



[arc/sec]

REACTIVE ARCHITECTURE

SIX INTERACTIVE INSTALLATIONS

WideShut CitySail ShippingLandscape arch[id] ZeroPlus Carrera

[arc/sec]
REACTIVE ARCHITECTURE



C O N T E N T S

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INTRODUCTION

[arc/sec] : Architecture per Second

[arc/sec] is a scale unit setting architecture in relationship to time. Started in 1998, in Berlin [arc/sec] has become an international project platform for architects, artists, designers and engineers working in the field of Reactive Architecture. Reactive Architecture focuses on environmentally responsive design strategies as an interaction between landscape, people, architecture and digital information. `Reacting` in this case means a responsive behaviour to changing conditions such as weather, climate, program, frequency of use or topography. Reactive Architecture is focussed on efficiency relating to usage of space, material, construction, energy, time and pleasure. The [arc/sec] projects take strategies and processes in nature as an impulse for architectural development. Based on today's technologies, a biomimetic view on form and construction and the functional creativity of nature is used as a role model to develop new relationships to architecture.

While taking advantage of traditional low tech solutions, the overlay of physical conditions and data based technology allows the exploration of new dimensions of responsive behaviour.

In an architectural context information technology has redefined five fields:

Form: Drawing, graphic and morphing programs have introduced a new formal language. Digital programs allow the design and control of complex biomorphic shapes.

Fabrication: More interesting than just the graphical appearance is the ability to describe and eventually fabricate complex elements, through large scale digital fabrication methods.

Calculations: Today we are able to deal with dynamic calculations. In opposition to a classical architectural approach this allows the development of flexible constructions, which are able to adapt to different conditions. Flexibility in opposition to rigid constructions is the key principle of the success of evolutionary design in nature.

Sensitivity: Taking nature as a model, it is the principle of instant control and regulation that leads to highly energy efficient solutions. Using sensors and learning programs, data technology enables us to go in a similar direction.

Communication: Humankind is fascinated by contact with man made objects. From early childhood dolls inspire our communicative imagination. Interactive virtual pets and robots are closing the link to the living environment. Here our expectations are growing with the rapidly changing status of technology.

These conditions find their direct expression in current architecture. "Friendly Alien" is the name of Peter Cook's Museum of Modern Art in Graz, Austria. The building appears as a biomorphic blob form that, through its media facade BIX, by Realities United, is eagerly communicating with the surrounding city.

The low energy house R128, from architect and engineer Werner Sobek in Stuttgart, does not have any light switches, door handles or taps. The temperature of the building can be controlled by mobile phone from any spot in the world. The concept explores the question of how many technical devices are useful. Is it necessary to know how much milk there is left in the fridge while on holiday? We should not forget that dynamic reactive or sensitive architecture has been around for thousands of years by simply utilizing living nature.

The edge between real and virtual space is an intersection in today's life. The concept of Reactive Architecture integrates data as a new building material, which is utilized next to other traditional materials such as stone, steel, glass or vegetation. The fusion of digital media and physical reality offers a new approach and an opportunity to explore space, material and information in an architectural context.

The overall intention however always stays the same. The main aim is the efficiency of the building and that the user enjoys living in it.

Uwe Rieger

Auckland, September 2008



R128 Low Energy Building



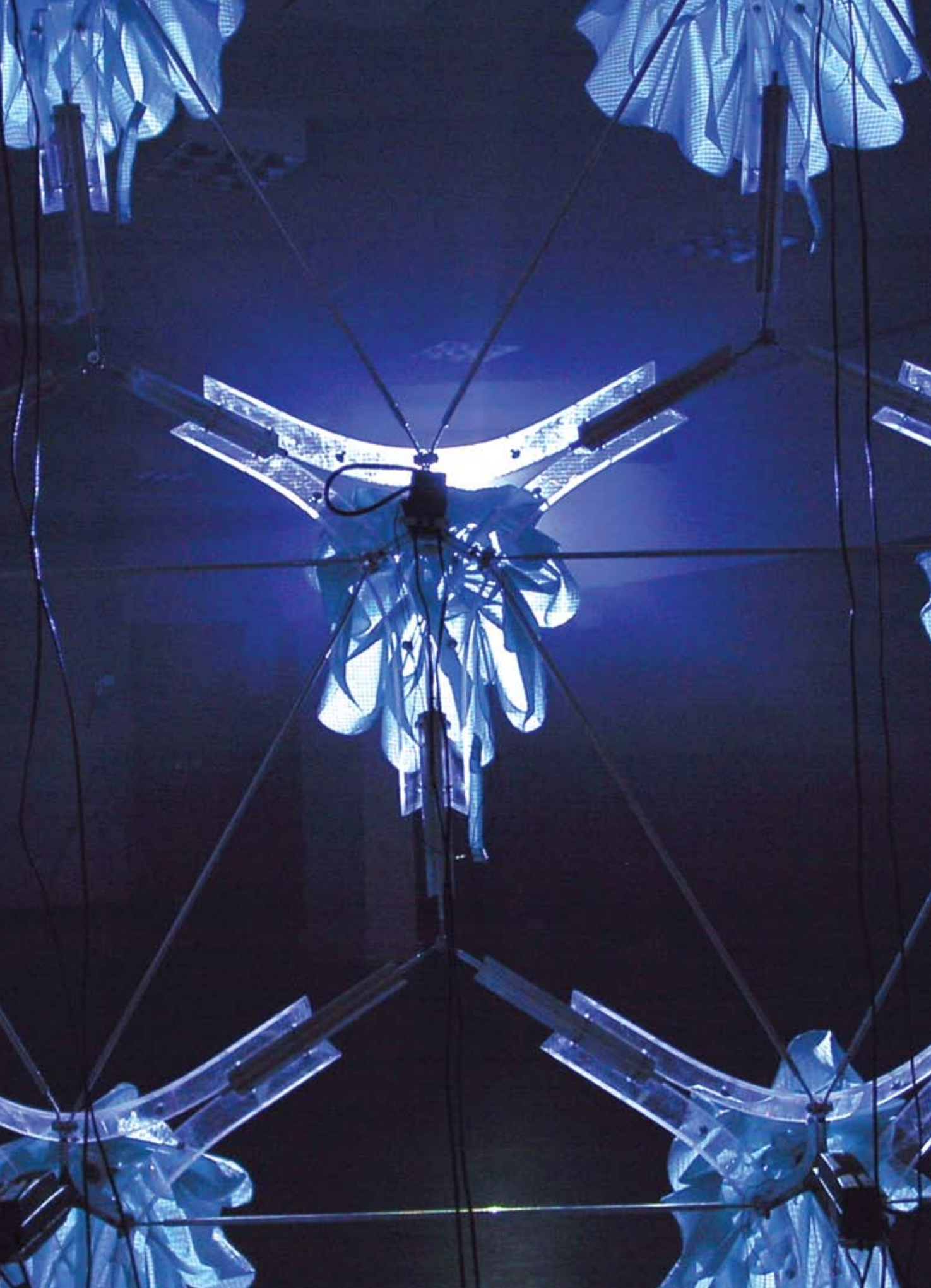
Kunsthaus Graz



Media Facade, BIX



Vegetative Windbreaker

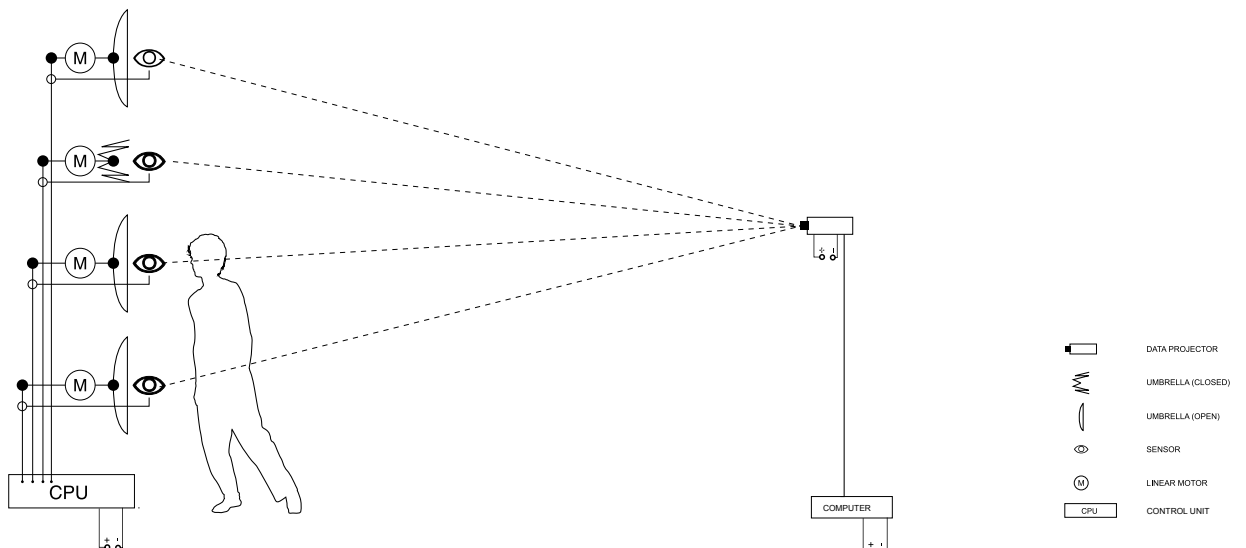
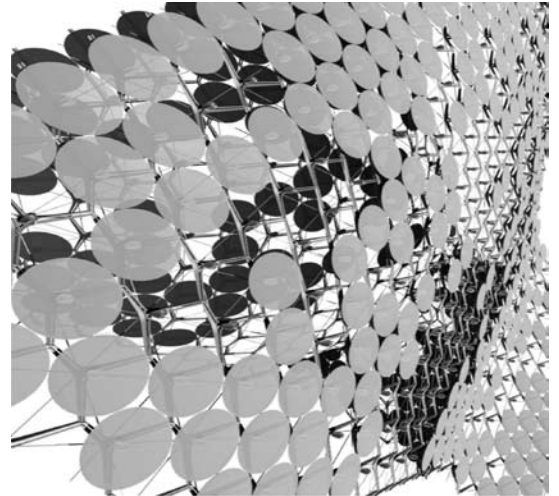


1

WideShut

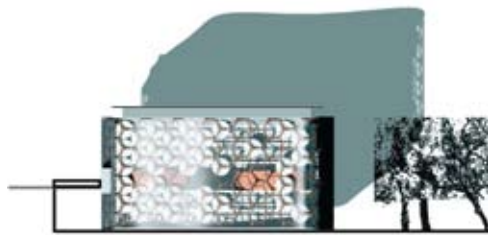
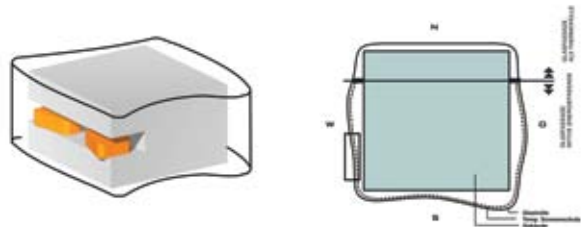
XTH-berlin with Jannes Wurps and Kai Bergmann

The installation WideShut is the prototype for a light sensitive facade system. The installation consists of thirteen motor driven umbrellas supported by a flexible light structure. In this installation the umbrellas are additionally used as a projection surface for a video beam. Thirteen sensors react directly to the changing light and control the opening of the projection surfaces. In this way the light sensitive surface of the umbrellas responds to the choreography of the changing pictures of the video animation. By shading parts of the projection the spectator can influence and control the movement of the umbrellas.

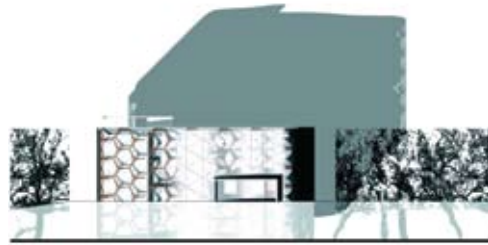


Architecture Saar-Lab

In an architectural competition for a pharmacy laboratory building for the University of Saarbrücken the WideShut project was used as an intelligent façade system. On this basis XTH-berlin developed in cooperation with the engineering office Rentschler + Riedesser, a passive energy concept. Situated in a park like environment the building changes its appearance in response to the thermal requirements of the different seasons and the changing amounts of sunlight during the day.



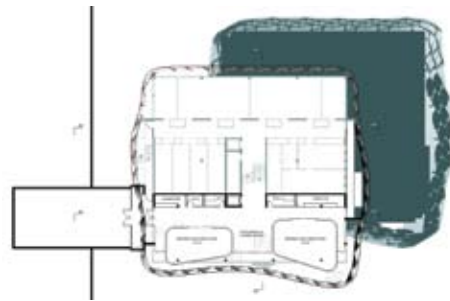
SOUTH ELEVATION



WEST ELEVATION



CROSS SECTION



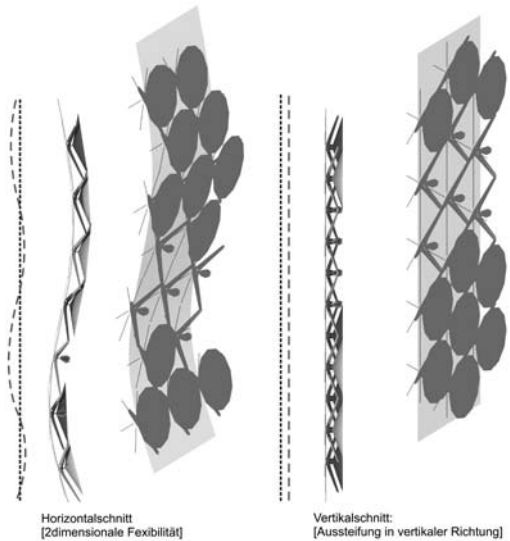
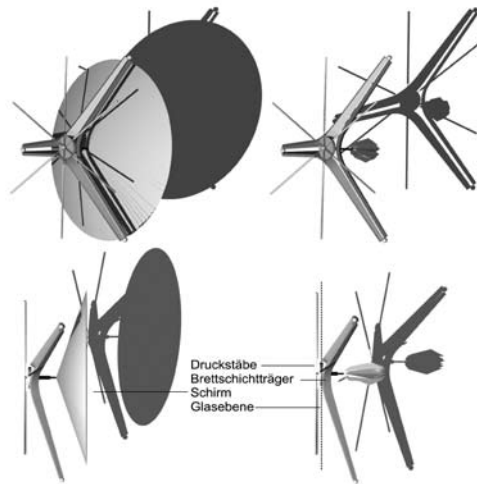
LEVEL 0



LEVEL -1



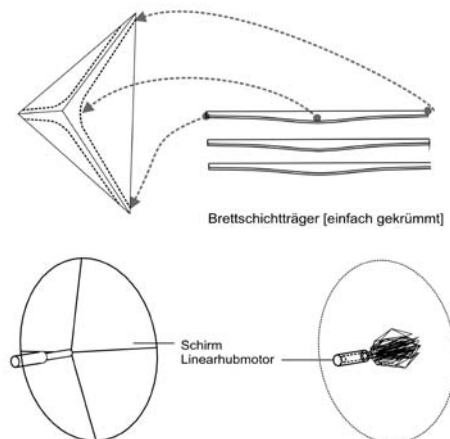
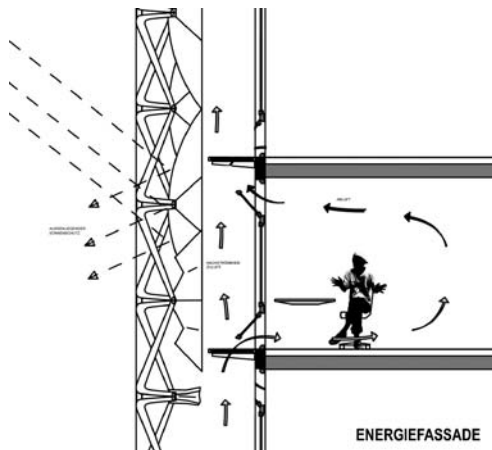
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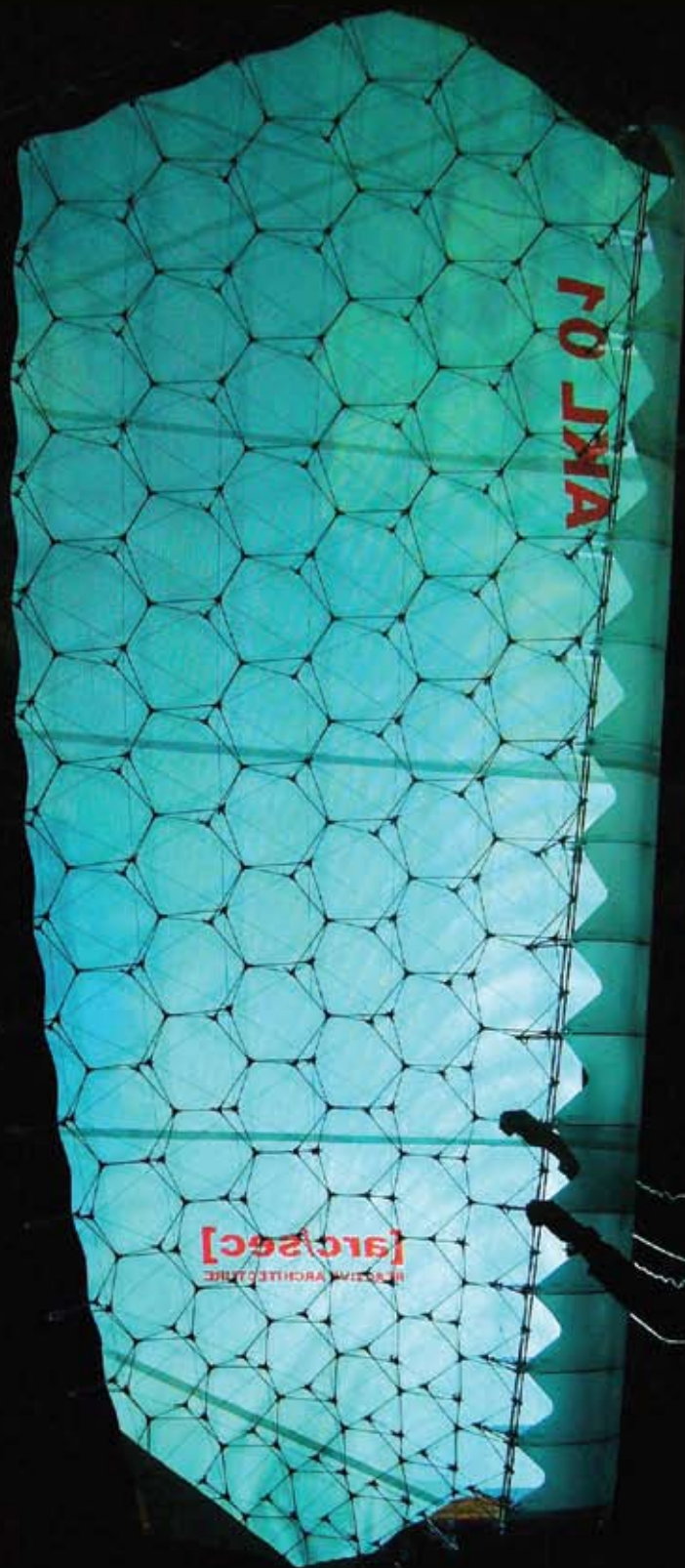


System WideShut

WideShut is a light sensitive facade / roof system. The basic element consists of three beams curved in one direction along the surface of a three-sided pyramid. In combination, the elements make up a three-dimensional comb structure, which is stiffened at the knot-points by pressure rods. In the X-Direction the elements can be added in curves. The Y-direction is stable through the gearing of the comb structure.

The bowl shaped indentation is used for the assembly of the sun shield. This consists of linear motor driven umbrellas (d=280cm). The umbrellas are covered with translucent fabric. The control works automatically according to climatic conditions. Depending on to the time of the year, the position of the sun as well as individual control, the roof/facade has a lively, changing and flourishing appearance.



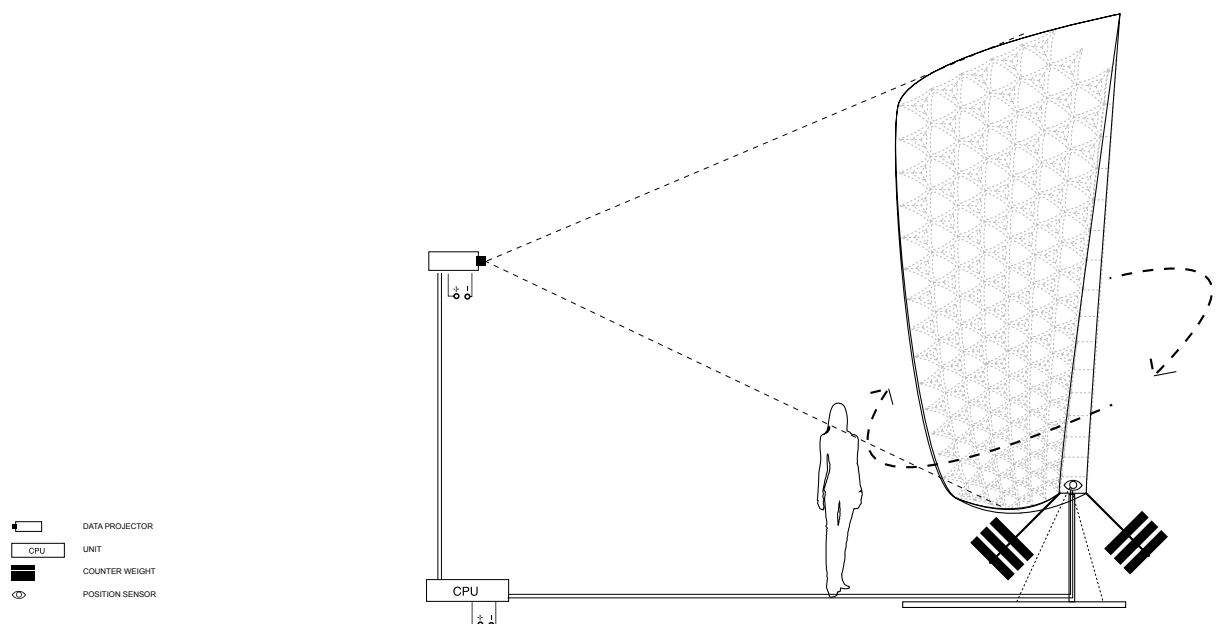
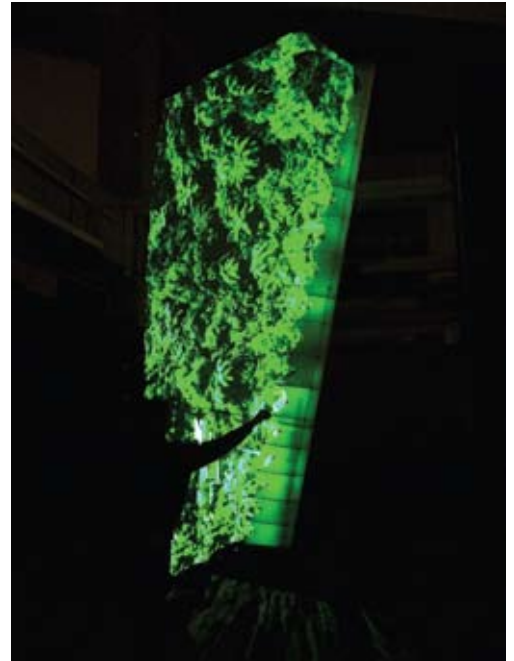


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CitySail

Uwe Rieger with Fraser Horton and Alexander Wright

The CitySail model is a surface supporting structure in a physical 1:25 model. The construction has been developed as a tensegrity system in analogy to a dragon fly wing. The dynamic ultra light construction minimises the usage of material and consists of structurally identical pressure elements. Three membranes are taking all tension forces. The inner CNC cut membrane defines the position of all members and the wing profile. In order to translate the time related and environmentally responsive aspect of the CitySails project, the installation combines physical and digital modelling. Projected place bound data are used as an additional source of information in order to introduce and represent process oriented architectural aspects.





Architecture CitySail

XTH-berlin in association with Duncan Lewis

CitySails can be described as hybrid building-machines, blurring the boundaries between land, water and city scape. The CitySails combine an internal, vertical garden structure to generate a composite growing environment/recreational living area which is situated in the middle of the Central Business District.

The challenging constructive system of these wing type towers is flexible, turning with the wind and therefore self-stabilize in windy conditions. The

face of the 100m high towers rapidly changes with the seasons of the year in correlation with the surrounding environment.

Inspired by the structure of the surrounding suburban areas, the CitySails are organized as a thin vertical layer of growing green. The functions of irrigation, living, and gardening form a hybrid system that is highly adaptive to seasonal and climatic changes.



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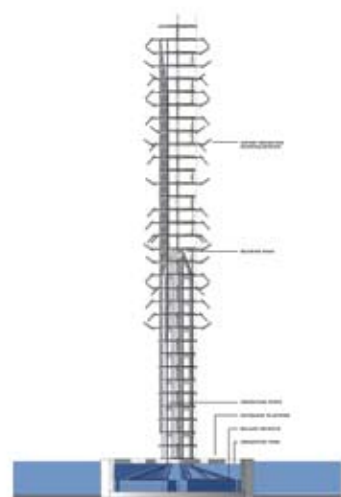
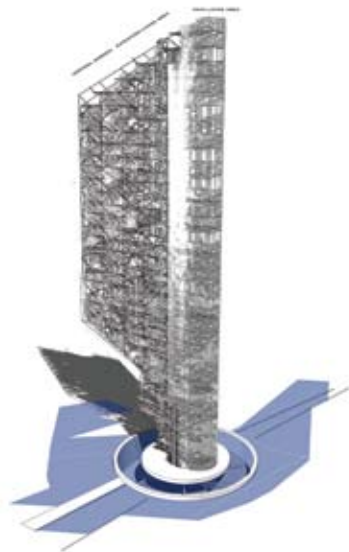
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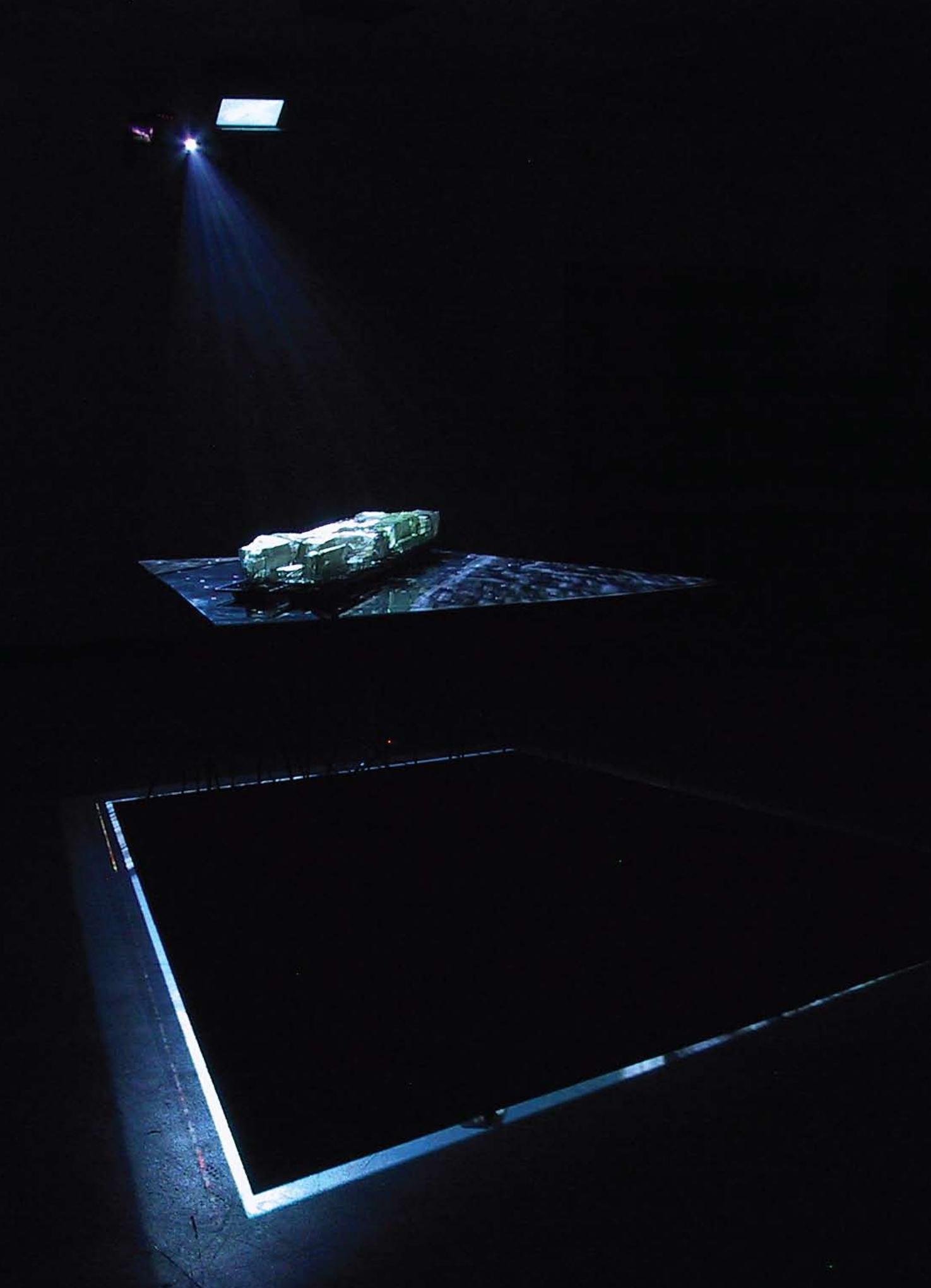


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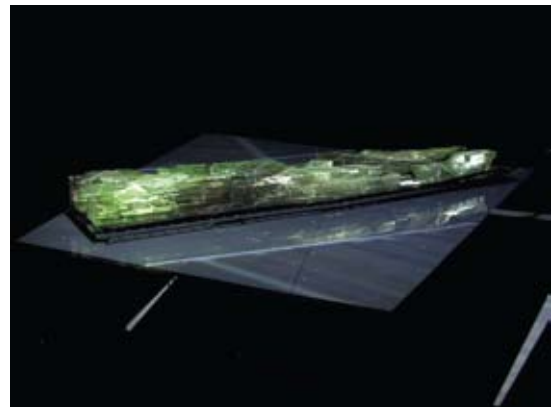
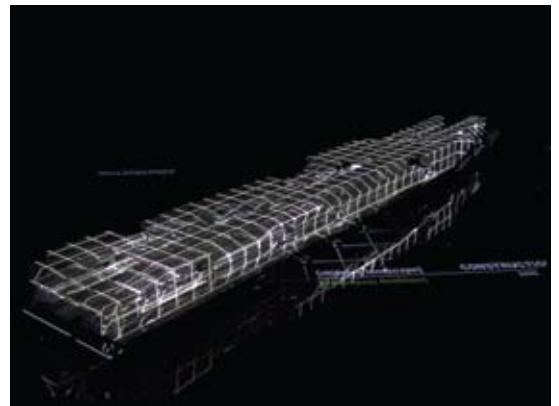
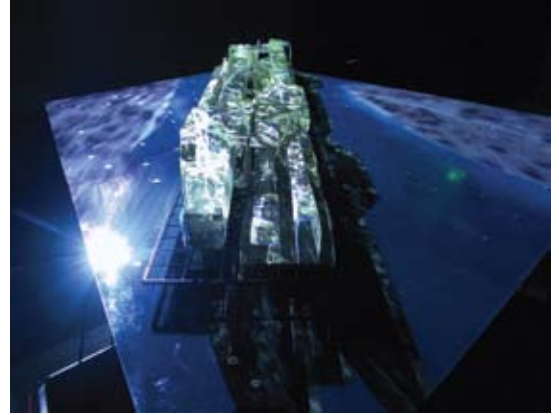
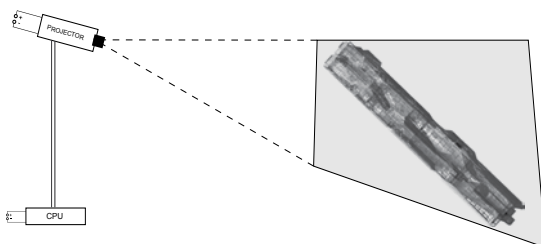
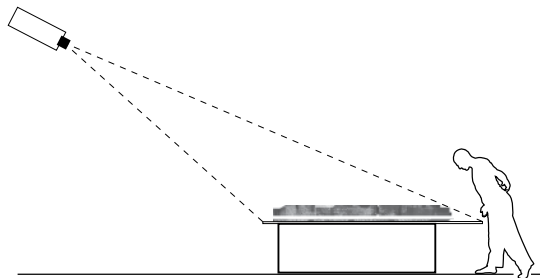


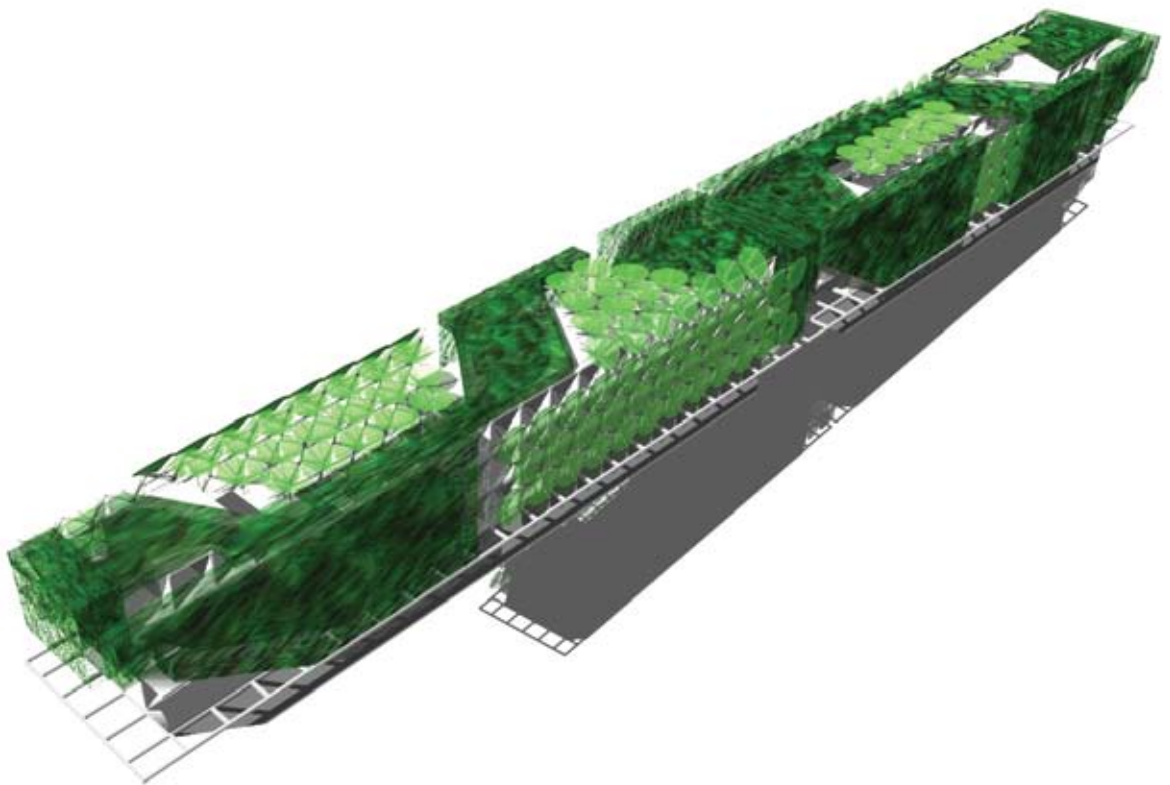
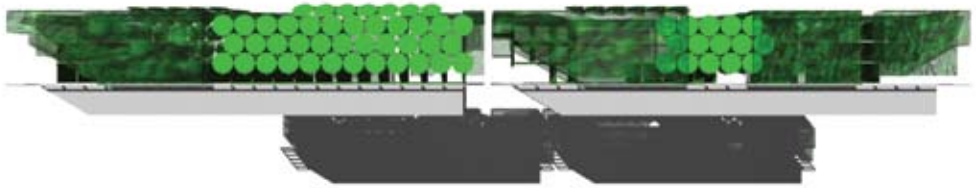
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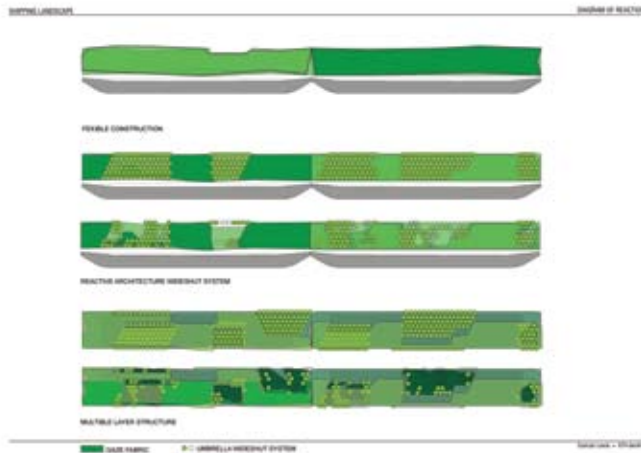
ShippingLandscape

XTH-berlin and Duncan Lewis

The model of ShippingLandscape is a haptic-digital installation. Digital information is overlaid in a place bound and choreographic manner with a physical model. Multiple layers of steel gauze serve as a translucent projection surface allowing the creation of a light-constructive spaces. The simulation shows the adaptation of the system to changing landscape and climatic conditions.



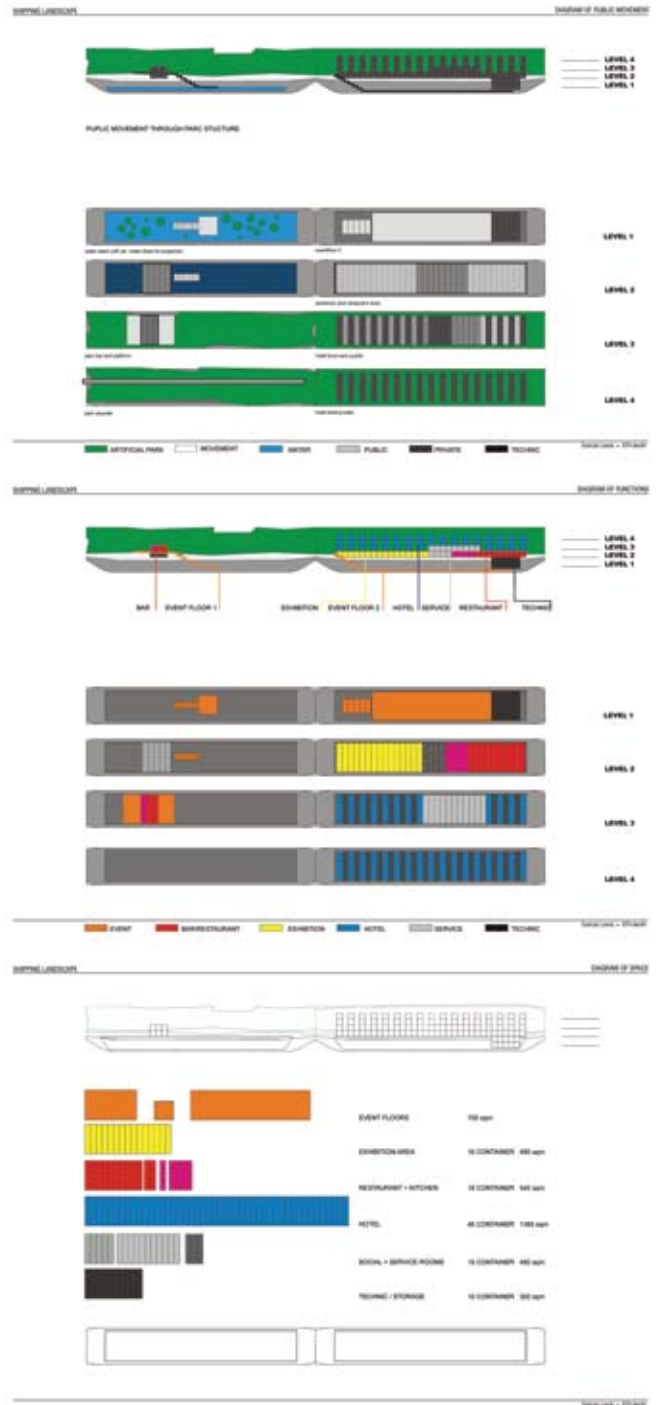


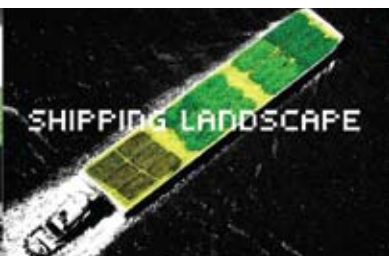


Architecture ShippingLandscape

Relying on various landscape patterns and placed along rivers, a hybrid barge-based network positions built volumes between landscape and architecture. This extruded system dissolves into shippable parts, maintaining flexibility and allowing the system to react to existing micro-conditions.

The units provide a series of public and private spaces, allowing the areas to be used for hotel rooms, restaurants and sports facilities. The flexibility of the system allows various combinations of micro-urbanistic patterns and functions, as well as allowing for differing relationships between existing structures. New impulses for towns in their relationship to the river sites are given, as new water related qualities are introduced. The swimming system easily adapts to different conditions and shifting local requirements for function, density and even seasonal changes. In seawater and tidal areas the swimming barges are transformed into water storage tanks to run the internal irrigation system, creating artificial islands along the coast line.







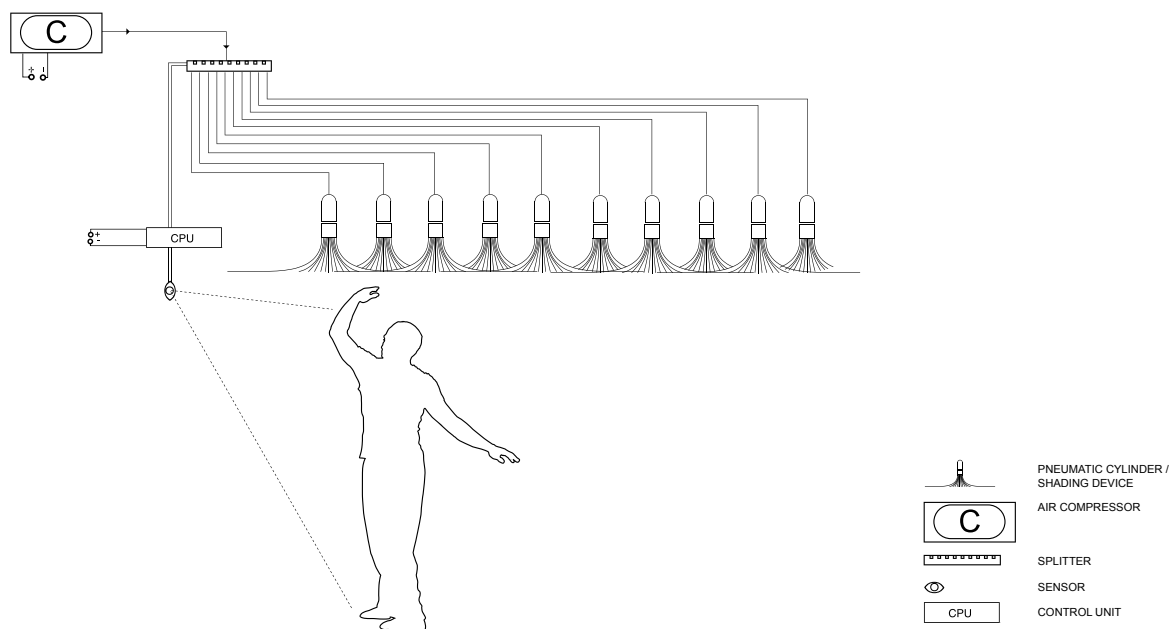
4

arch[id]

Barrington Gohns, Fraser Horton, Julian Legg,
Rayneil Singh

arch[id] investigates new possibilities of space created through poetic construction. The goal is an environment capable of constantly renewing and expanding the boundaries of one's perception.

arch[id] is a 1:1 scale model of a reactive pneumatic surface which responds and reforms as it reacts to external influences. The surface structure of the model is built from a penrose pattern capable of forming organic curves.







Architecture arch[id]

arch[id] is developed architectonically as a light modulating façade. Its ability to react to changing light intensity allows varying solar penetration, as when, for example, it is used to control overheating in the afternoon through a denser surface clustering on the western facade.

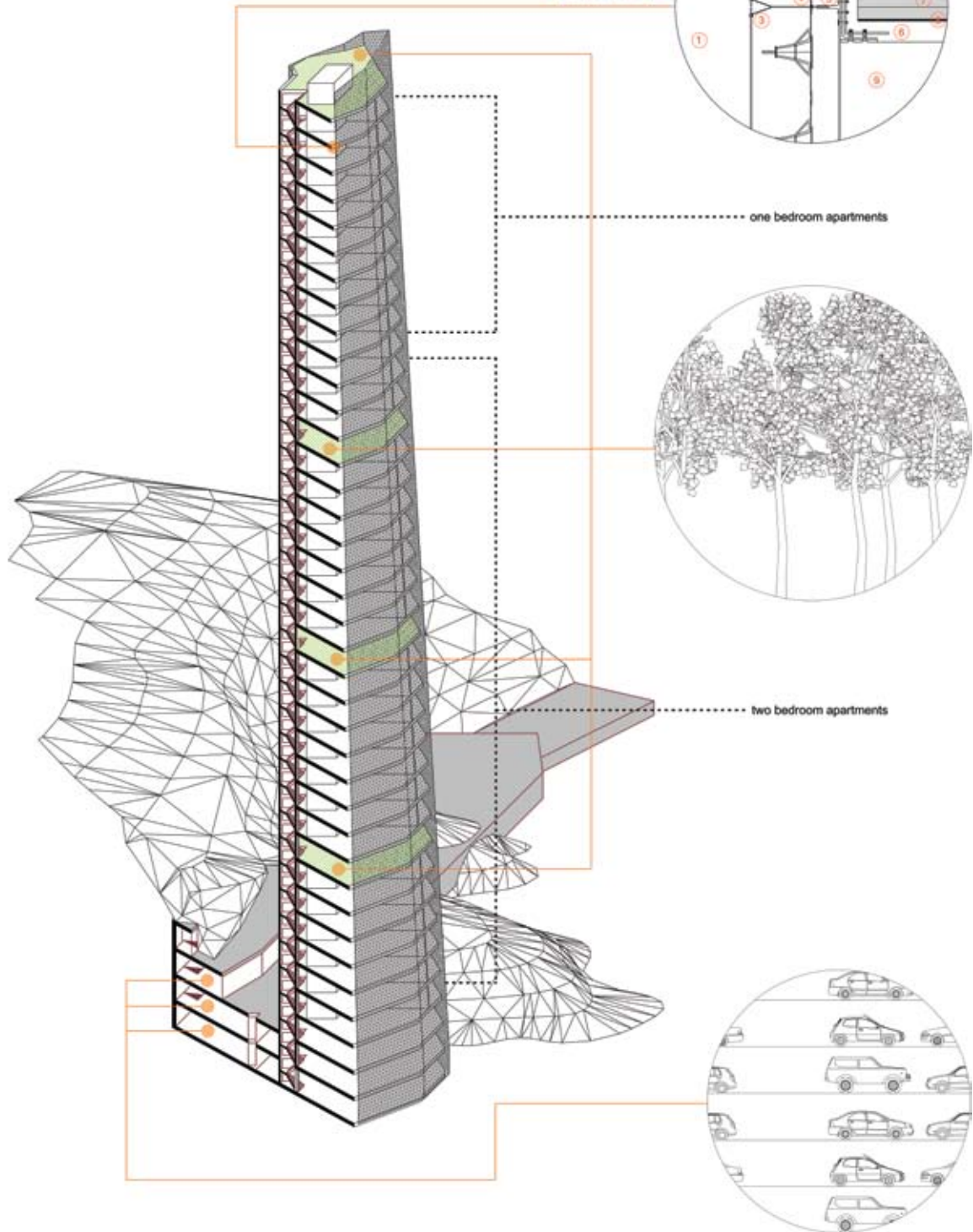
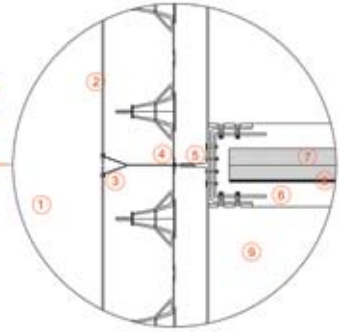
arch[id] is contextualized in a tower situated adjacent to North Head, wrapped east to west creating a dynamic façade which is ever changing throughout the day.



SECTIONAL AXONOMETRIC

FACADE DETAIL

1. open air
2. glass
3. spider joint
4. reactive surface joint
5. steel rod connection
6. concrete slab
7. thermal insulation
8. acoustic insulation



scale 1:50 @ A1

ZeroPlus

Uwe Rieger, Paola Leardini, Kerstin Rosemeier,
and ZeroPlus Team

Zero.Plus is an international research initiative to design, build and monitor New Zealand's first Zero Energy House under international Passive House standards. Meeting these specific requirements, the project will lead to the construction of the first Passive House in the southern hemisphere certified by the Passivhaus Institut Darmstadt (D) and the validation of the related simulation tool Passive House Planning Package (PHPP) for NZ climate. Starting from the analysis of the NZ existing building stock, the proposed zero emission living unit aims to offer new answers to the needs and desires of occupants, while taking energy efficiency and carbon emissions into account, as well as achieving a new level of Indoor Environmental Quality (IEQ). The explicit integrative-design focus of the project will introduce a new architectural language as a reflection of New Zealand's climate, resources, culture and life style.

In a long term perspective the Zero.Plus unit represents a prototypical show-case for the development of a sustainable urban settlement of 50-100 residential units.

The Zero factor refers to no CO₂ emissions due to the usage of 100% renewable energy sources and on-site ecological water treatment. The Plus factor describes the increase of Indoor Environmental Quality (IEQ), according to WHO and ISO standards, and the quality of design, material, construction and fabrication.

The multidisciplinary project team consists of New Zealand and European University researchers, practitioners and industry. The project has been set up to become part of an international platform on sustainable urban settlement and Zero Emission Housing.

Zero.Plus will introduce a new standard and provide a show-case to prove that a zero energy approach is practical and cost-effective in New Zealand.

Project organization: Dipl.-Ing. U. Rieger, Dr Paola M. Leardini, School of Architecture and Planning, UoA; **Building Physics:** Dipl.-Ing. Kerstin Rosemeier; **PHPP validation for NZ and project certification:** Prof. W. Feist, Passivhaus Institut, Darmstadt (D) and University of Innsbruck (A); **Urban design sustainable strategies:** Prof. K. Zillich, N. Couling, B. Arch (Hons), Institut fuer Städtebau und Architektur, Technische Universität Berlin (D); **Simulation and sustainable design:** Prof. D. Schwarz, Institute of Architecture and Planning, Hochschule Liechtenstein (FL); **Consultant architects and engineers:** Stephenson & Turner Architects Engineers, Auckland





1. Plant the site

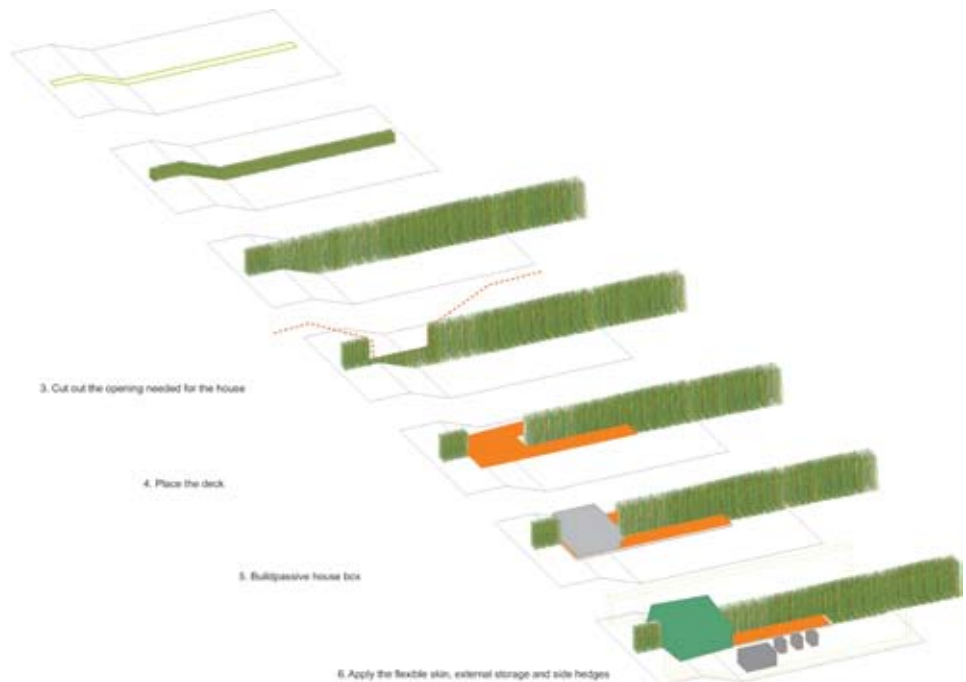
2. Let the vegetation grow

3. Cut out the opening needed for the house

4. Place the deck

5. Build passive house box

6. Apply the flexible skin, external storage and side hedges



6

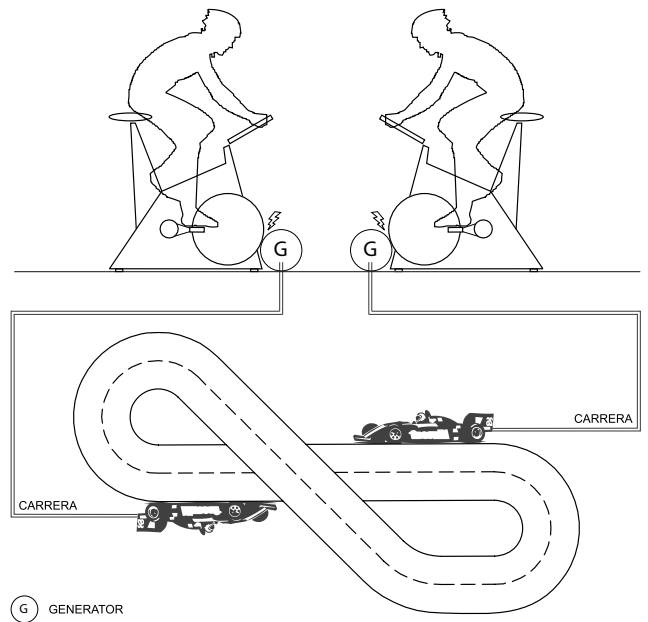
Carrera

Luka Hinse

Carrera is an interactive installation, working with the human being as an energy source. The system is based on the fact that energy can only be transformed, but never be lost.

The setup consists of two elements: a gym cycle and a slot car race track. The gym cycle is modified in a way that it can supply the energy to run the slot cars. Each track is driven by one gym cycle so that two people can race each other. The faster you pedal, the faster the slot car moves. Contestants experience a new form of playful interaction.

Carrera is a conceptual gate to a range of products that make use of energy generated by human beings. These products can be used to produce power or transform energy into a new quality. It also shows ways of rethinking and questioning our energetic behaviour in a holistic view. Fitness studios today don't differ very much from treadmills of ancient times and it is time to think of the potential of this available energy. To put this into the context of architecture, the Carrera concept can function as an add-on to Photo Voltaic Systems to supply energy for Passive Houses. With the available white LED, for example, as a light source, a few minutes of pedalling would be enough to create hours of light.

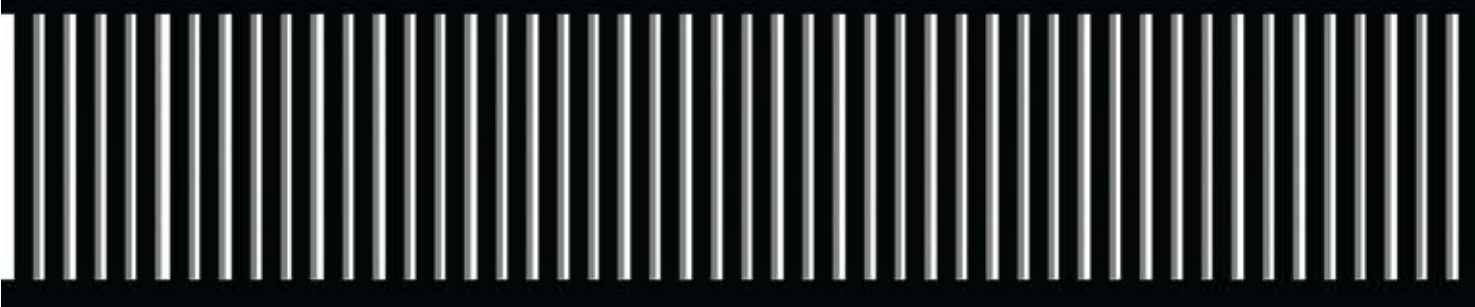




CARRERA 08



energy can never be lost



Uwe Rieger studied Physics and Architecture at the University of Muenster and the Technical University of Berlin. He taught Architectural Design as an Assistant Professor at the Technical University of Berlin, the BTU Cottbus and within the Masters program of the University of Muenster. He is the co-founder of the Berlin based interdisciplinary group [kunst + technik] e.V. Starting in 2000 he has been running the office XTH-berlin with two partners. Uwe Rieger has realized a wide range of projects and has been invited to various international exhibitions. Currently he is Associate Head: Design at the School of Architecture and Planning at the University of Auckland.

XTH-Berlin develops architectural projects around process oriented spaces and reacting systems. As a spin off from [kunst und technik]e.v. the office was founded by Uwe Rieger, Martin Janekovic and Helle Schröder.

XTH-berlin develops architectural strategies between material and information and between social needs and new technologies. The projects take strategies and processes in nature and landscape as an impulse for architectural development.

Duncan Lewis is a British-born architect, with his office 'Scape Architecture' based in Bordeaux, France. Duncan Lewis relates architecture to ecosystem, finding new ways to create architecture blurring the boundaries between nature and the constructed. He has realized various international projects, has been internationally exhibited and has been teaching as visiting Professor at a number of European Universities.

Dr Paola Leardini is a Lecturer in Sustainability at the School of Architecture and Planning of the University of Auckland. She is a researcher and practitioner, with a specific experience in design and the construction of energy efficient buildings in Italy and Switzerland, and is a PhD graduate in the field of Indoor Environmental Quality studies.

Kerstin Rosemeier has specialized in building physics. She holds architecture and planning degrees, has been the managing director of an engineering company, and an advisor to German federal state government in matters of energy efficiency in the building sector. Currently she teaches architectural design studio at The University of Auckland.

The **ZeroPlus Team** consists of: Soo Ryu, Patrick Loo, Miguel Machado, Fiona Short, Andy Ong, Nick O'Leary, Holger de Groot

Luka Hinse studied Industrial Design at the University of Art and Design, Burg Giebichenstein, in Halle/ Saale, Germany and the Facultad de Bellas Artes de San Carlos de Valencia, Spain. He taught Conceptual Design as an Assistant Professor at the University of Art and Design, Burg Giebichenstein, Halle/ Saale. He worked for Matsushita Electric Works (Panasonic) in Tokyo/ Japan and has been running his own Studio in Berlin. He started Pecha Kucha nights in Berlin and New Zealand. Currently he is part time tutoring architecture at the University of Auckland as well as running his own studio in Auckland.

The **arch[id]** design team consists of Barrington Gohns, Fraser Horton, Julian Legg and Rayneil Singh. The project was developed and built as a part of the 4th year design studio 'North Head' at the School of Architecture and Planning at The University of Auckland.

Acknowledgements

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Carrera:	Les Mills, Auckland

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