
the body and a counterpart, the interdependency between a single program and an architectural device, the interplay between a device of/ for inhabitation and a habit or a behavioural pattern.

4 **DATA [MEDIA]**
Invisible (environmental) forces (data streams, weather lines, topographical lines, technological forces, Codes (status, gender, race, weight), news, gossip (social factors/ communication)

5 **SPACE [FORMATION]/ SURFACE STRATEGIES**
Heterogeneous -compressed- elastic space arrangements (fold -mesh-raisin), material/ mechanics, fabrication/ production strategies, programmed wall, rotational occupation, unintentional spatial definition/ [reactive-abstracted potential]

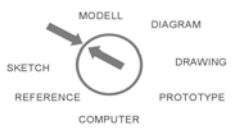
The **PROSTHETIC SURFACE** STUDIO investigates possibilities of architecture as a dynamic system, and the potential of a prosthetic surface that affects space – a surface formation that acts as an operative third skin. Parameters of this system and its interrelations are time, movement, space, surface formations, individual, data and media. To date, the dynamics accommodating change through an architectural environment have been constructed as adaptable, flexible, modular, mobile, or morphing system, but are restricted in later applications. The **PROSTHETIC SURFACE** STUDIO thus examines the processes, techniques and devices of contemporary approaches, in order to formulate alternative solutions.

A departure point for the studio is the mutual correspondence of fashion and architecture, as both professions share strategies and techniques of production. A specific method of surface prosthetics as apparent in the work of Hussein Chalayan (‘Aeroplane Dress ‘ and ‘Remote Control Dress’), and concepts of dynamic volumes as apparent in the work of Issey Miyake, Alexander McQueenn or Rei Kawakubo will be investigated. Here, a number of strategies are executed and can thus be analysed and used for an inhabitable and modifiable spatial envelope with responsiveness.

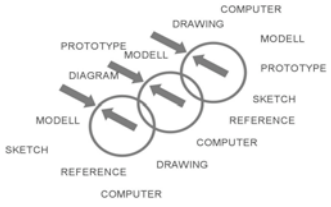
To name but a few agents of change: constructive line and operative surface, communication, coding and signage, form information programs, pattern charts, volume outlines, texture fields, surface operations, and implemented electronic or digital extensions. In all named, the prosthetic surface is potentially activated twice, before production and in operation by the impact of data/ information. The **PROSTHETIC SURFACE** STUDIO then pursues a process of change in the phases of design, construction and operation of architecture. We will review, define and instrumentalize new surface conceptions and techniques, develop new strategies, and consequently present new architectural solutions for an unlimited number of inhabitation options and user profiles.

The ultimate objective of the **PROSTHETICSURFACE**STUDIO is a new definition of architecture and space as an interactive, elastic, responsive, evolutionary cultural entity.

[MEDIA ROTATION SYSTEM]



LINEAR DESIGN
CLOSED SYSTEM _ LINEAR
DIRECTED
CONTROLLED METHODOLOGY



INTEGRATIVE DESIGN
OPEN SYSTEM _ HELIX
FEEDBACK INFORMATION - FORM
INVENTIVE/ INTUITIVE
RESPONSIVE METHODOLOGY

DESIGN PHASES The design process undertaken in the **PROSTHETIC SURFACE** STUDIO was structured in the following sections:

_REFERENCE ANALYSIS AND PARAMETER SETUP: In this term, the studio work departed from two main references points; the selection of one specific fashion image and consecutive analysis, and the search for an animal, vegetable or other bionic reference with similar strategies and characteristics. While the fashion reference could be shared, the animal reference analysis had to pursue key points on an individual basis. From both, a set of rules, principles and parameters were derived that defined the framework for the development of a design model.

_DESIGN MODEL/ CONCEPTUAL DEVELOPMENT: The defined set of parameters produced by the reference analysis was then shaped into a design strategy, on an individual basis and under collateral team discussion. The design model is the profiling instrument of the idea or concept, in this phase it employs various media and subsequently evolves into the studio task of a a prosthetic surface device. This section aims at sampling, testing, experimenting, gaming, re-shaping an idea or concept through prototyping, through sections of a possible architecture or detail without real-time requirements. The design model strategy is shared collaboratively, it uses and re-interprets references, and constructs an archive of ideas which can be applied to a range of projects and scales. The conceptual development also includes series of media (sketch, physical and computer modelling) to understand each single parameter and their interferences. The rules are tested, extended, demolished, reset. The design model, in this case the prosthetic surface device, is a worryless architectural indication; it frames the conceptual intention, explores materiality and fabrication, and delivers the uncompromised ideal solution.

_MEDIA ROTATION: A substantial part of the design model development is the media rotation strategy; the pursuit of a principle through various media such as computer animations, sketches, physical models, renderings etc. In each, the respective medium redefines the form/gestalt through its inherent material properties. The key moment is feedback. Each consecutive medium addresses additional criteria and thus contributes to the design; through material character, production methods, textural and physical properties. Instead of using a linear, hierarchical line of production in a step-by-step continuity, the media rotation uses an integrative approach where additional elements, alternate options and partial solutions of the design process cross-reference and re-inform each other, and are calibrated by the design model.

_ARCHITECTURAL APPLICATION/ DESIGN PROPOSAL
Completing reference analysis and design model, parameters and device are ultimately counterchecked and refined in the architectural application phase. An individual user profile, program selection and site selection deliver additional demands which the design model has to negotiate. Rules, method and techniques of conceptualisation and design acquired beforehand are thus under investigation when challenged by the architectural application based in reality. From a process point of view, the final application should show an intact rule system as derived from the references, and a design model uncompromised by actual demands and clearly legible in the design proposal. In trems of studio task, the final design should maintain interactive, responsive or dynamic aspects in order to negotiate alternate programmatic demands or user changes, or simply display a phenomenal behaviour as architectural equivalent of a bionic presence.

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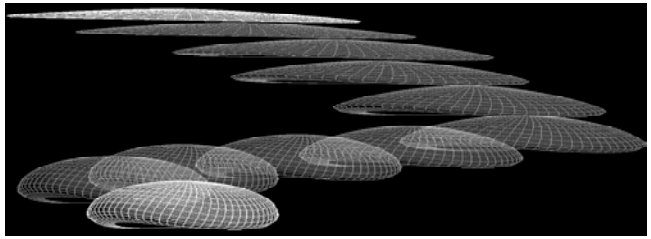

DESIGN MODEL/CONCEPTUAL DEVELOPMENT

The design development developed from a textile collar of a semi-transparent fabric. Its folds and bended surfaces indicated the specific pattern of fabrication and structural system, which could be transferred into architectural parameters. The massing and translucencies, three-dimensional surface and structural depth embodied dynamic and changeable characters along with the model's movement. correlative reference of another reference, a jellyfish, showed similar underlying principles in terms of surface and shaping a volume/ space. Yet, unlike the fashionable garment, the jellyfish is a dynamic bio organism in a self-morphing process.
The conceptual development examined possibilities of a prosthetic surface in a transition between a static and dynamic situation. As a dormant static condition, the surface once establishes a formation of regular or irregular elements, which are folded, curved or shifted to create space, and then remains in such positioning. In a dynamic status such as the morphing surface of the jellyfish, the surface acts as an operative system showing a series of conversions of flexible and interactive volumes and sub volumes. A design model thus consequently required an equivalent continuous surface transformation through a shift in massing and density, in order to be able to define a possibility for a dynamic architectural application.

The design model employs a dynamic spatial system, derived from the interpretation of the jellyfish's body movement, which showed an interval between expansion to contraction. The body of jellyfish represents a typical prosthetic surface, which potentially provides different spatial experiences through a morphing process. Movable layers of various sizes divide the spatial sections, a concentric control line affects the direction of the movement and the specific location of each layer in relation to the overall volume. The sections within this system embody interactive and elastic characteristics. As an architectural proposal thus, this principle might demonstrate how changes within a single layer influence adjacent spaces and therefore result in a redistribution that provides alternate possibilities and flexibility in terms of spatial and functional requirements.

SPACE – NODE, CONTROL LINE, SURFACE

The prosthetic surface suggested here formats space, both interior and exterior, depending on the implemented surface operations controlled by fixed spatial nodes. Such nodes form the constructive lines, which subdivide the program into diverse functional areas and control the operation of the morphing system. Accordingly, the dynamic system creates the potentially interactive and elastic spaces.

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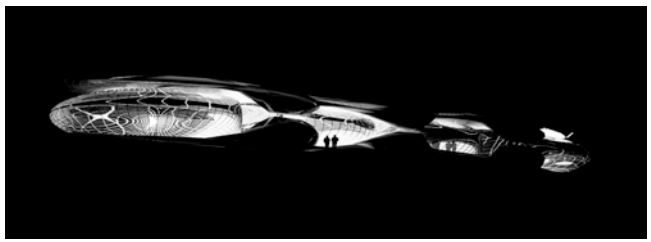


SPATIAL CONFIGURATION – MODULE AND ASSEMBLAGE

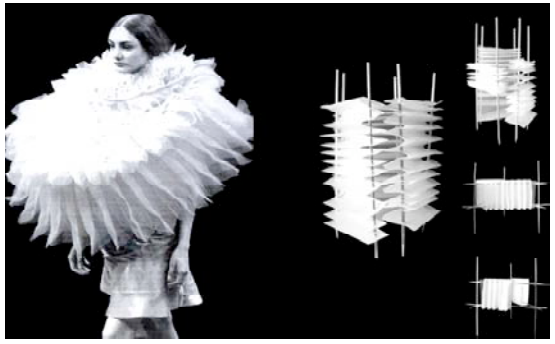
A digital model, abstracted from shape and movement of the jellyfish, was developed to create an optimal module to stimulate the spatial transformation. The transforming process to the volume, including folding, curving, rotating, extending, represents a series of spatial configurations in shaping spaces, similar to the ones analyzed in the jellyfish behaviour. By simulating and comparing spatial configurations, the control moments for operations of the module could be determinated in a specific framework of structural configurations and the relevant constructive lines. Hence, except for the structural elements, all others could be adaptable and flexible, thus affecting the potential behaviour of internal and external spaces. The assembled module became the fundamental element for the organization of the whole program, and could be considered as separated spatial nodes, arranged in defined ways. A dynamic spatial layout employs locations of fixed spatial nodes. These control the transformations of the adaptable elements that need to be connected, overlapped or interjected. Particularly in this project, the spatial layout orients itself along the spontaneous grouping in which a swarm of jellyfishes moves. Ultimately, the program becomes a dynamic system and consists of diverse operations in formatting space.

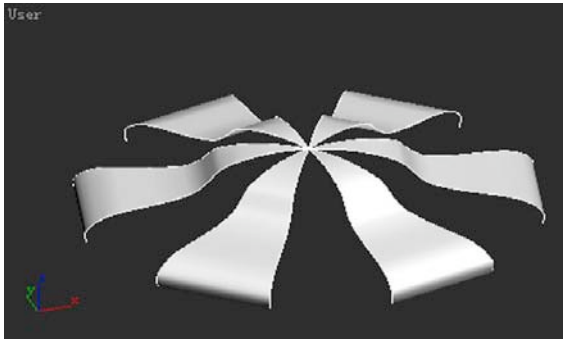
SPATIAL CHARACTERISTICS – INTERACTIVE AND ELASTIC

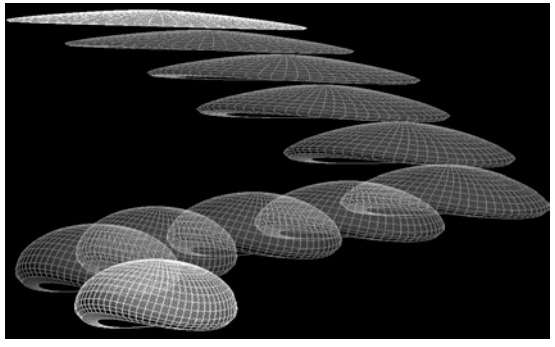
Space emerges in accordance with the operations processed on various programmatic fields, divided into permanent and temporary occupation. Permanent spaces derive from the fixed structural elements and compose the fundamental shape of the program. Yet the term ‘permanent’ refers to a relative rather than an absolute status. The relationships between those spaces as a totality could be rendered in degrees; as stable, interactive or interdependent. Supplemented through an organization by control lines, a range of possibilities is provided for temporal and temporary, instant or elastic spaces in response to a dynamic organization.

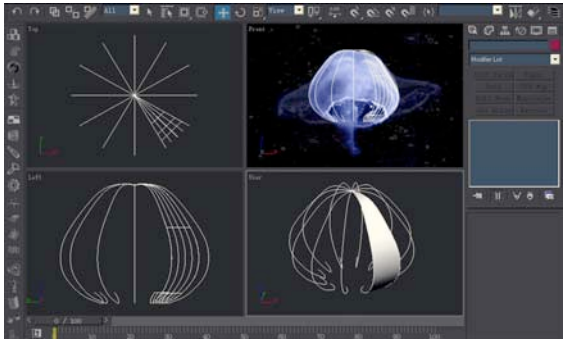
ARCHITECTURAL APPLICATION

The final architectural proposal focuses on the translation of the given principles determined by the design model to an actual program, a real architectural project. A exterior surface borrows from the organic shape of jellyfish, it constructs the structural framework and formats a permanent envelope for the program fields of an entertainment center. Inside four separate spatial sections are positioned, like air bubbles, which are controlled by a spatial articulations of two control lines. These spaces could be overlapped and interrupted. Between control lines and exterior shells two responsive packages are injected to readjust their positions, filled with air or a similar element capable of expansion and contraction. Along with the adjustment of the control lines, the spatial joints could be shifted vertically and horizontally, depending on functional requirements. Thus the interior spaces and their respective packages form a real dynamic system to create diverse spatial configurations and a series of interactive and elastic spaces.

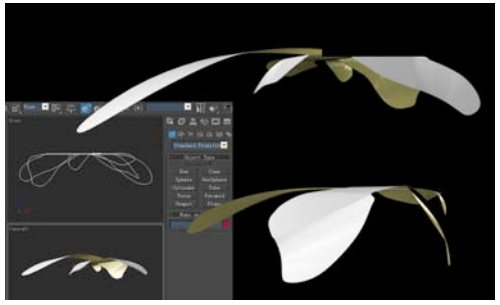
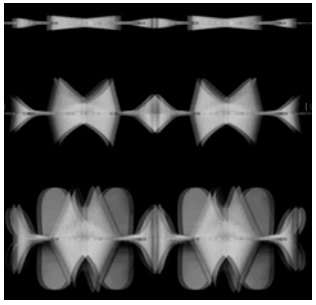
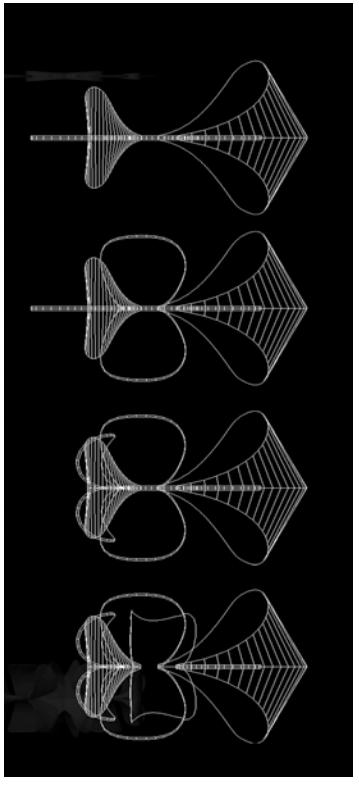


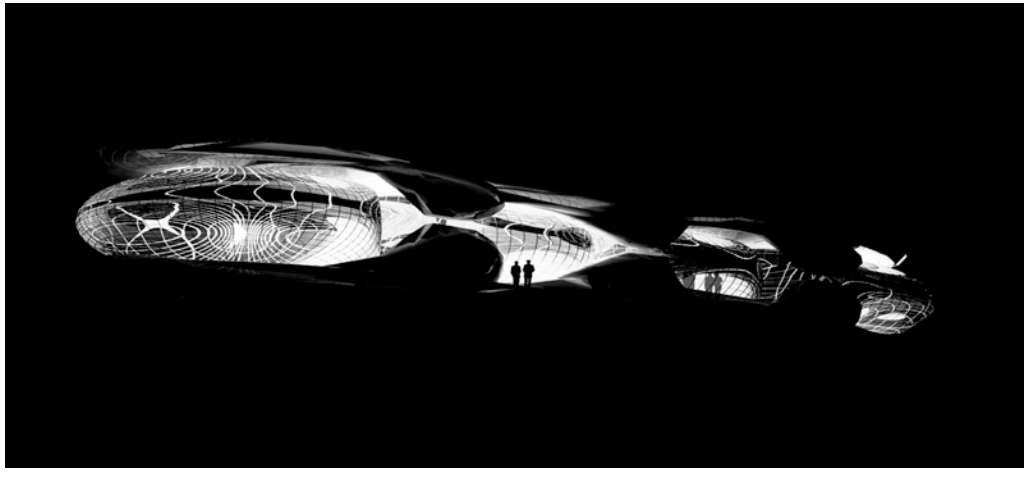






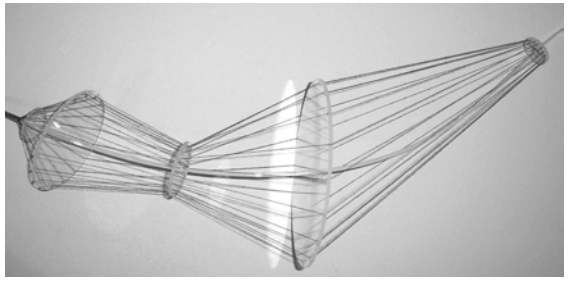
REF1: FASHION FOLD, MODEL RESEARCH
REF2: JELLYFISH, 3D-MODEL OF CONSTRUCTIVE LINES
DIGITAL MODEL - JELLYFISH MOVEMENT
SURFACE FORMATION - EXPANSION
REF3: DICTYDIUM CANCELLATUM (CHINESE LANTERN)
SURFACE FORMATION - CONTRACTION

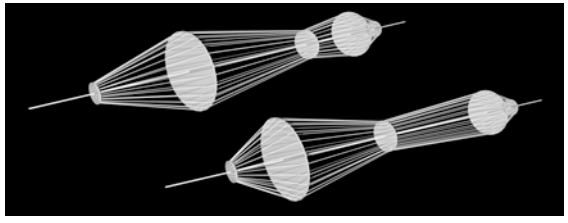





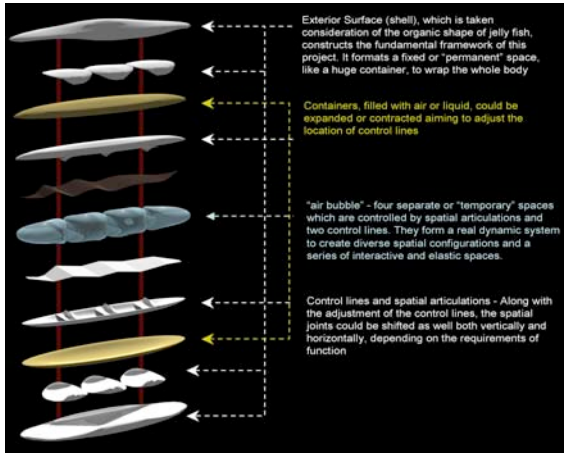


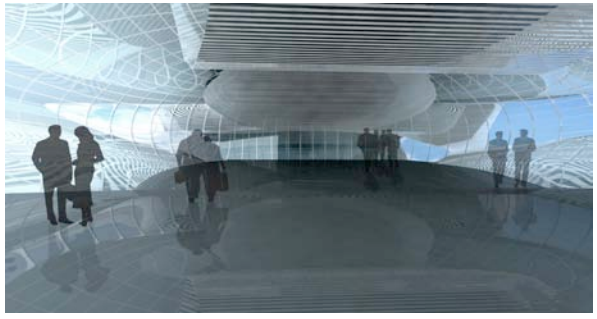
MODUL- FLEXIBLE SURFACE OPERATION TO CREATE ELASTIC SPACES: A DIGITAL MODEL ABSTRACTED FROM THE SHAPE OF JELLYFISH, WAS DEVELOPED TO CREATE AN OPTIMAL MODULE TO STIMULATE THE SPATIAL TRANSFORMATION. THE TRANSFORMING PROCESS, INCLUDING FOLDING, CURVING, ROTATING, EXTENDING AND SO FORTH, REPRESENTS A SERIES OF SPATIAL CONFIGURATIONS WHICH HAVE THE SIMILAR CHARACTERISTICS, LIKE JELLYFISH, IN SHAPING SPACES.

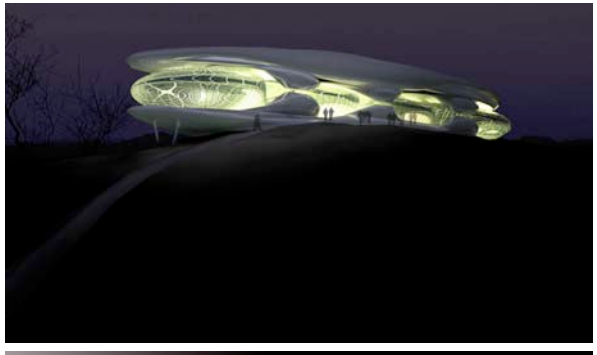
REF2: JELLYFISH, SWARM BEHAVIOUR
SPATIAL CONSTRUCTION THROUGH IRREGULAR SURFACE
> FOLDING/MORPHING/BENDING
PHYSICAL MODEL [STRING, WIRE, TRACING PAPER]
DIGITAL MODEL: BEHAVIOURAL SURAFACES IN FIELD
RENDERING INTERIOR, LEVEL 1

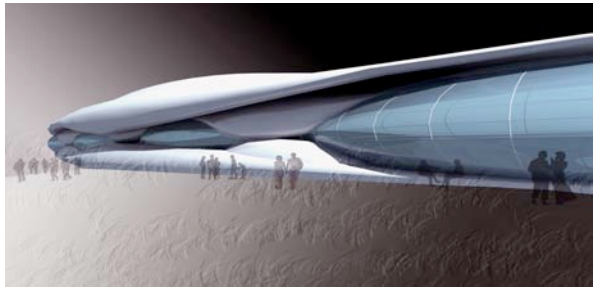


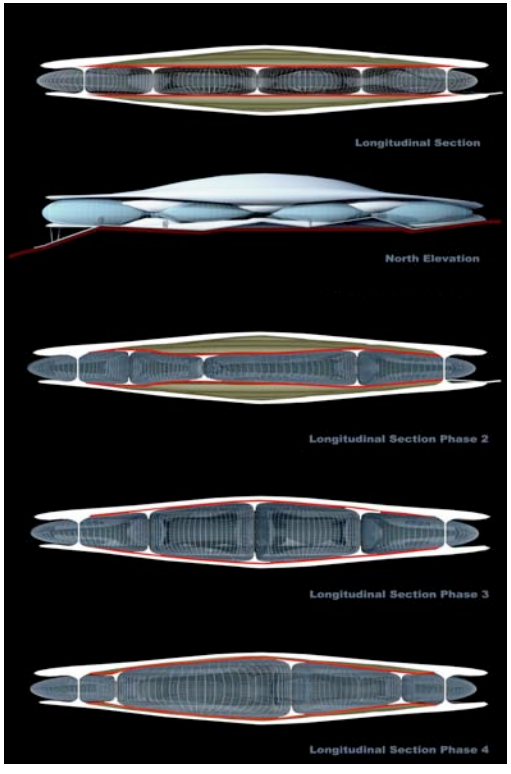


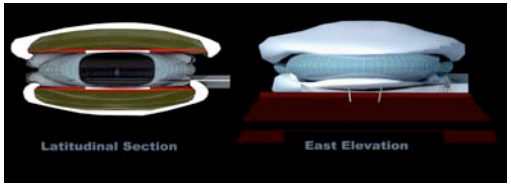












1: DESIGN MODEL: SPACE DIVIDED BY MOBILE LAYERS AND VARIED IN SIZE , THE MIDDLE CONTROL LINE AFFECTS THE DIRECTION OF THE MOVEMENT AND THE LOCATION OF THE LAYERS.

2: NODE, CONTROL LINE, RESULTING SPACES
3: RESULTING SPATIAL CHARACTERISTICS_INTERACTIVE AND DYNAMIC
4: LIGHT, INETRIORS, ATMOSPHERE

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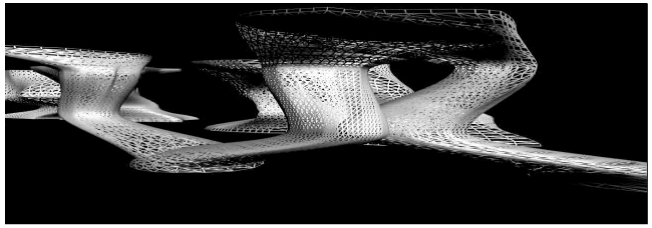

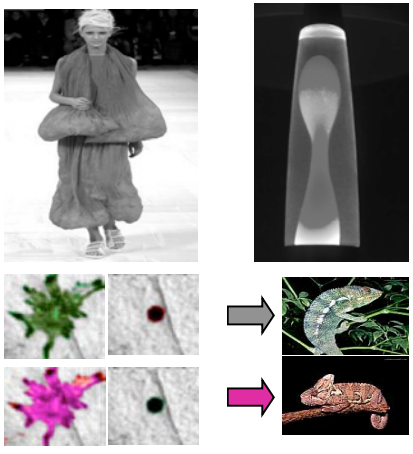

'We want architecture to be in the hands of people. I have this nagging doubt: is architecture inherently a totalitarian space? When designing a space, are you necessarily designing people's behaviour in that space? I want us to do the opposite. Why do we, me and 200 other architects in the word, all make places that evolve, twist, warp… we obviously want spaces that work as biology. We want a space to live, to not as a monster that overtakes the person, but as something that reacts. Action is great, but transaction is better. Action is ultimately private; transaction lets other things in as well. We would love to make spaces that would actually react to those spaces. I don't know really how to do that yet.'
VITO ACCONCI

KEY WORDS
evolution, pigment movement, aggregation, dispersing and translocation
volume penetration, overlapping, floating, transformation
elastic surface, density, tensile mesh

REF 1: CHAMAELEON

This proposal investigates the research strategies and manufacture techniques of fashion, biology and architecture. The colour-alternating phenomenon of a chameleon skin, and the Y.S.L 2002 Summer Collection are analysed and applied as strategies for a modifiable spatial envelope.
The phenomenon of a three-dimensionally adaptive skin organization allows the chameleon to adjust their colour to a surrounding environment. Inside the basic skin unit are chromatophores, pigment containing and light reflecting cells. In theses cells, a pigment movement occurs, the particles change their massing and grouping in controlled acts of aggregation, dispersion and translocation. Together with a variation in the chromatophore's volume, a change results in an apparent adaptation, or shift in colour. Briefly, the principle can be stated as such: a colour variation is based on a density variation and volume variation.

MODEL 1_INK:

An ink test simulates the mechanism of a chameleon's adaptable skin. The ink drops move in three dimensions within the body of two liquids, water and a layer of oil that, due to a different density, swims on top. Depending on the direction of movement, they show a different phenomenon. When moving horizontally, the drops disperse, aggregate, expand, encircle, intertwine, overlap, and merge. When moving vertically, they drop down, extend, abrupt, and penetrate through different layers. Drops with changing forms affect each other and their spatial environment, they form extended volumes, diffuse, change shape and mass. The interrelationship of drops defines alternative spaces with changing section, plan and volume. The variations of the ink volumes have an impact on the surrounding element; visible as a shift in the variation of hues and shadows.

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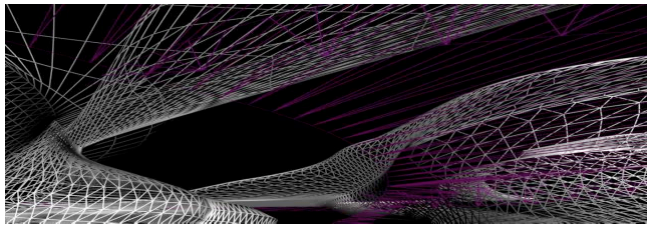
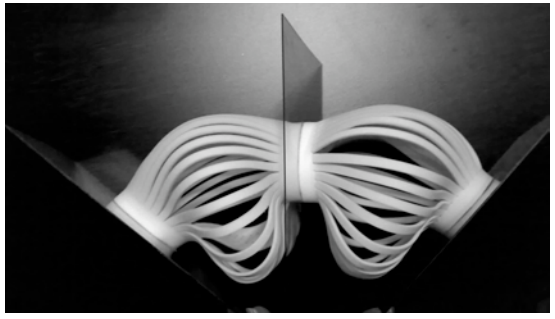
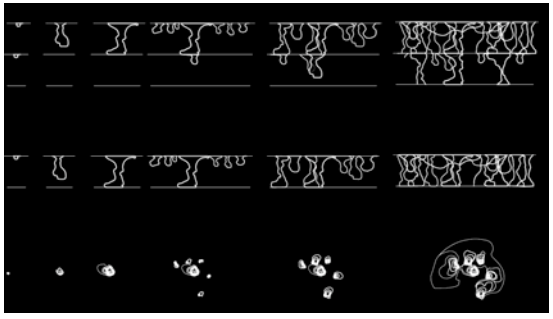
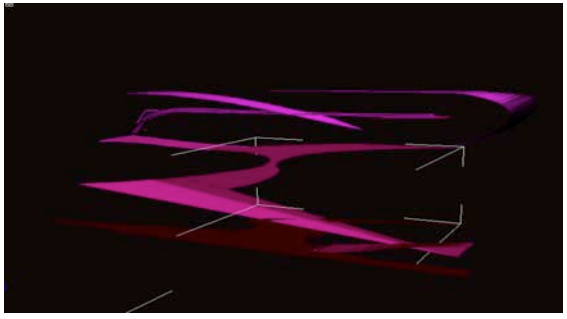
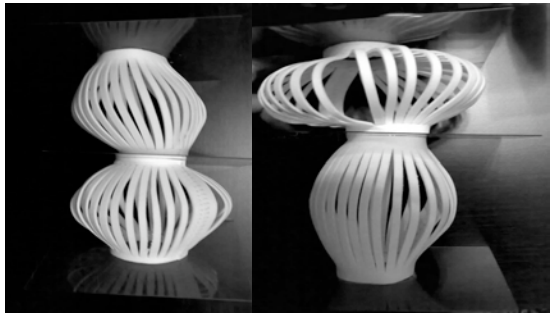
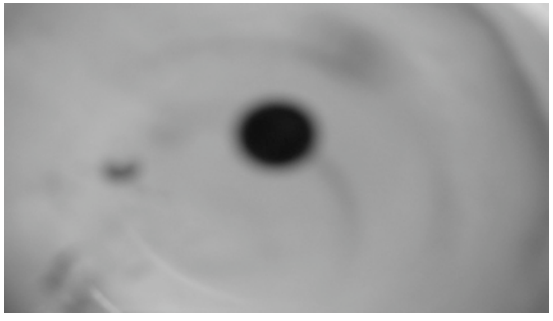
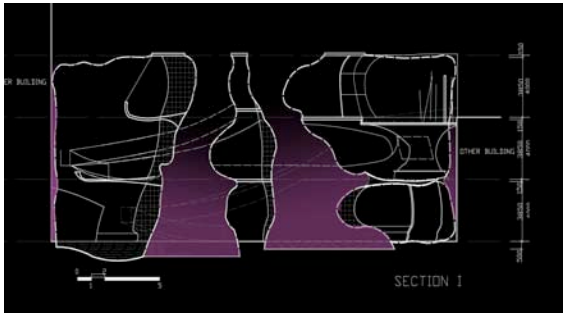


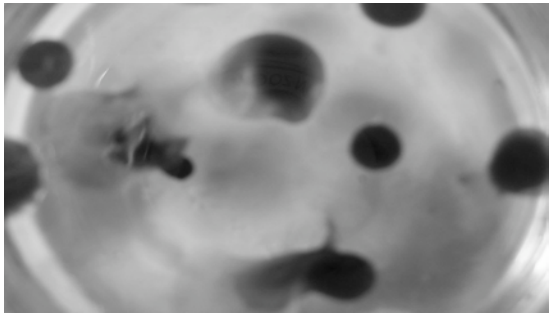
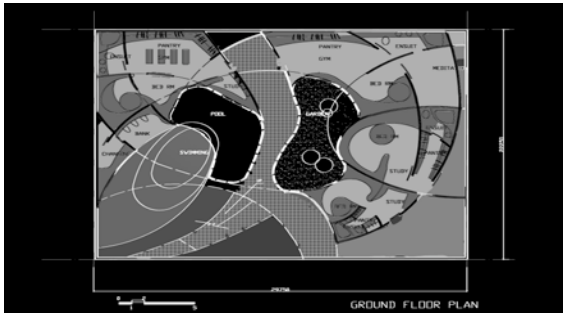
MODEL 2-4_STRUCTURAL MESH:

Similiarly, the shape and deformation of a volume were investigated in a second step. A series of building different physical models was conducted to understand strategies of a volume change. A first model combined stable circles with elastic bands. A second model cut a plane in stripes, folded the plane to a tube, and used several perspex sheets with circle diameter cuts which were shifted up along the tube, causing it to deform and thus display various spatial options between dependent levels. A last model reviewed a homogenous mesh and its deformations to explore tubes and variable circular cuts in the levels in dependency to one another. Different densities of the tube surface caused variation of hue, tensile, and shadows, and thus defined degrees of privacy from public (visually accessible) areas. Each time, the texture of the nodes between construction lines engineered a differentiated density in correspondence to the tension applied. An elastic control circle as opposed to a stable one allowed not only a horizontal, but also a vertical between the layers. Thus, a movement through the surrounding volume could connect and extend spaces three-dimensionally, using surrounding plan and section at the same time for an expansion.

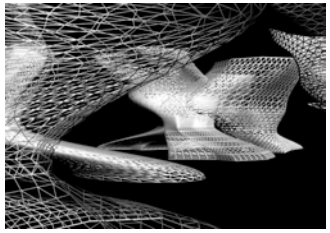
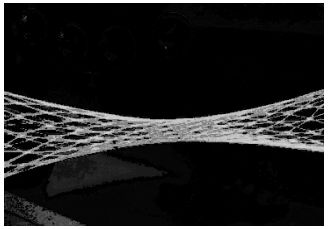
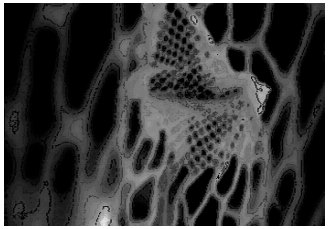
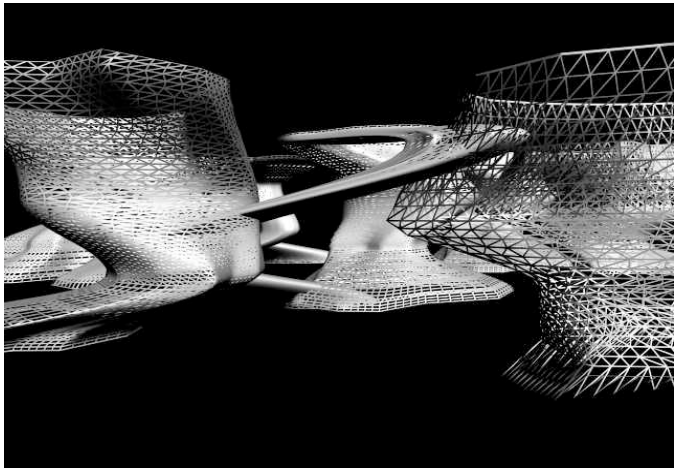
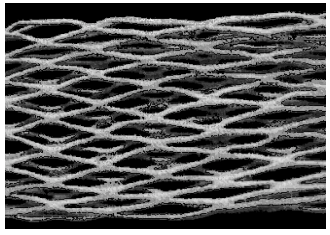
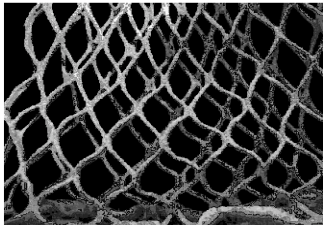
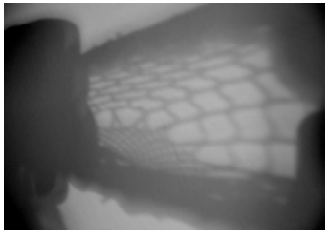
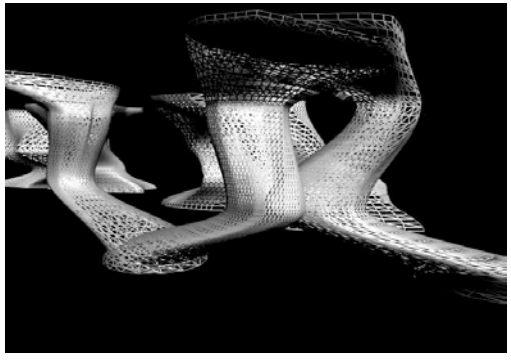
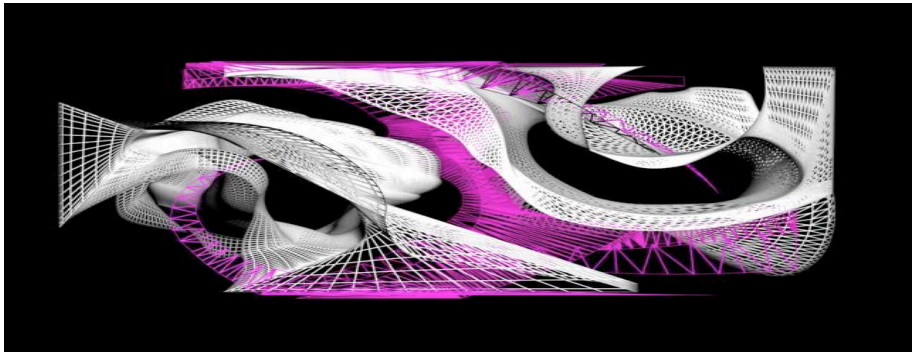
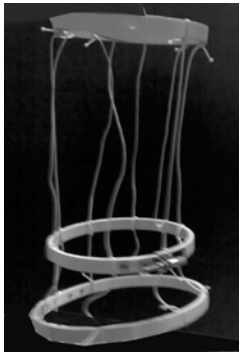
ARCHITECTURALPROPOSAL_VOID:

The design uses the translation of the design model principles into architecture through a number of components; the void in form of a courtyard insertion or hole in the fabric of a city, the penetration and intersection of several programmatic volumes, and ramps which produce a vertical linking of void and spatial elements. The element of an elastic surface mesh communicates or explores relationships between void and volumes, and blurs the distinctions between interior and exterior, inside and outside world. This elastic masking deforms and forms spatial division, from both floor and ceiling; it creates yards, functional sections such as kitchens, lounge, and livings areas, and also defines the external public area.
The interplay of several volumes within a suppositional containing boundary stimulates a possible spatial phenomenon of continuous dynamic change. The volumes twist, shrink and expand, bend and rotate themselves; and aggregate, abrupt, intertwine and encircle with each other. Light penetrates through the masking mesh, projecting shadows on surrounding surfaces, the variation of hues and forms provide alternating spatial characters, colours and atmospheres. The proposal could also provide a solution for space in an urban context with very high density, where an intense spatial experience is interiorised. In high-density areas, domestic space is surrounded by other buildings in every façade, leaving as the only possible access to outside the roof. Hence the volumes deliver a void, which supplies all levels with light, ventilation, and visual connections. The subtle wave of the enclosing envelope, the deformation, translocation and twisting of the mesh surface provide responsive spaces with a distinctive material and phenomenal character.

CONCEPT MODEL 1: COMPONENT STUDY - STRUCTURE AND CIRCLE
PHYSICAL MODEL: FIXED CONTOUR LINE, INDICATIVE CONTOUR LINES
CONCEPT MODEL 2: DROP ACTIVITY - EXTRUSION
CIRCULATION RAMPS
ARCH PROPOSAL: PLANS OF INTERSECTED PLANES

CONCEPT MODEL 1: ELASTIC SURFACE - MESH PROPERTIES
DIGITAL ARCH PROPOSAL: INTERSECTION OF VOLUMES
RAMP AND COURTYARD SYSTEMS
PHYSICAL MODEL: FIXED CONTOUR LINE, INDICATIVE CONTOUR LINES

JSC_0T1

Is there a method available that gives disabled or aged people more freedom of movement in reality? This project will suggest the possibility of using moving surfaces to aid the mobility and comfort of both able and disabled people through new architectural ideas.

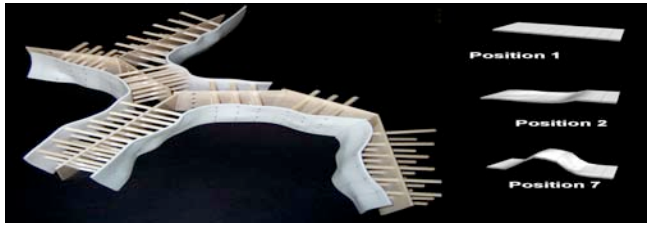
REF 1: USER PROFILE
There are two clients; both are actual people. ‘A’ is a very famous superstar pro-gamer ‘Yohwan Im’ from Korea. ‘D’ is an Australian and is disabled because of infantile paralysis. Both are pro-gamers and studied Multimedia and Computer networking at university, therefore, they spend most of their time at home and in front of a computer. They met at ‘The Second International Game Competition’ in Seoul. The final architecture for these clients will function as a work office and primary residence. In the games, both clients are freeing their movement. They can control everything with a joystick or keyboard, communicate with others easily and go anywhere they want inside the game. However, in reality, ‘D’ is not free to move without a wheelchair or help at all times.

REF 2: FASHION
The design model is derived from Rei Kawakubo’s ‘Lumps’ collection. Here, pads that expand the surface material exaggerate shoulders and hips. The design features two dominant pattern; lines and dots define a contrast of upper and lower parts. These lines and dots are expanded as the fabric bulges. In the design model principle, the lines cross each other and compose the curved surface. The dots are reinterpreted to support the surface and become posts.

MODEL 1: MOVING SURFACE
1 - The different post lengths creates the curved line and the composition of curved lines establishes the surface. This principle is applied to create a moveable surface.
2 - If same length posts can go through the plate (or potential floor), then the surface can be moved by adjusting the length of the posts. The posts on the opposite side of the plate create another curved line. Consequently, the surface responds between ‘A’ and ‘D’. The surface will use an elastic material like rubber, foam rubber or textile to be flexible, posts will be made of a hard material to sustain the surface.
3 - The multi-level structure between ‘A’ and ‘D’ is generated as a ‘bee-hive system’ in order to optimize the surface use. The 120 degree angle of the wall provides more positive spaces than a right angle wall in moving surfaces. The hexagon edges can be utilized for the back of the chairs, sofas, and hidden devices for furniture.

REF3: SURFACE FURNITURE
Panton Chair 1973 - The Panton chair combines a variety of possibilities for positioning the object on the ground and a body on the object, thus creating a multiple use tool that responds to different positions and requirements of its user.
AWG 2001 - The AWG project shows the use of minimum spaces with maximum function based on basic daily activities. Circle elements supply a series of functions located on specific positions. When active, the segment rotates and can be occupied.

JSC_0T2



MEASUREMENTS AND POSITIONS

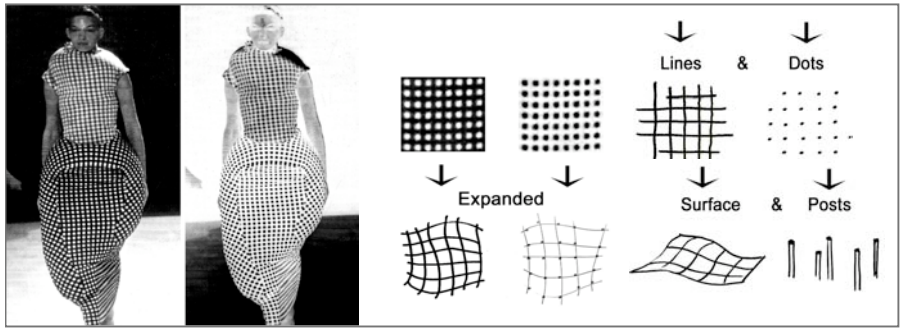
Several measurements for male human body sizes were investigated, from Da Vinci's reports to the Modulor by Le Corbusier. A standard size of 183 cm was set, then moved into seven different positions matching a program. They span from a most comfortable position using minimum energy, to extreme positions. These seven different positions were employed to generate a range of receiving surface shapes. From the study of positions according to program undertaken, the exact scale and module were decided. The surface as a bed requires more space than that as a chair in the plan. By applying the maximum movement of a man, a basic module in the plan is determined, 2.4m x 2m. In this prototype module, one meter long posts both support and move the surface at crossing points every 20 cm. The points of action form the actual slope and flat shape for different shapes and positions of the human body as required. The surface in the graphic shows the central part (1m x 2.4m) of the basic module as actually moving the action point with 20cm gap. Such a surface contains also alternate possibilities of furniture use (sofa, bed, cushion and chair).
Yet the surface movements on the ground are reflected in the ceiling structure as well. In such a modelled space, several different shapes in the ceiling can be experienced as the surface responds to occupation in another space. In section, 2.8m x 2.0m modules are suggested. Each surface bridge a maximum height of 1 meter, ie if a ground surface moves 1 meter up and a ceiling surfaces moves 1 meter down, a 0.8m gap is generated, which creates a half wall and produces different spatial sequences with a unique atmosphere. Between these surfaces, functional units are integrated. While some parts of the surface are continuously responsive in height adjustment, others are fixed and function as storage cavities or furniture insertions.
The surface can also adjust to the number of occupants and thus produce a social landscape such as an enlarged seating area or shared work facilities.

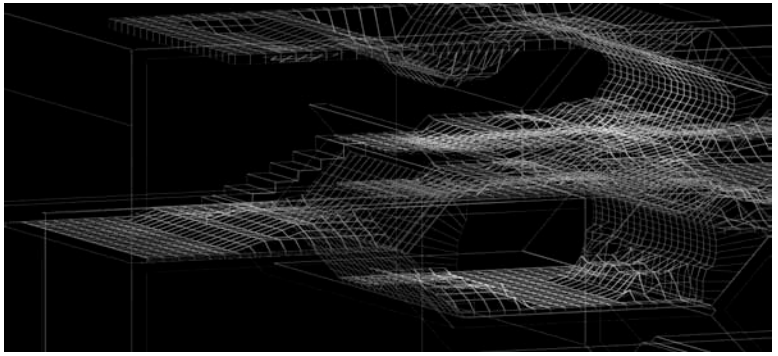
PROGRAM SECTION STUDIES

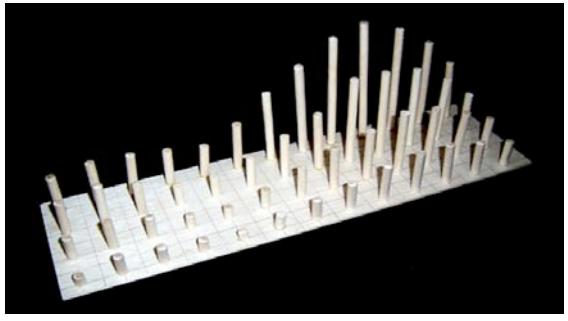
According to the pattern of the daily life of A and D, their capacities and occupations, positions of the surface are predictable. The section of the space for A and D will be changed with different positions according to the time of day. A and D have different schedules for their work and hobbies with different life styles. Basically, the surface correlates between A and D, allocating to each a private and shared zone. Though both live in individual areas, they can monitor and communicate with each other through the movement of the surface (an advantage in terms of specifically for health issues and safety reasons). The basic shape of the surface can provide seven positions. Diagrams were developed to show various surface formations for different activities over a period of 24 hours, including an extended number of players, ie receiving guests at some time of day. If not in use, the responding system of the surface is switched off with remote controller, so the surface remains static.
The honey-comb structure provides an organisational core for unit and building layout. In another version, a small unit of it may be plugged into an existing building typology and thus offer many possibilities to adapt the space depending on user and architecture.

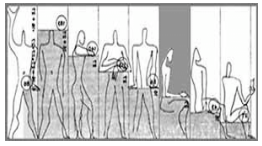
SURFACE AND SPACE

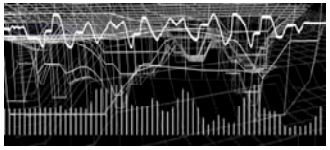
The building proposal displays an arrangement of several units equipped with these functional moving surfaces. The building is positioned on site, expanding into two directions. It consists of 6 units, each with 3.5 levels and used by a partnership of people, such as D-Disabled and A-Abled living together. The honey-comb structure consists of bigger spaces for social and work purposes and smaller spaces for individual use. The upper level areas are used by "A" and "D" as office space, as the clients are Pro-Gamers. Individual private sections are separated from the open zones of the shared spaces "AD" (kitchen, living room, game room). Areas dedicated to 'D' have a relative higher amount of adaptive surface, and thus more inscribed programs. The spaces for "A", "D" and "AD" overlap and intersect, so the users can relate to each other through movements perceived on the surface. Infrastructural and service zones are provided by a conventional floor and wall systems. The end part of the surface in the building section and the surface with furniture are fixed without posts but the surfaces left over are massaging the movement. The system thus proposes a varying degree of program inlays, sloped structures with moving surfaces and regular orthogonal walls in a static structure.
In this way, the project supports interior mobility and enhances the comfort of people through architecture.

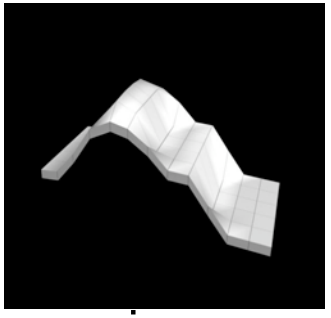


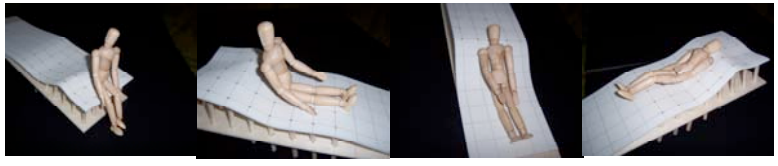


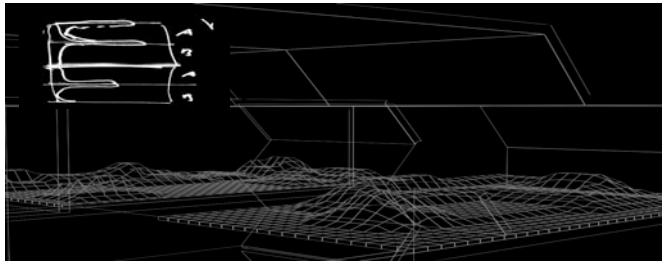


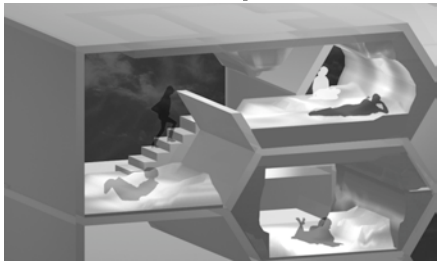




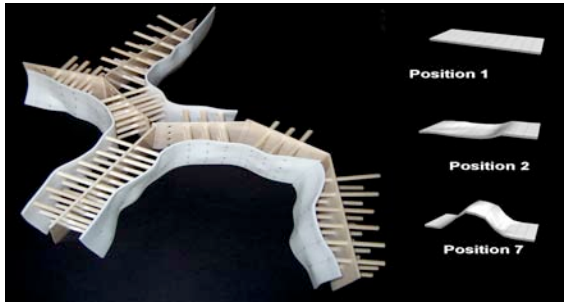


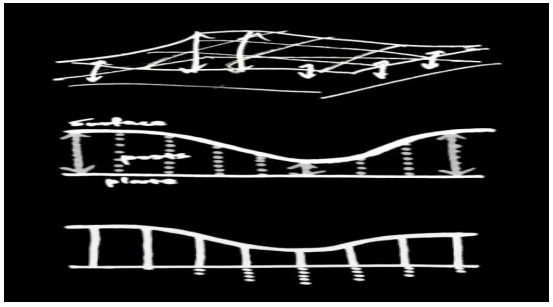


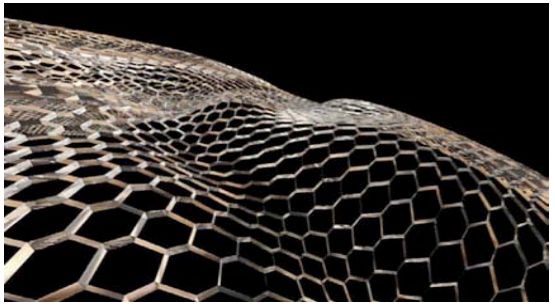


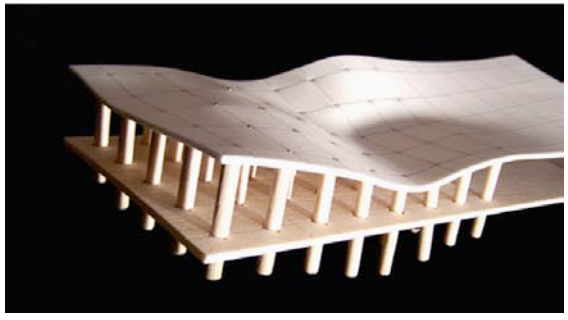


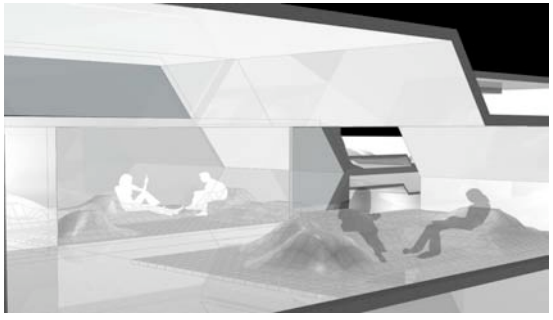
REF 1: KAWAKUBO, LUMPS: SURFACE AND CONTROL POINTS
PHYSICAL MODEL: HEIGHT SPECIFICATION
REF2: LE CORBUSIER ADAPTED FOR DISABLED
REF 3: AWG2001, PANTON CHAIR 1973
SURFACE STUDIES AND SPATIAL SITUATIONS

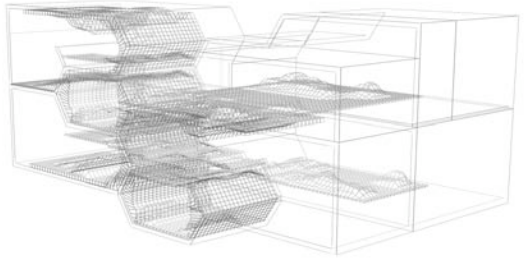


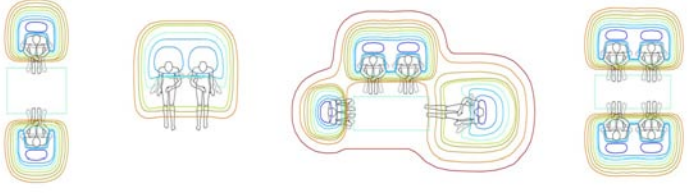






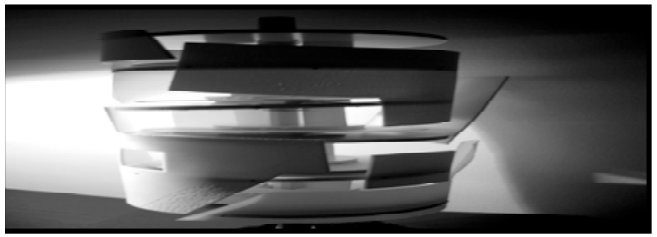






DESIGN MODEL: NODAL PINT OF WALL SYSTEM WITH ADAPTABLE SURAFACES
RENDER: SURFACE CONDITIONS, INTERIOR LANDSCAPE
DIGITAL MOD1: MESH FIELD: AREAS OF COMPRESSION
FUNCTIONAL ZONES: ISLANDS OF HABIT AND USE

BN_0T1



REF1: AIRPLANE DRESS/REMOTE CONTROL DRESS (HUSSEIN CHALAYAN)

The dress employs automobile and airplane design and fabrication techniques. A degree of flexibility is provided by the presence of flaps that move and open the surface partially. The movement of the flaps is instructed by remote control, operated by a mechanism below the smooth dress surface. The surface areas of the airplane dress can be differentiated into larger, stable, indeterminate areas, and smaller movable elements. Movement occurs along defining lines which form the stitches/joints/seams of the fabric/fiber. The lines define the fold patterns, which in turn define the dress. The dress mediates a uniform appearance in terms of the material used (one visible material), the white colour (monochromatic) and the line of axis (expect when folds open. It has an iconic form that is dissolved into several bits and pieces.

REF2: SYSTEM OF GEARS

Gears are a substantial element in mechanical systems, ie in clockworks. They are toothed wheels or cogs that transmit motion and movement between two or more shafts. Applied as a strategy to orchestrate mechanical forces, gears are used to transfer and modify movement, specifically in adjusting the direction of rotation.

DESIGN PARAMETERS

Thus, the following principles, derived from an analysis of the references, were used to define the design model:
The external skin (surface, façade) could be a movable, mobile and dynamic element in order to adapt to interior requirements, such as user profile or program changes, or to changes in external conditions such as temperature, sound, light conditions, and aspects of surveillance and privacy. Interior spaces should be modifiable through movable partition systems. The change dynamics should cause a delay, ie a change initiated by one client would affect other spaces or occupants as well. The principles governing the mechanism of gears and clockwork should be incorporated in the design, both as a mechanical, remote control and electronic systems technique, and as an aesthetic strategy. The architectural object should feature an iconic form and a uniform look, made up of several smaller components and bits/spaces.

BN_0T2

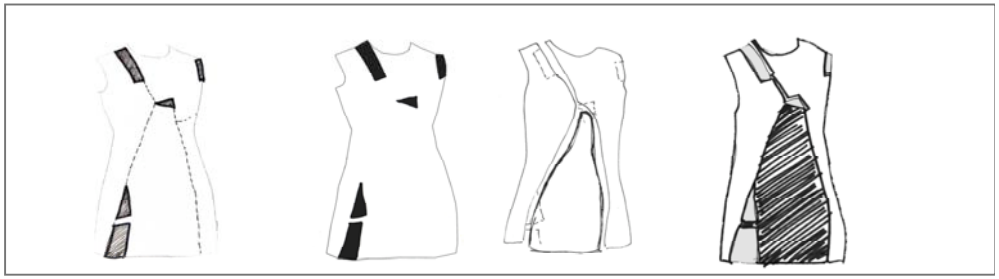
ARCHITECTURAL COMPONENTS

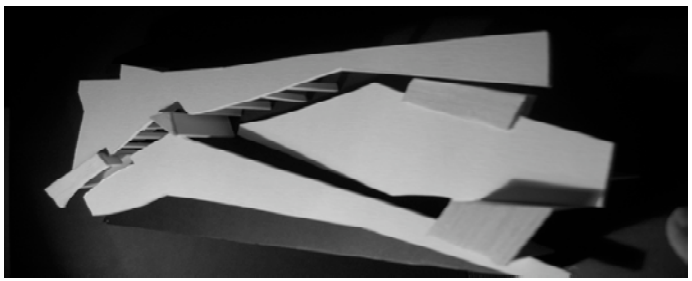
_SKINS: The design is a concentric tower with relocatable external skin and internal partitions. Both exterior and interior system can be operated according to the requirements of the user. Mechanisms of gears and tracks provide movement lines and techniques, which are controlled via remote sensor system and manually by operating buttons. The external skin defines the overall shape, yet it responds separately to each individual level, and is thus operated by one user of that particular level only. In this way, the building displays a continuous change of external appearance, looking different each day or hour. The surface layers rest and rotate on several adjoining tracks, concentric in nature, each one of a different material. Surfaces can be opened or shut by a large degree in the horizontal plane, thus dramatically affecting the interior spaces of the building. Hence if a surface rotates along the inner most track at a time, it has the possibility to change tracks and move on to another one. The operation of the surfaces changing tracks could be compared to traditional track system of a railway line.

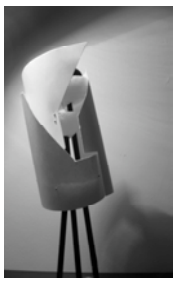
_CENTRAL CORE: is located at the center of each floor space, and remains in the same position on each level. It contains secondary functional units such as stairwell, bath, toilets, kitchen, lobby and passageways.

_PROGRAM AREAS: are devided by sections of the circle, privatized usable spaces of separate users. The spaces are divided by lightweight non-permanently positioned partitions, which are adjusted according to a 24/7 scheme of occupation of one or more users, and combine a multiple activity range of sleeping, working, eating, entertaining, etc. The spaces on each level are interconnected horizontally and vertically and affected by the adjustment of other skins or internal organisations.
When one of the users on a particular level wants to use the shared kitchen, he will negotiate with the adjoining user/s and induce a rotation of this core section. The design proposal introduces constant changes and flexibility in the built space as part of a communication and interaction between the building participants. In the same manner, the appearance of the façade displays a joint identity, different at various times. The proposal is aimed to provide a collateral, customized, adjustable and user-user interactive space.

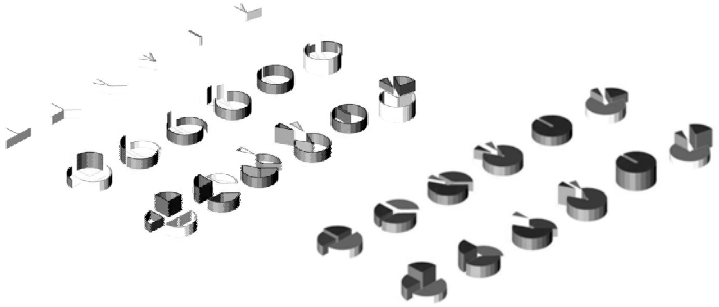
_URBAN CONTEXT: a series or clusters of such buildings could be arranged organically in close proximity to each other. The operation of specific external surfaces of one building might be controlled by users of another building, affecting light and shadow qualities in adjacent environments, in the left over spaces and courtyards and the buildings.

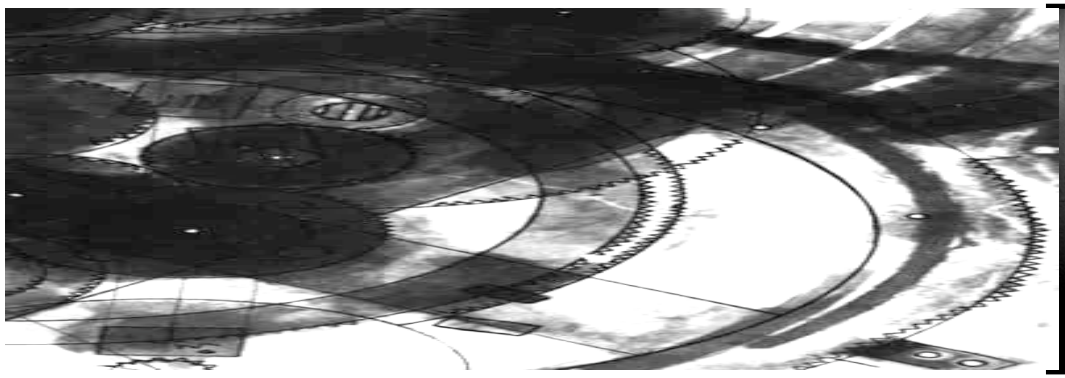


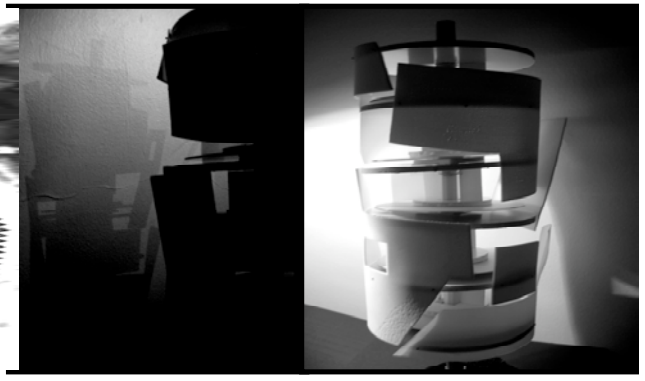


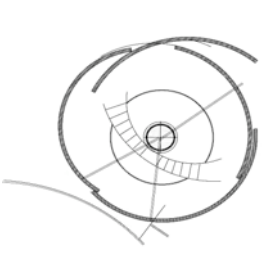


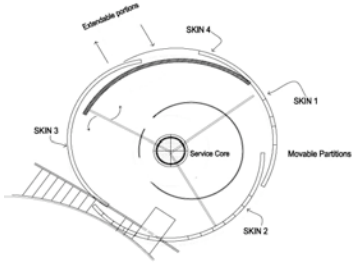
REF1: REMOTE CONTROL DRESS, HUSSEYIN CHALAYAN
SKETCHES: ANALYSIS FLAPS AND FIELDS
MODEL1: DEPTH OF SEPARATION LINES
MOD2: VOLUME AND ORGANIZED PARTITIONS

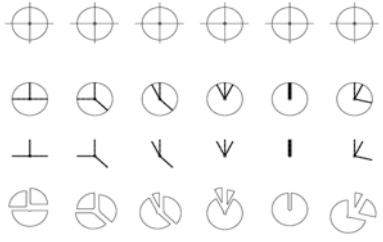






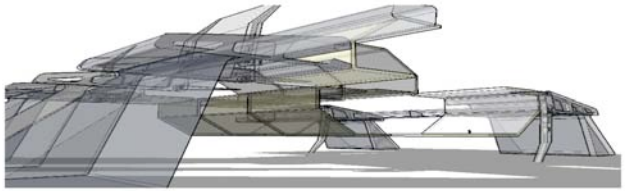


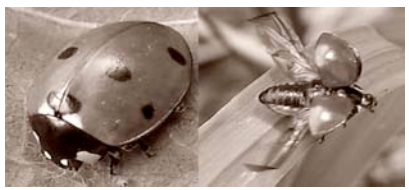


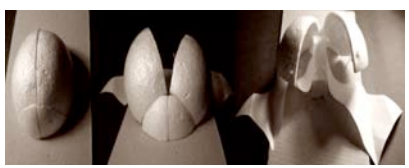


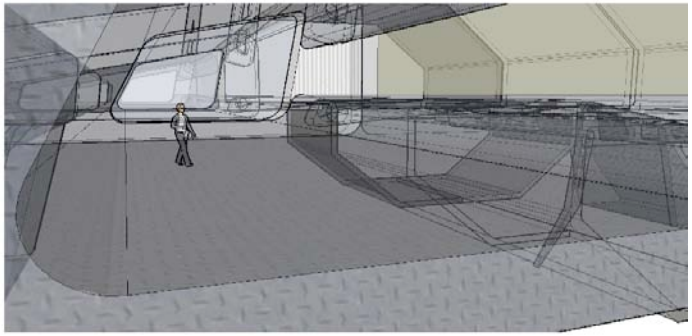
DIG MOD1: MODULE GENEALOGY (LINE TO VOLUME)
REF2: MECHNAISM, GEARS
STUDIES OF ENCLOSURE (LIGHT PENETRATION)
PLAN: ACCESS ROTATION AROUND CORE ELEMENT
CLOCKWORK POSITIONS: ORGANIZING PROGRAMMATIC ZONES

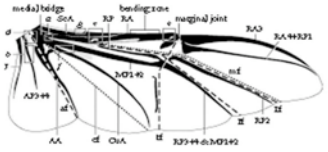
PN_0T1

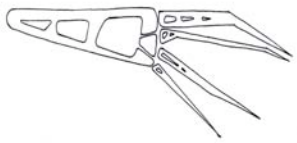


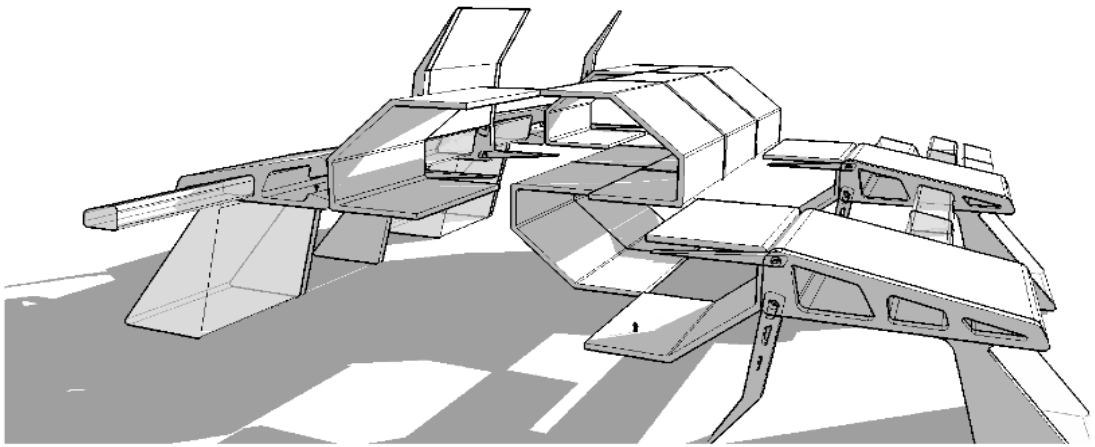


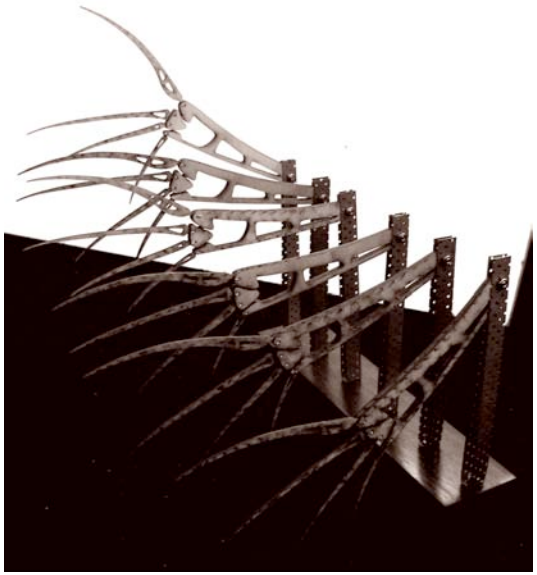






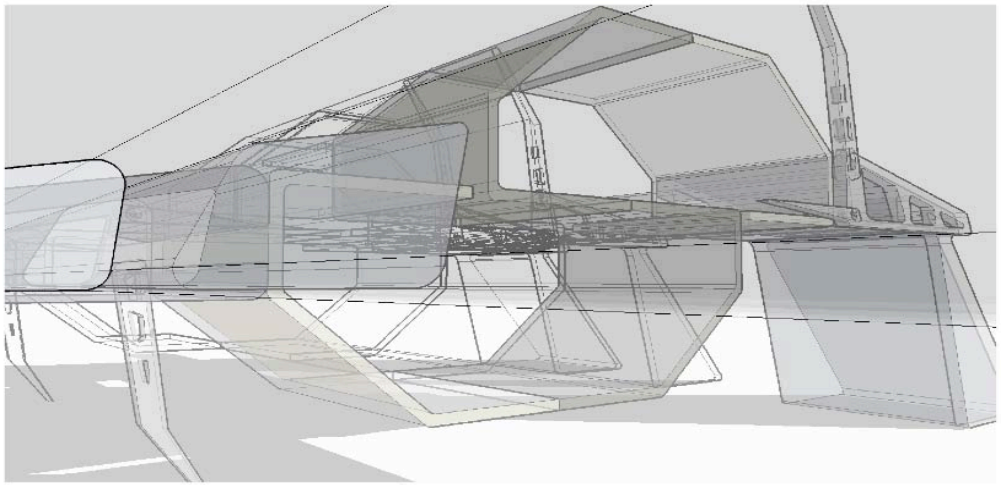


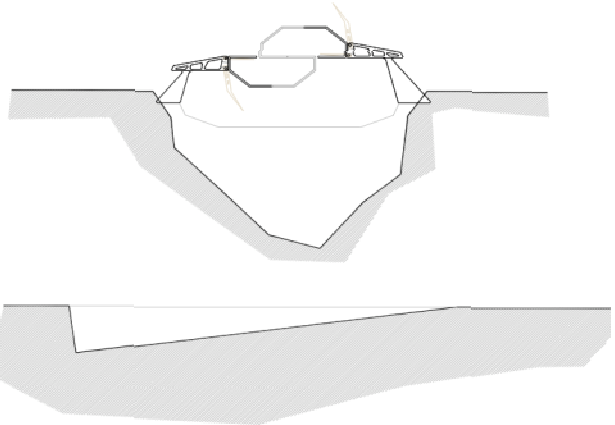


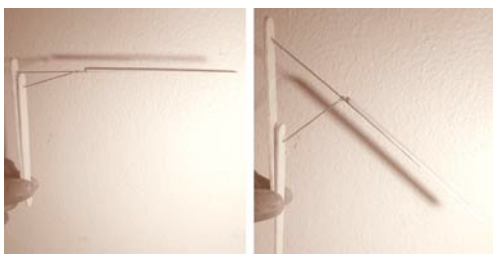


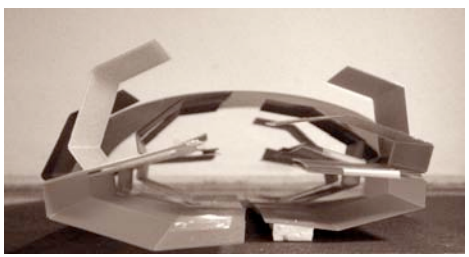
REF1: LADYBUG WING STRUCTURE
DESIGN MOD1:MODULE REPETITION AND POSITIONING
DESIGN MOD2: ABSTRACTED STRUCTURE FOR MOVING MECHANISM

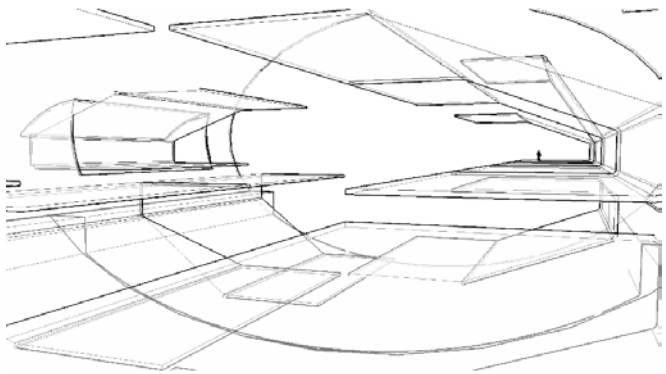
ARCH PROPOSAL: MODULE PLACEMENT ON FIELD
RENDER INTERIOR SPACES: WORKING HALL
RENDER INTERIOR SPACES: CONFERENCE AND LABORATORY ROOMS
ROOMS



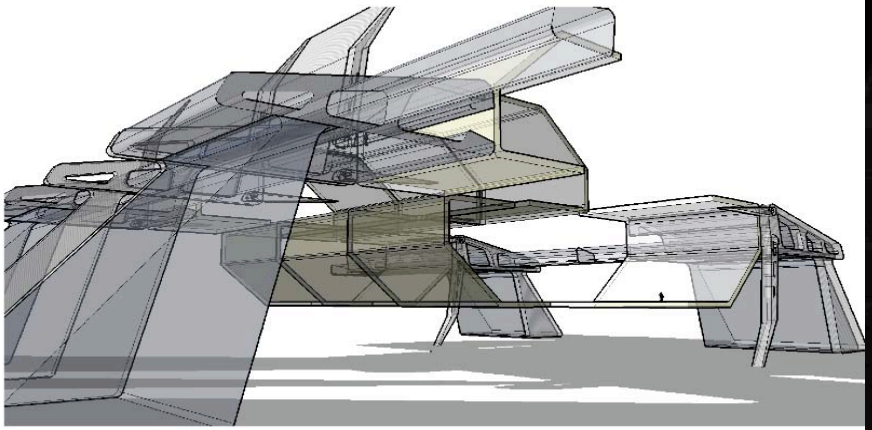


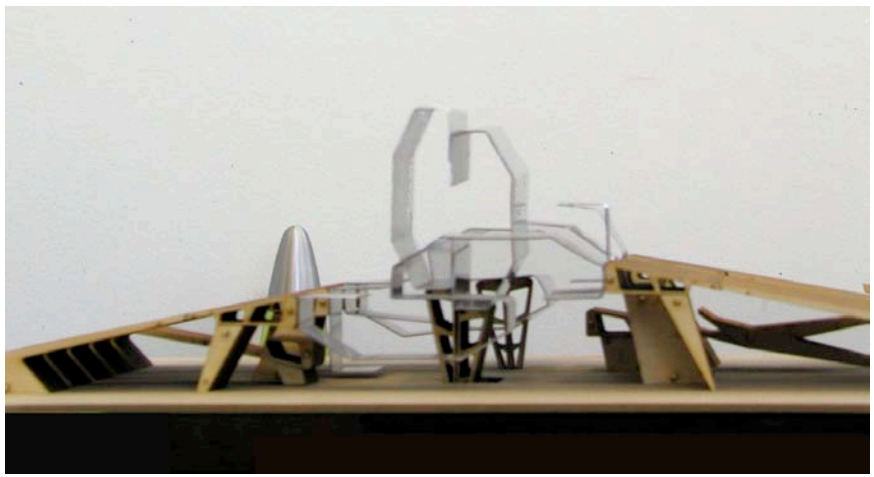


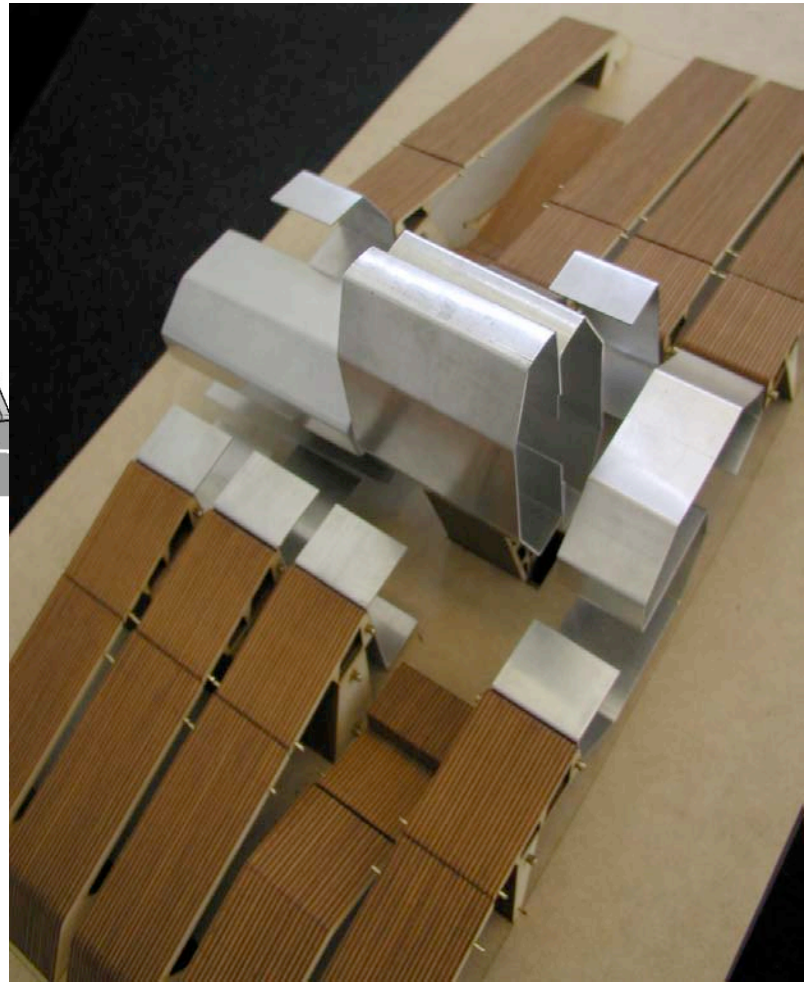




RENDER INTERIOR SPACES: CONTINUOUS OPRATIVE SHIFT BETWEEN
WORK ZONES
POSITIONING 2: FIELD AS BRIDGE CONSTRUCTION
MODEL 1: MECHNISM
MODEL 2: DIRECTIONAL POSITIONING OF MODULES WITH DIFFERENTIATED
MOVEMENT BEHAVIOUR
PERSPECTIVE: MASSING OF SPACES

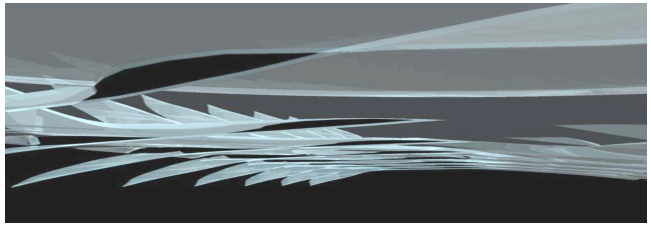


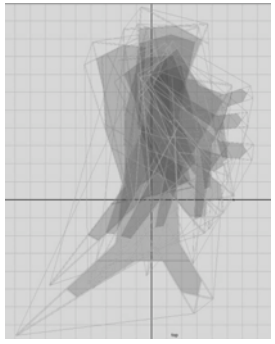


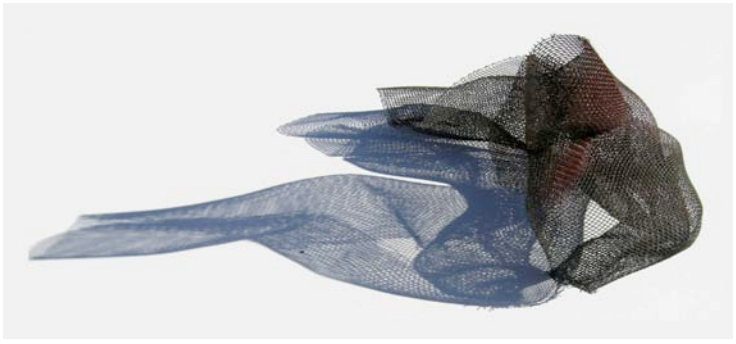


PERSPECTIVE RENDERING: SPATIAL SEQUENCE
MODEL 2: WORK LANDSCAPE
MODEL 2: PROGARMMATIC TOWER AND FIELD

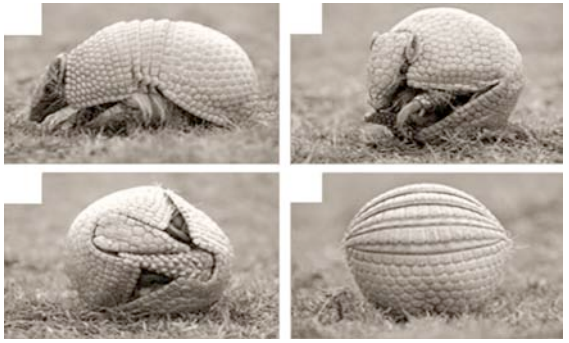
PV_01

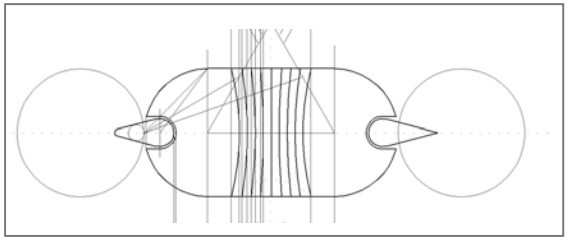


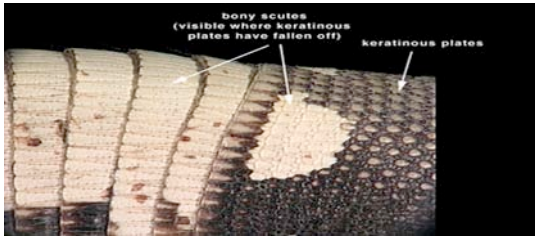


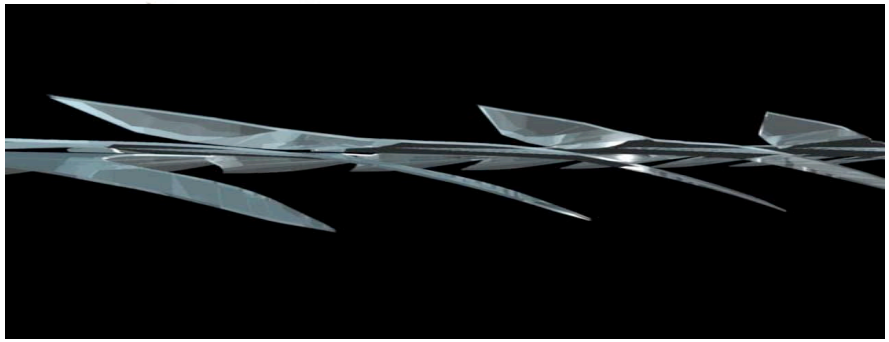


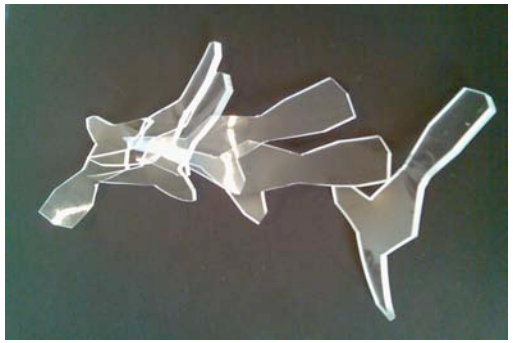
REF1: PLEATS PLEASE, ISSEY MIYAKE
MOD1: ARRANGEMENT OF MESH (OVERLAY OF TEXTURE, SHADOW EFFECTS)
REF2: ARMADILLO ARMOR PLATES, SLIDING AND ROTATING
DRAW1: SIMILIARITY AND DIRECTIONALITY OF HEAD AND TAIL MODULES
SLIDING PLATES ALONG A DEFINED CONTROL LINE
DASYPODIDAE: DEATIL SKIN PLATES
MOD1: KERATINOUS PLATES MECHANISM
MOD2: COMPLEX MECHANISM

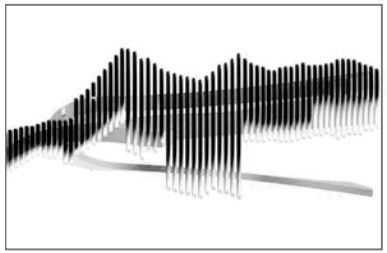


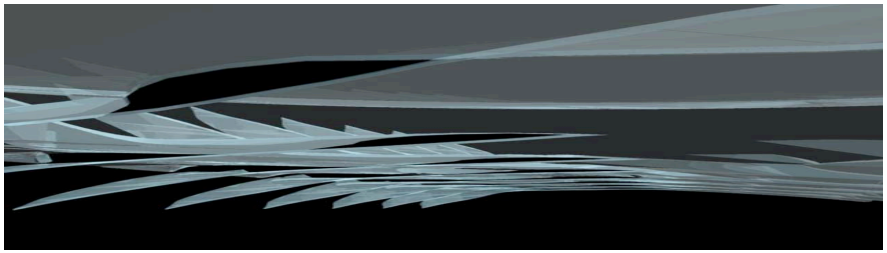




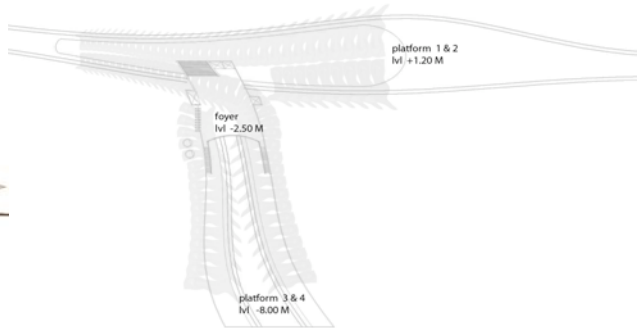


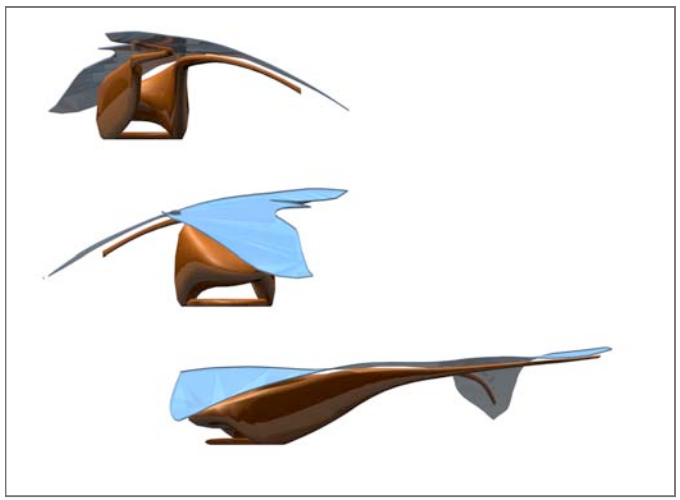


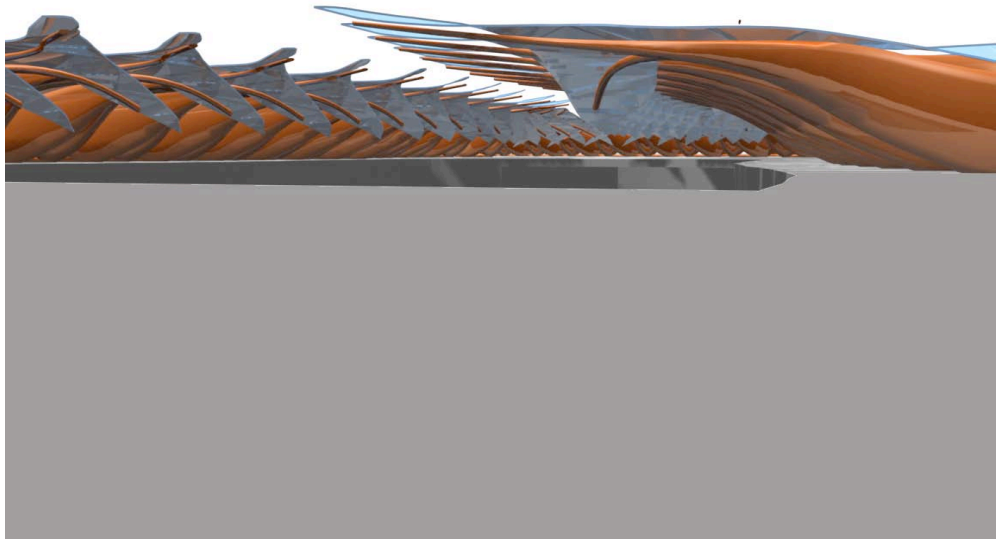




MOD3: ORGANIZED AND RANDOM MODULE PATTERNS (PHOTO, DIGITAL)
COVER WRAPPING BODY (NO CONTROL LINE)
SLIDING AND ROTATION ALONG A SPECIFIC PATH
3DIMENSIONALITY OF MODULES
RENDER PERSPECTIVE SECTIONS: THICKNESS OF PARTS, DIRECTION OF ARRANGEMENT

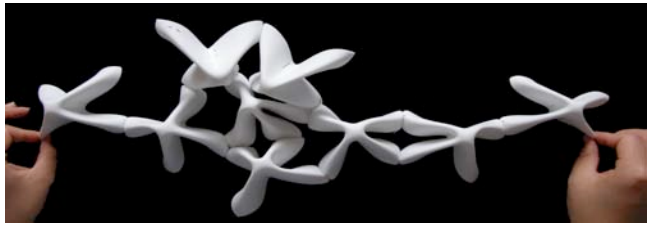


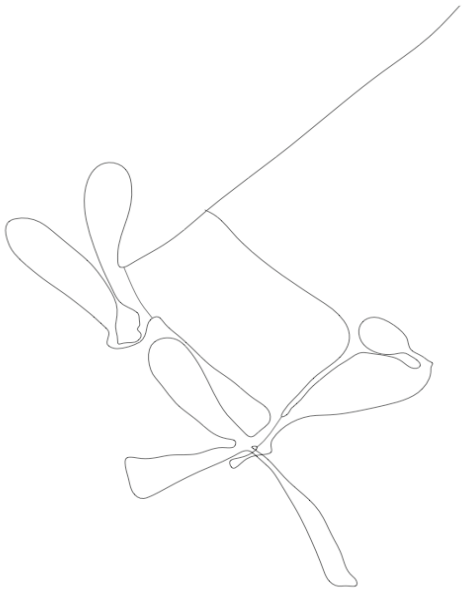


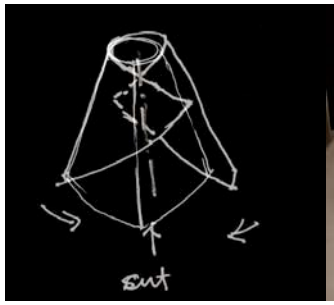


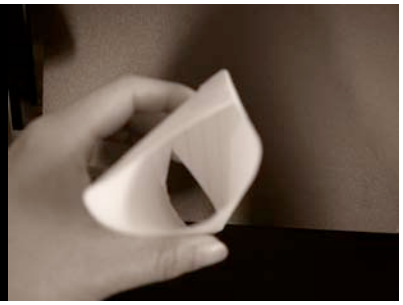
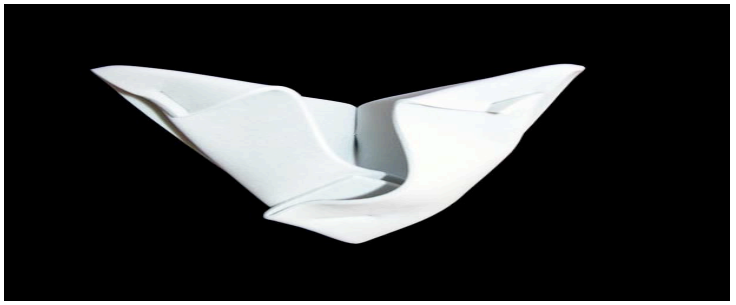
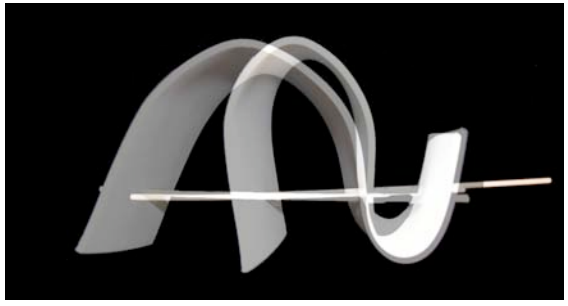
DIGITAL MOD4: MODULE AND VARIATIONS (SCALED, ROTATED)
RENDER PERSPECTIVE: STATION (SUB AND GROUND)
REF3: ACTUAL STSTION, NOW
PLAN: POSITIONIN OF ELEMENTS AND MAIN EXITS

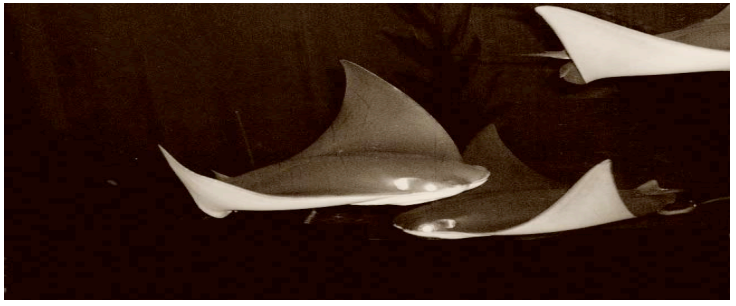
SSE_0T1





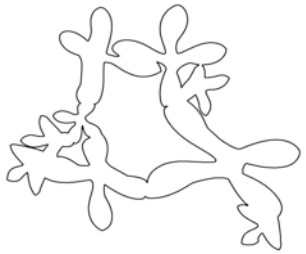



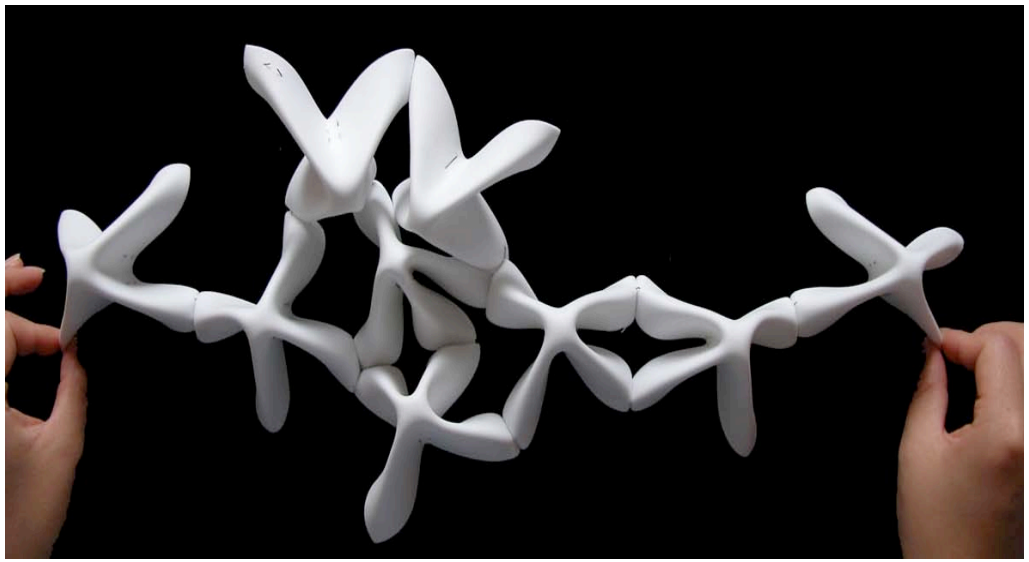




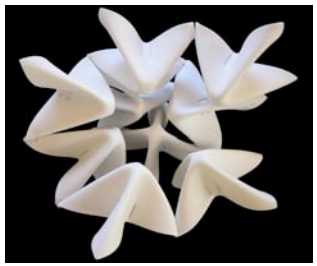


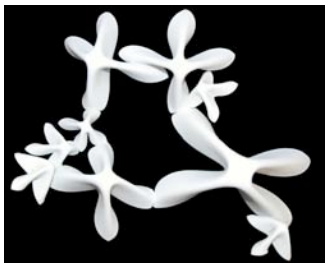


REF1: FASHION
REF2: PELAGIC STINGRAY
REF3: MODEL 1, ORIGAMI FOLDING TECHNIQUES
MODEL 2-3: SLIDING PLANE ALONG ONE AND TWO AXIS
MODEL 4: CUTTING EDGES OF THE PLANE BEFORE ARRANGING
MODEL 5: SURFACE AND APPENDIX
MODEL 6: NODE AND INTERSECTION POINTS, MULTIPLE FIXED TISSUE



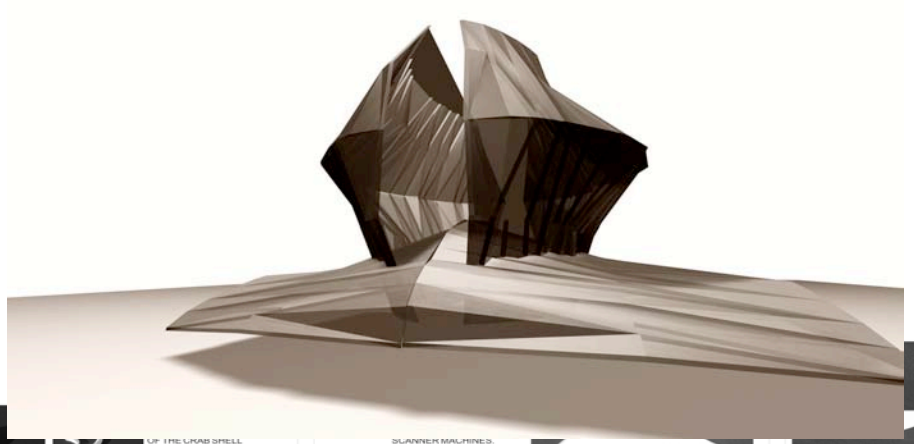


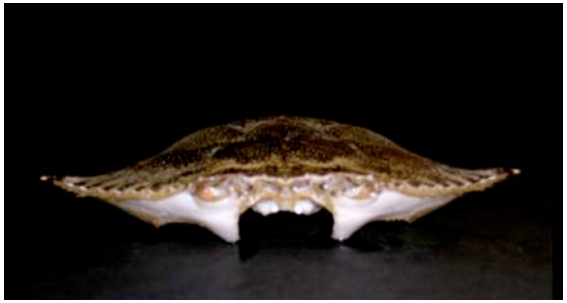


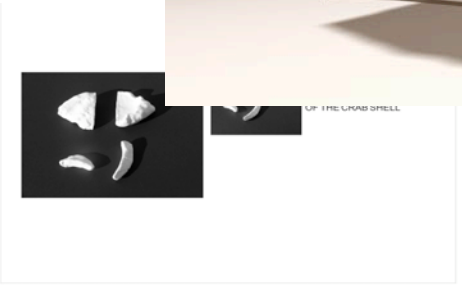


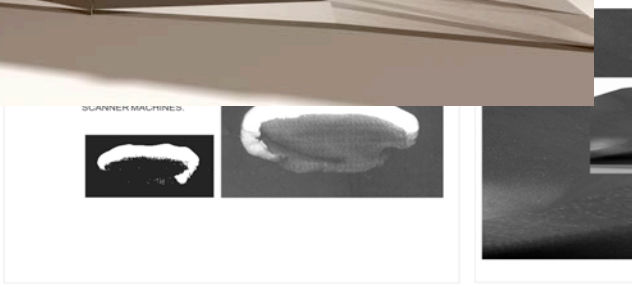
MODEL 7: MODULE WITH ENFORCED STRUCTURAL CAPACITIES
VAR 1: MULTIPLICATION AND POSITIONING OF SAME MODULES AS FIELD
VAR 2: SCALING, MIXING SIZES
VAR 3: CONNECTING MODULES WITH LARGER AMBIGUOUS ZONE

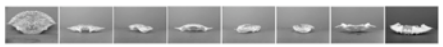
RLC_0T1

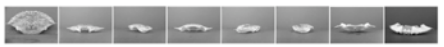




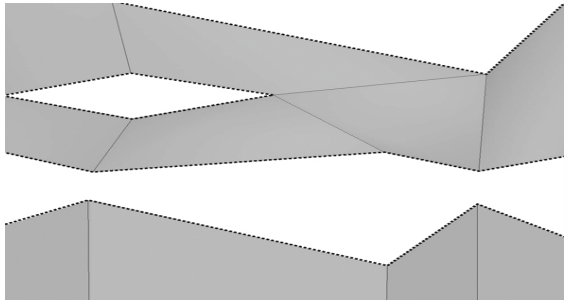


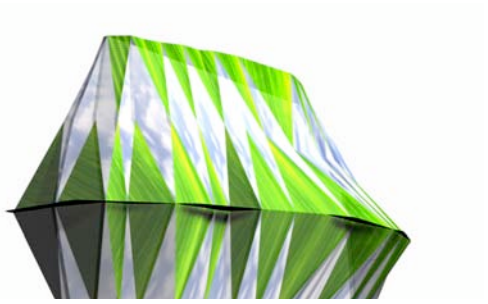


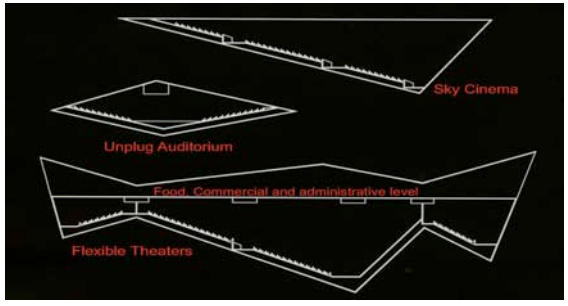


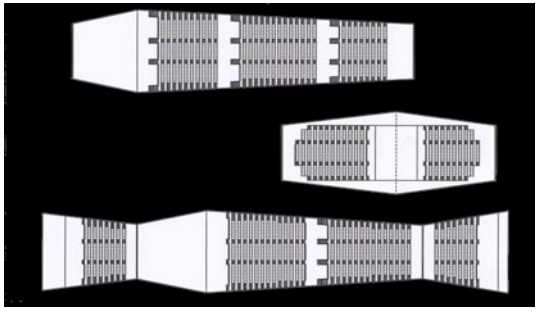


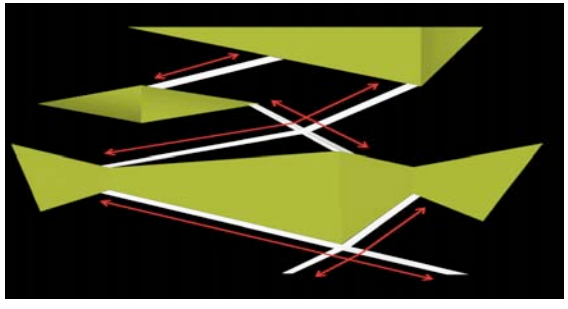
REF1: CRAB SHELL
DESIGN MODEL1: SECTIONS THROUGH SHELL
MODEL 2: ABSTRACTED, FACETED SECTIONS REASSEMBLED











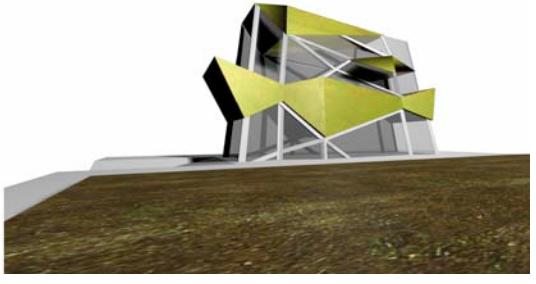


DIAGRAM: SPATIAL DEPENDENCIES
DIGITAL MODEL: TRIANGULATION OF SKIN STRUCTURE WITH SPECIFIC FIELDS
DESIGN MODEL2: SHRINKING INTERMEDIARY PROGRAMS

ARCH PROPOSAL: CINEMA COMPLEX WITH RELOCATABLE PROGRAM POCKETS
DIAGRAM 2: SEATING CAPACITIES AND VIEW DIRECTIONS
DIAGRAM3: STRUCTURAL AXIS AND ACCESS LINES
PERSPECTIVE RENDERING: PENETRATION OF VOLUMES THROUGH EXTERIOR SKIN

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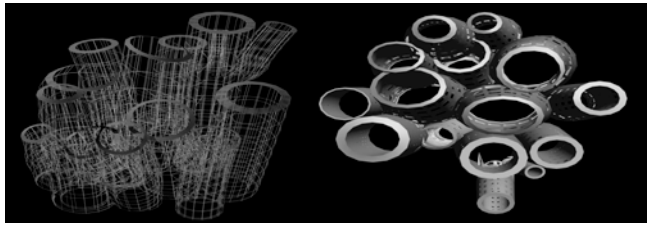


The project uses the sponge and a fashion sample by Alexander Mcqueen as a reference, to profile a design model. Its form and functions are generated after experimentation with form and functions of the references. Each reference was investigated in terms of specific characteristics and possibilities from which principles of structure, texture or material could be derivedand applied to produce a programmed surface with elastic, flexible or transformative capacities.

ANALYSIS AND DESIGN MODEL
REF 1: MCQUEEN

The fashion sample used for the design model is a model by MCQUEEN, a baroque skirt or its frame, and a top. Two different densities appear in the dress. Discrete programmatic parts of the program remain hidden, while public parts are presented as open, negotiable and transparent. While the upper part is compact, enclosed and rigid, the structure of the lower part consists of rings that enclose the body, yet allow the ability to twist and bend. The node points in the frame connect the rings, enable a movement range and provide support for the volume, they are part of a structural mesh. This fashion sample suggests aspects of transparency, elastic behaviour, an ability to compress, bend and twist, that followed closely a movement controlled by body, and is formed by rings and connections, which are flexible and homogeneous. These characteristics thus defined principle strategies to be applied in the conceptualisation and design for an elastic, responsive space.

PHYSICAL MODEL1: WIREFRAME STRUCTURE

The elasticity of a mesh depends upon the type of structure and the material used. Materials and specifically their connection points impart their properties onto a structural system, and render it rigid or transformable. Hence a series of models investigates in which way levels of response capacity change with variations of material and type of structure. By increasing or decreasing the number of nodes between rings, the response level changes, the structural mesh becomes more dynamic and elastic. Though the lower part of the dress has a homogeneous structure, in the physical study models this monotony was broken up to derive a more complex, heterogeneous system. The material specification of tension and compression lines maintains the overall form, yet displays a dramatic transformation when forces are applied in twisting or bending.

REF 2: SPONGE

Similiarly, the organism of sponges also show a heterogeneous structure, in terms of their complex organisation (they grow from a single combined base at the bottom and splits up on the top), their structural skin (which permeates water), they feature a solid footing and a hollow core. Like the dress, these sponges display an ability to respond to water currents with a free flowing movement of the structure, a twist or bend; while one part of the setting thus responds, the other remains unmotivated, because its dense material presence.

TS_0T1

A prominent property of the sponge is its double skin; the external skin is structural and thus supports form and shape. This external structural skin consists of a series of rings, nodes and cavities between which the water is deflected, through to a second functional skin, which filters the water for food supply. The system of a double skin might indicate here an interiorized response towards programmatic outer influences, such as amount of light coming and the visual permeability. Though the external skin has an ephemeral, transparent appearance, it maintains a firmness, stabilisation of the whole figure on the ground plate, and capacity of deformation; to compress, expand, twist and bend, it suggests a structure of a different kind.
These characteristics reinforce and extend the principles set by the dress and become rules for the design model and architectural project.

NODE SYSTEM AND SKINS

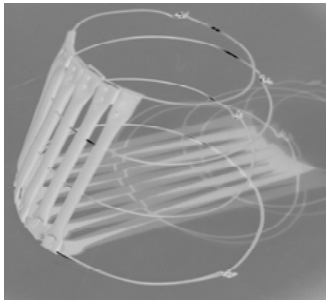
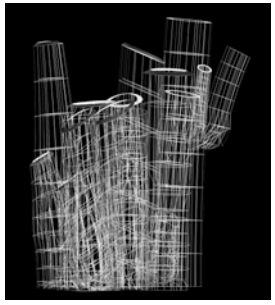
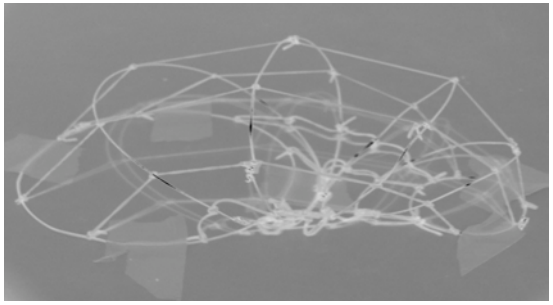
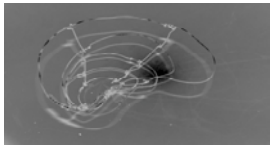
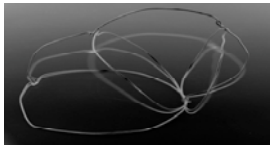
Both structural and spatial systems are developed based on a three-dimensional node. This node is the design model that drives the architectural and programmatic proposal. These nodes are a principle for program organization and structural detail, they are scaled and rotated to form enclosed cavity, structure wall system and interiorised spatial volume, from which the program activities originates. The nodes merge into one another at the top as they grow up. The spatial envelope is thus driven by the exploration of nodes from both sponge and dress, and their static and dynamic skin segments. The identity of nodes changes in materiality and density, according to program requirements; these nodes are formed as concrete elements in solid or static areas, as aluminium and steel elements covered with mesh in flexible operating zones.

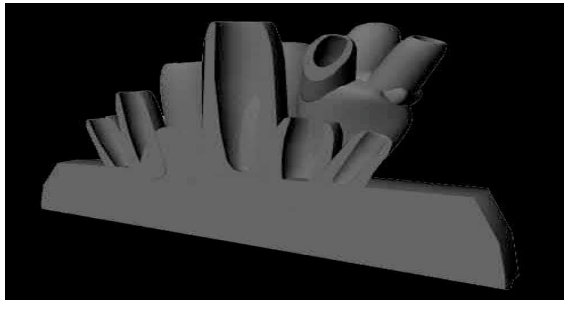
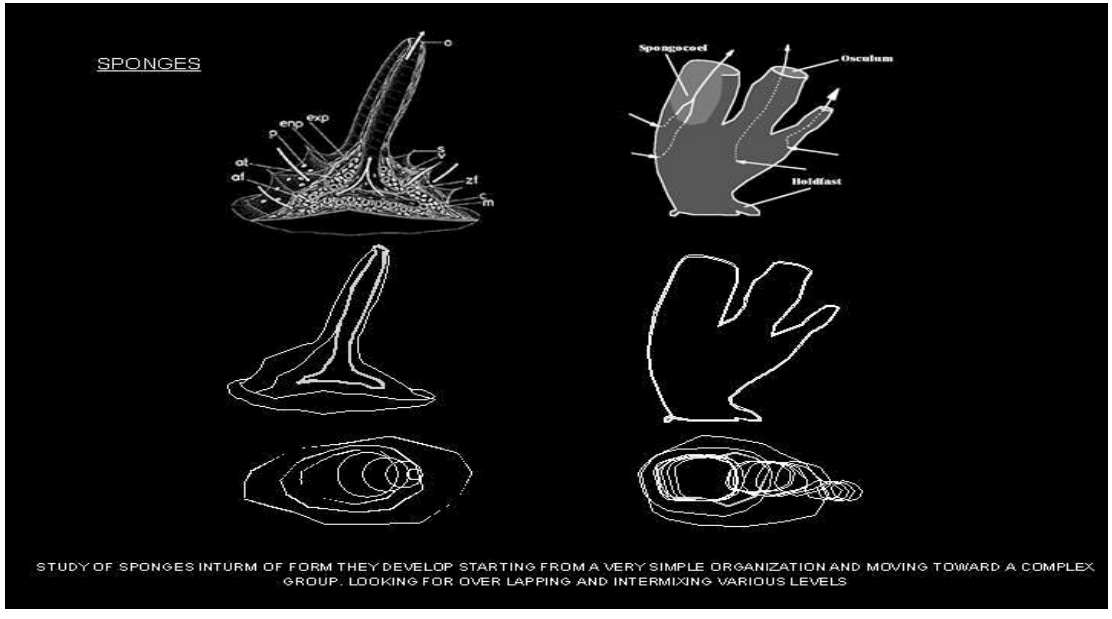
DIGITAL MODEL, ANIMATION, PHYSICAL MODEL 2-5

The form and shape of the nodes were developed though an exploration of various media. The digital animation study allowed an interpolation between forms of deformation, and thus sugested a dynamic behaviour. Seected results of these studies were then reworked in physiacl models, in styrofoam and clay. Again, these were reviewed and redrawn in the computer to identify the optimal solution.

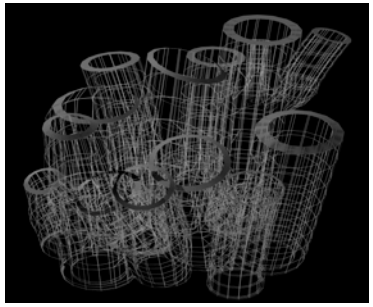
INTERACTIVE AND ELASTIC SPACES

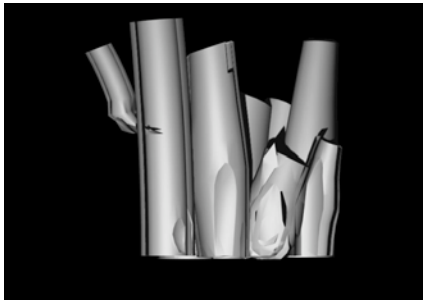
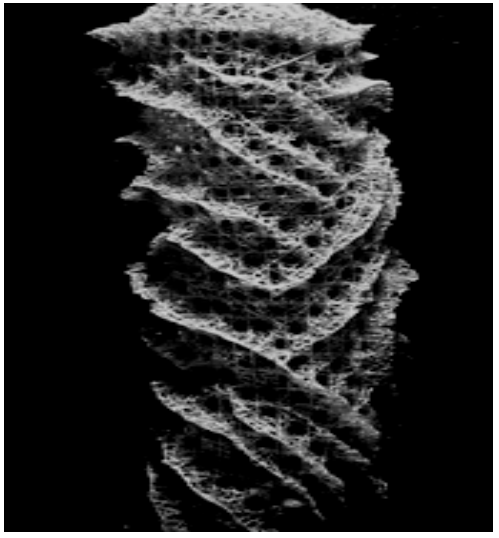
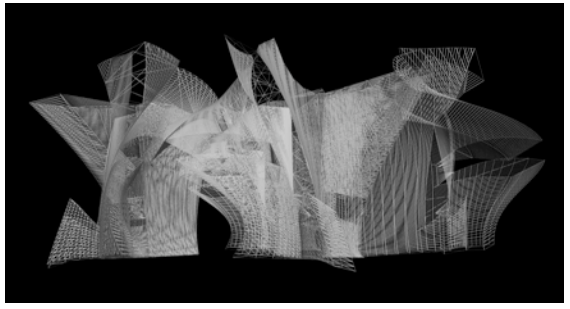
The prosthetic skin system developed through the reference research suggests a museum organization with an open core and surrounding compacted skins, which accommodate multi purpose exhibition spaces. The double skin concept renders space as diverse, interchangeable and enhancing the visual experience in a sequential arrangement. Moving and sliding partitions controlled by computers manipulate a series of required conditions, in nominated areas projection screens display an interactive dynamic system of walls, of an interactive and elastic communication space.

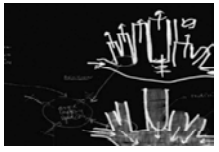







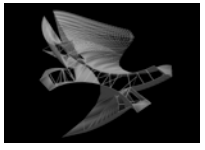
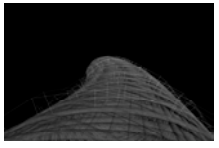
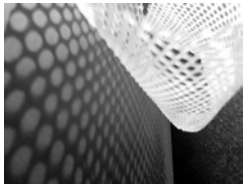
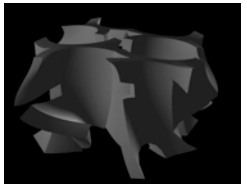



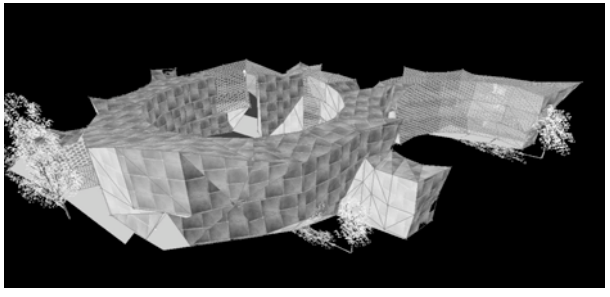
REF 1: MCQUEEN, SKIRT
MODEL 1: WIREFRAME AND PLASTIC STRAWS, TENSION AND STRUCTURAL BEHAVIOUR
MODEL 2: WIREFRAME, DEFOMED STAGES
REF 2: SPONGE POPULATION
DIG MOD1: SIMULATION OF STRUCTURAL TUBES (SPONGE)
ANALYSIS: ELEMENTS, FUNCTION, FORM, RADIUS
DIG MOD2: SECTION THROUGH POPULATION, BRANCH SYSTEMS



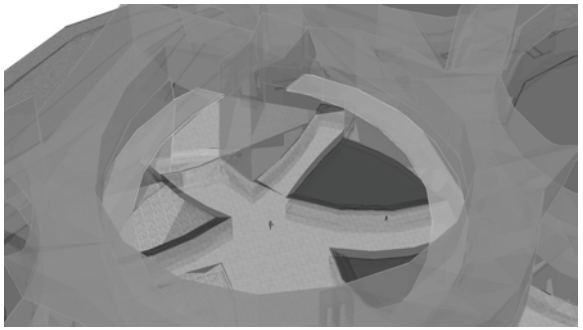


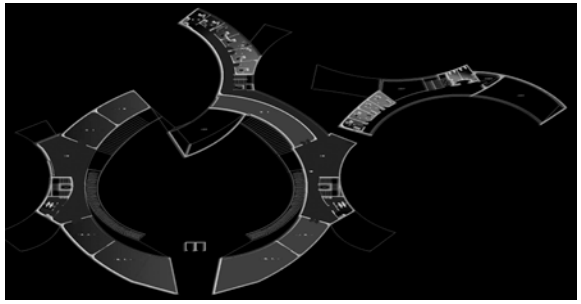
DIG MOD1: SIMULATION OF STRUCTURAL TUBES, WIREFRAME
DIG MOD1: INTERSECTION OF TUBES, NODAL POINTS
DIG MOD1: STRUCTURE: SECTION, INTERSECTION
SKECTH: FLOW DIAGRAMS THROUGH VOLUME

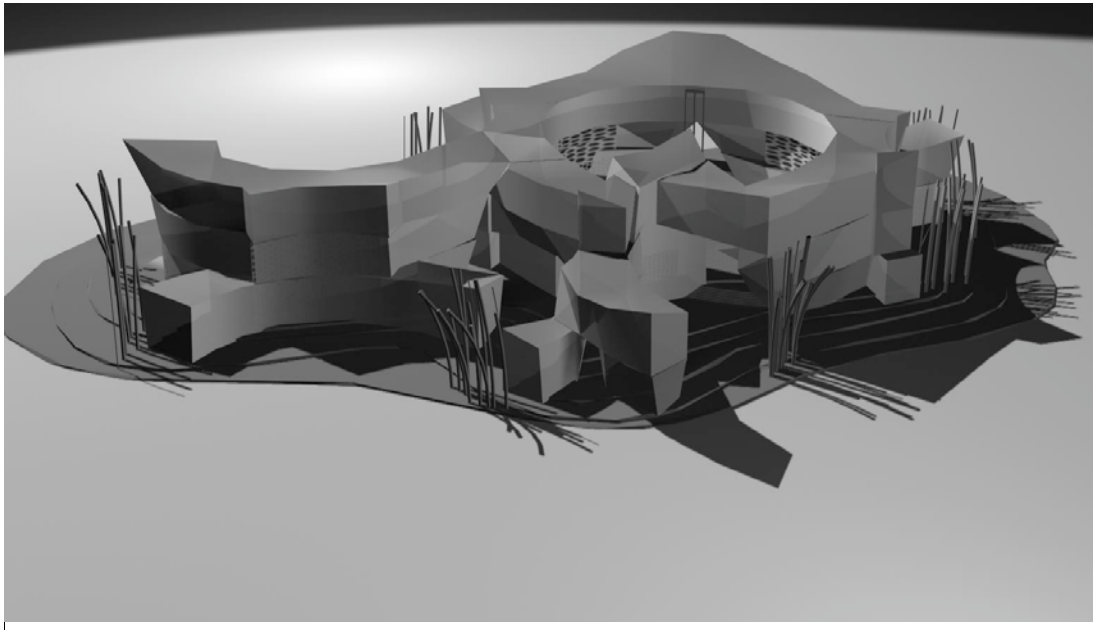
REF3: SPONGE SCELETON, CHAMBERS
MODEL SERIES 2-4: NODAL POINTS, STYROFOAM, CLAY
DIG MOD 2: NODAL POINTS, ANIMATION, STILL (RENDERING AND WIRE FRAME)
SKETCH: NODES POSITIONED AS PROGRAMMATIC INTERSECTIONS

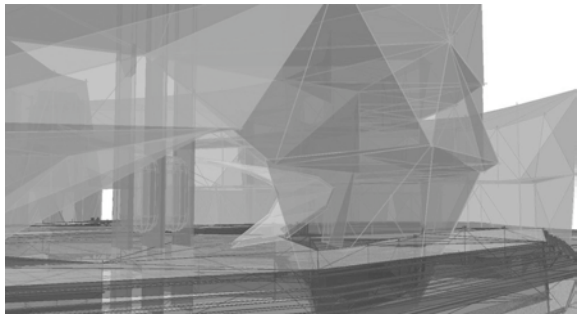
RENDERING: EXTERIOR SKIN
MODEL 5: STRUCTURAL SKIN, LIGHT CONDITIONS

NODE FRAGMENTS AND FORMATIONS (SCULPTURAL ASPECTS)









MODEL 6: LASERCUT PLANES BSIMULATE FORM
RENDERING: INTERIOR COURYARD (FLOW)
RENDERING: STRUCTURE AND VOIDS
PLAN: PROGRAMMATIC CORE, VOIDS
PERSPECTIVE RENDERING: PERMEABILITY OF SPATIAL SEQUENCE

FIN
THANK YOU