

Climate and Architecture

Exhibition at the Royal Danish Academy of Fine Arts

School of Architecture, Copenhagen

20th of November - 20th of December 2009

Preface

CLIMATE AND ARCHITECTURE

Exhibition November 20th - December 20th 2009
The Royal Danish Academy of Fine Arts,
School of Architecture

Arranged by:

Institute of Architectural Technology in collaboration with Institute of Planning

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Sustainable Living: Winner -projects of Student Competition

The Resilient City: Charles Bessard, Institute of Planning

The New Olduvai Gorges: Philippe Rahm

Sargasso Cloud: Philip Beesley, Waterloo Architecture and Mette Ramsgaard Thomsen, CITA Centre of Information Technology and Architecture, Institute of Design and Communication

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Editor: Ola Wedebrunn

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Proofreading and translation: Sigrid Jørgensen

Print: P.J. Schmidt A/S

Sponsored by:

Realdania

KAB Fonden

Margot og Thorvald Dreyers Fond

Aase og Ejnar Danielsens Fond

The Royal Danish Academy of Fine Arts,

School of Architecture

The Danish Ministry of Culture

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VILLUM KANN RASMUSSEN FONDEN

Martha og Paul Kerrn-Jespersens Fond

Knud Højgaards Fond

The Canadian Research Council

ISBN: 978-87-7830-227-4

The Royal Danish Academy of Fine Arts

School of Architecture

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In the universe of architecture it is often necessary to go further than to the direct challenges and immediate solutions in order to find an answer, being able to match the complexity of such great questions as the interrelations of the physical designs, its technology, and resources, and the climate.

The exhibition *Climate and Architecture* at The Royal Danish Academy of Fine Arts, School of Architecture shows that architecture - by taking a creative stand on the conditions of a sustainable future and by combining art, culture, and the values of society with new technology – is able to challenge our ways of thinking.

The exhibition presents results of The Royal Danish Academy of Fine Arts, School of Architecture, works which connect landscape – and town planning, architecture, and design. Furthermore the exhibition defines climate through parameters where body and senses are related directly, actively, and interactively to the great climatic challenges.

The exhibition proves that education and research in the field of culture are important elements of our future.

Carina Christensen,
Minister of Culture

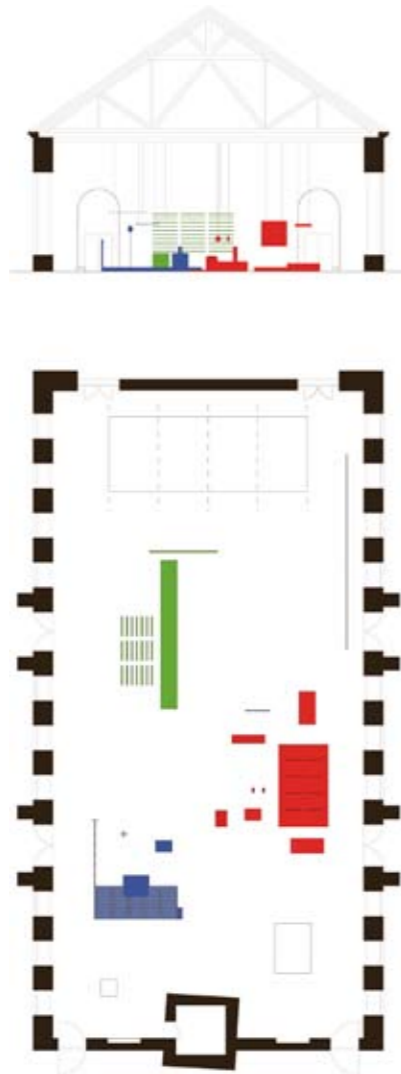
Introduction

Torben Dahl & Peder Duelund Mortensen

The exhibition *Climate and Architecture* displays how architecture by relating creatively to a sustainable future and through a vocabulary of architecture, art and technology is able to meet the present challenges of change.

The exhibition considers, analyses and rethinks basic elements of architectural means and goals: What are the biological needs of man? How can our physical surroundings cover these needs, and is it possible that new interactive models and structures will create new expressions and appearances of architecture? How is it possible to plan new cultural values and behaviour by crossing concepts of scale for dwellings, buildings, settlements and landscape?

The exhibition is a sensual, po-



etic and architectural argument adding to the present climate debate. The challenges for the built environment are considerable. Still, there are both competences and models to suggest possible solutions to contest challenges of cultural patterns and behaviours in the living environment and in the building culture. Changes even make it possible to create and recreate qualities of living, to improve building and make better cities.

In connection with the international climate summit, COP15, in Copenhagen, the Royal Danish Academy of Fine Arts, School of Architecture at the Institute for Architectural Technology and the Institute for Planning focuses on the role of architecture in the urgent debate about the climate, interpreting the issues of climate and

sustainability in different ways.

The activities have been going on throughout the year 2009 and are to be closed at the same time as the summit.

Through the subjects for a prize project *Sustainable Living* students from the school have worked with suggestions to future architecture and planning in spring 2009 which are to lay down guidelines for a sustainable society and living. The deadline was in June 2009 with awarding prizes to the best of 111 suggestions.

In August some selected projects being awarded have been presented in an adapted edition as the contribution of The School of Architecture to the Conference of The Ministry of Culture, "COP-Kreativ".

In November and December

2009 the exhibition *Climate and Architecture* together with the UIA-arrangement *Open Forum* and the international UIA students' workshop *Sustainable by Design* are to be the contributions of The School of Architecture on the occasion of COP15.

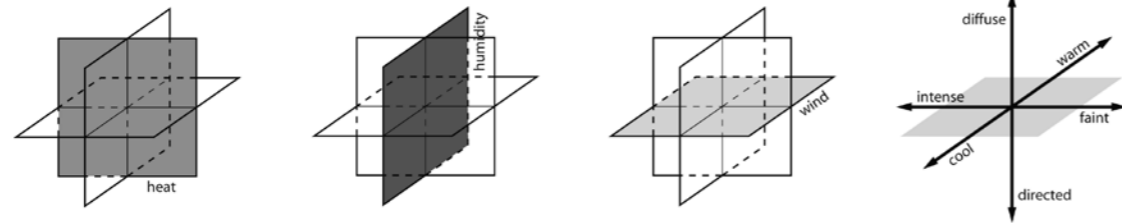
In connection with the exhibition the book *Climate and Architecture* is published, written by several researchers in close association with the Institute of Architectural Technology and edited by Torben Dahl.

Its most important message is that an analysis of the local climatic conditions and an involvement of the quiet climatic adaptation, being in the traditional architecture of the very same environment, imply a rich and unexploited architectural potential.

If you explore the essence of architecture, one of its most important functions might be the transformation of the outer climate into an acceptable and comfortable inner climate. From man's first settlements in central Africa this building with a climatic function has developed from the simplest shelter in the cave or under the shade of the rain forests to a very refined and complex system of regulating the heating, the cooling, the air-condition, the humidity, and the light.

Today nobody asks questions about technology, giving us comfortable housing and working places.

Nevertheless the global warming and the actual connection between the climatic development and our culture of settlement have



HEAT

HUMIDITY

WIND

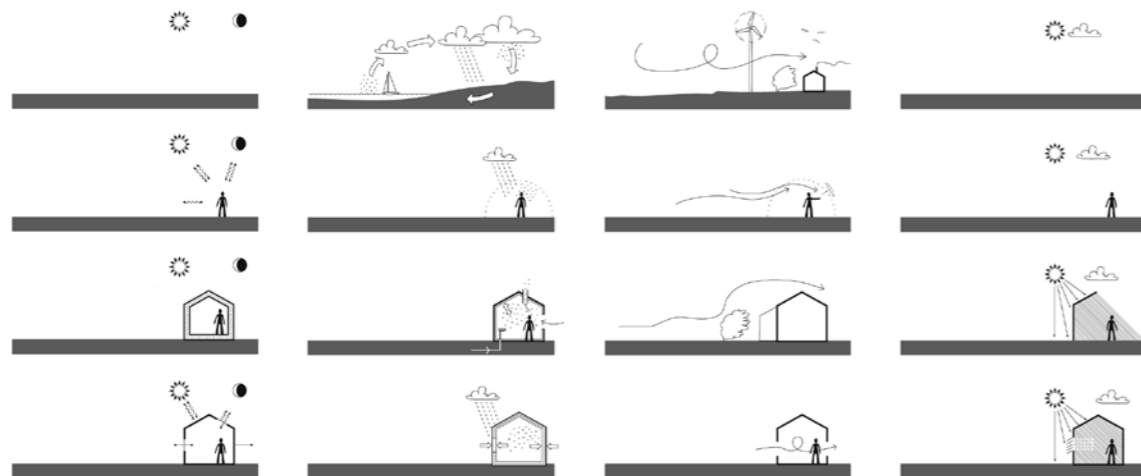
LIGHT

CLIMATE

COMFORT

SCREEN

CONTROL



pointed to the demand for a re-orientation of this energy-consuming and environmentally damaging system.

In the universe of architecture it is often necessary to go further than to the direct challenges and immediate solutions to find answers, matching the complexity in such important questions like the interrelations between the built environment, its technology and the resources, and the surrounding climate.

In the exhibition there are results of works from The School of Architecture which connect the planning of the landscape with the urban planning, the architecture with design. The exhibition defines climate on parameters which relate body and senses directly, actively, and interactively to the great climatic challenges.

The core of the exhibition is the installation *The New Olduvai Gorge*, designed after architect Philippe Rahm's idea and proposal in cooperation with The School of Architecture. The installation is implemented with the audience of the exhibition as an event, unfolding each day throughout the ex-

hibition period. The installation consists of architectural scenarios about the following concepts: The cold, the warmth and the daylight. The three scenes are composed by cultivated fields of mint and chili, areas of light, sounds, sitting and working places connected to daily life's inner and outer transformation of energy.

Sargasso Cloud is the second installation of the exhibition, created by CITA/ The School of Architecture, Centre of IT and Architecture, at a summer school led by Professor Philip Beesley. It is a textual, detailed, and interactive phenomenon in three dimensions, demonstrating the qualities of the digital technology and its ability to a dynamic adaptation – a loose woven textile, pointing at the decisive importance of the skin and the climate screen when meeting new conditions.

The exhibition consists of a number of elements, too, bringing the reflection very close to the architectural work: The awarded suggestions from the competition *Sustainable Living* are sources of some short films, being shown on flat screens. The projects and the

films are all produced by the students from The School of Architecture.

The installation of *The Resilient City* by architect, Ph.D. student Charles Bessard demonstrates the increase of the water level and its power to change Copenhagen on a large scale, and at the same time it demonstrates the architectural, textual, and sensual potential of the element water in the transformation of the city, very close to the body.

The students of The School of Architecture have through their suggestions of the competition and their participation in workshops and at the summer school given their valuable ideas of alternative solutions to our future interaction with climate and nature.

The New Olduvai Gorges

(Les étés artificiels)

Philippe Rahm architectes

Question of place and climate is strictly connected to the question of feeding.

Friedrich Nietzsche, *Ecce Homo*, 1888

So what nature give of uncomfortable can be corrected by art

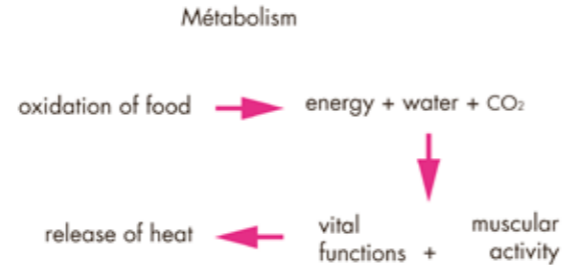
Vitruvius, *De Architectura*, 20 B.C.

If we want to know the essence of architecture, we finally have to return to our “endothermic” condition: the necessity of maintaining a body temperature at 37°Celsius. Architecture exists because of the enzymes necessary for the biochemical reactions of the human metabolism. Present by billions in our body, these molecules can work in an optimal way only at a temperature between 35 and 37,6°C. So man has to maintain his constant physical temperature independently of the outside temperature. For that purpose, he composes with internal means of his own body such as various mechanisms of physiological thermoregulation and external means of the body such as clothing and/or construction of shelter. So architecture is not autono-

mous. It really goes into the range of the means to maintain our temperature close to 37°. It is an answer to a steep decline or increase of the body temperature with, by examples, vasodilatation mechanisms, sweating, thirst, or muscular contractions. These answers are remotely applied or associated. They develop themselves from nature to artificial, microscopic to macroscopic, biochemical to meteorological, food to urbanization, between physiological determinism and pure cultural freedom. In this mission, architecture appears as a bigger way of vasoconstriction, or, conversely, feeding appears as a smaller variant of architecture. Because finally architecture is nothing else than a shape increased by mechanisms of physical thermoregulators, an increased form,

exogenous change, and artificial thermogenesis or thermolysis.

From an anthropological point of view, when we think that we are too cold, or the opposite, when we think that we are too warm, we find the cause outside of ourselves, in an inadequate outside climate, at an atmospheric level. And we try to make this outside climate comfortable by correcting it – that is the origin and the mission of architecture. In reality, the first signs of architecture are physiological and totally internal and autonomous, to perspire if it is too warm or to shiver if it is too cold. They are the first answers to a rise or a reduction of the body temperature due to an unfavorable thermal environment. Then, in the simplest way, the most rudimen-



tary gestures come, that to drink if it is too warm to lower temperature by evaporation, or to eat if it is too cold to launch the combustion process of nutriment which will produce some heat in the body.

After these endogenous corrections, if nevertheless the body does not manage to compensate the too cold or too warm temperature of the outside environment, the range of the geographical corrections develops. First action of correction is a movement, that of migration or transhumance, to move, to change place, to pass from the cold to the warm environment, to put ourselves in the sun or in the shade. The second action is to get dressed or to undress, to wear white clothes that reflect the heat or to dress thick clothes which iso-

late. The third action is the one, to build shade and freshness artificially or to build sheltered places, without air movement and warm. These exogenous measures which we take from the outside world are only an outside body projection, outside a phenomenon of thermogenesis when it is too cold, or of thermolysis when it is too warm. To paraphrase Vitruvius, architecture in cold countries or winter appears as an increased, exogenous thermogenesis, outside the body. And architecture from warm countries or summer gives itself as an exteriorized thermolysis, correcting artificially the uncomfortable part of nature.

Thermogenesis is the greater production of heat in the body in case of cold. It comes in consequence

of a sports activity or absorption of food. It consumes a lot of energy. By thermogenesis, we activate shivers, we stimulate metabolism, and various hormones that warm up our body to maintain it around 37° C. On base of thermogenesis, we find food, mainly proteins, that is meat or fish, and also sugar. The main part of the food is used for this mechanism. The digestion of proteins, their combustion in Krebs' cycle in particular, provokes a strong heat, increasing the body temperature.

Eating is an internal form of the same process of thermal reactions as the one urging us to build houses in cold climates. Also, typical constructions from warm countries, riads, porticoes, thick walls, are exteriorized forms of thermo-

lysis, this function of the body, which serves to dissipate surplus of heat by vasodilatation or sweating.

It might seem surprising to want to go back to the profound understanding of reasons and means of architecture, but the problem of global warming suddenly brings the climatic mission, the responsibilities of architecture into mind. Architects of today investigate the extent of architectural means, making sense of sustainable development. They have to understand how they can limit energy consumption and production of greenhouse gas and, as we know, it is all about the reduction of spent energy in buildings, in heating, etc.

Today, we know measures to be tak-

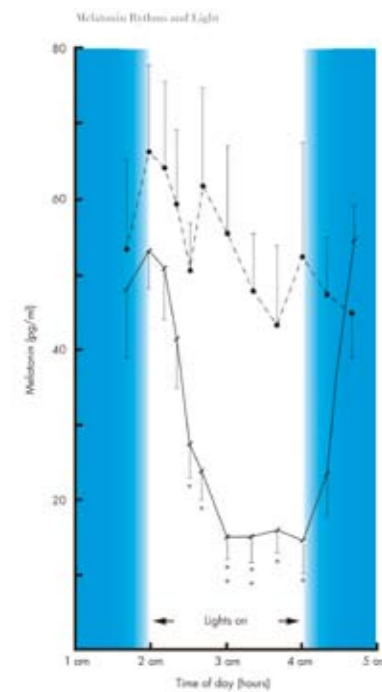
en concerning urbanization. We advocate essentially for a densification of the city and for a concentration of functions to limit wasted energy in movements. We take measures now concerning building where we advocate, on one hand, for the use of renewable energy and, on the other hand, for a considerable improvement of heat insulation of the building envelope coupled with a controlled renewal of air. But do we have architecture acting on a more moderate, finer, smaller, thriftier level? Less heavy, less present architecture, a diluted, almost homoeopathic architecture, but still having the ambition of a climatic correction of elements which need to be respected? Today, we would like to go further down in scale of measures of climatic corrections in order to in-

vestigate sensitive zones closer to the body, on the limit of our skin, to reach the point where architecture dissolves and becomes pure thermogenesis.

But don't let us make a mistake! If this search consists merely in saving energy spent in the building and in fighting global warming, it is also a question of discovering new modes of houses and spatial compositions, of elaborating new strategies of design and beauty, where scales mix, where architecture becomes as much construction and structures as food and sweating.

Exposure to bright light shown to inhibit human melatonin production (indicated by solid line) when compared to controls (dashed line).

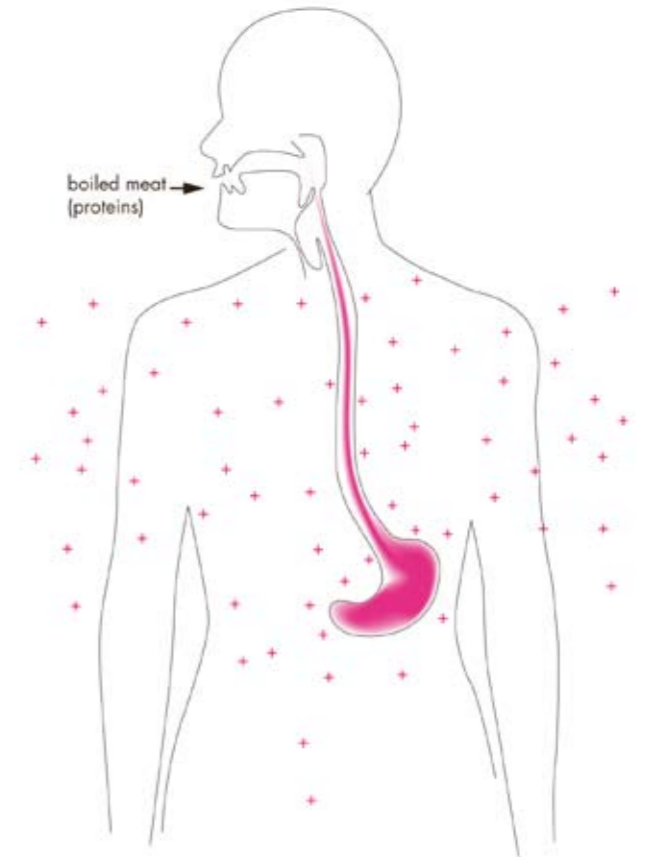
Source : A. Lewy, T.A. Wehr, F.K. Goodwin, et al., "Light Suppresses Melatonin Secretion in Humans." Science 210:1267-1269, 1980.806040201



visible spectre



Proteins tranformation in energy by digestion. Release of heat.



The exhibition at the School of Architecture of The Royal Danish School of Fine Arts is a part of this kind of strategy. It provokes emergence of new architectural solutions without acting any more on demarcation around a comfortable climate where the body temperature can remain effortlessly in 37°C, but in the appearance,

from the inside, from endogenous architectural solutions. It investigates microscopic, digestible, electromagnetic forms of architecture, somewhere between dietetics, thermogenics and aesthetics.

We have created three stations in the exhibition room, three spots, which each of them answer to an

uncomfortable climatic situation that we could find on the earth. An answer to a too cold climate by adding more warm, an answer to a too warm climate by adding coolness and finally an answer to a too dark situation by adding more light.

+ more warm

The first spot is place where we find different solutions for stimulating an endogenous thermogenesis which develops little by little outside the body without ever becoming garment or house.

Our work begins at this moment, by recomposing space from necessities of the body, by mitigating one by one lacks and deficits. Architecture is here a juxtaposition of elements which each answers a lack, an incapacity, those provoked by the coolness of Danish winter for exemple. Architecture closer to and in the body, which brings element by element answers, heat, nutriments.

- a black polyethylene platform,

matt, squared, to get at most the present electromagnetic radiations from the room, to trap and transform them into heat.

- a grating platform under which is a field of hot peppers (heating in the earth) enlightened around by photosynthesis lights. Hot peppers stimulate Ionic channel and neurotransmitter TRPV1, the one that detects temperature sup to 44°C and also bustles in presence of «capsaicin», a molecule we find in red hot pepper. The «capsaicin» and temperatures up to 44°C stimulate the TRPV1 which activates the sensation of strong heat.

- a device to produce warm tea with hot pepper to drink the heat of hot peppers

- a cup distributor for tea

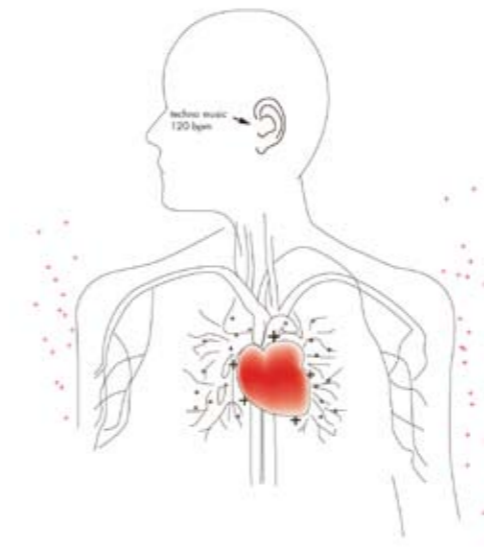
- a professional cooking device for boiled meat to ingest proteins which constitute fuel of the body produced heat to maintain temperature at 37°C.

- forks like for «fondue Bourguignone» or wooden sticks

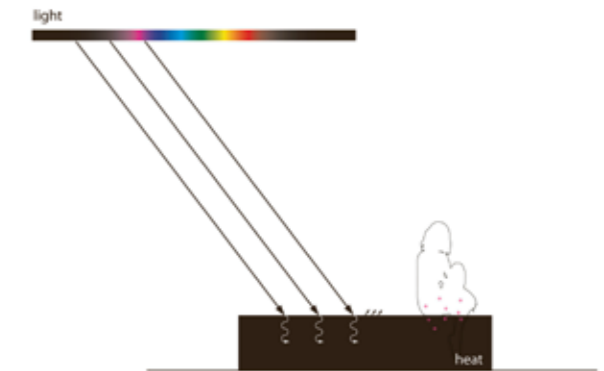
- a techno music spread by directional speaker with a beat 120 BPM to help heart rhythm to increase from 60 beats per minute to 120 beats per minute, so increasing metabolism and muscular activity generating a surplus of heat.

- a bench for five persons, to muddle and share human heat.

Stimulation of the sensation of heat by activation of neuronal channel ion TRPV1 44°C.



Acceleration of heart rhythm according to the music rythm(60 bpm => 120 bpm)



Black colour = albedo maximum transformation of the wavelengths into heat through contact with the black surface of the platform.

+ more day

The second spot is the place that increases the level of light in the decrease-period of sunshine and the short days of winter in northern latitudes, remote from equator, plunged into winter. Architecture provides here endogenous solutions to the deficiencies in vitamin D, vitamin A, melatonin provoked by the absence of sun light.

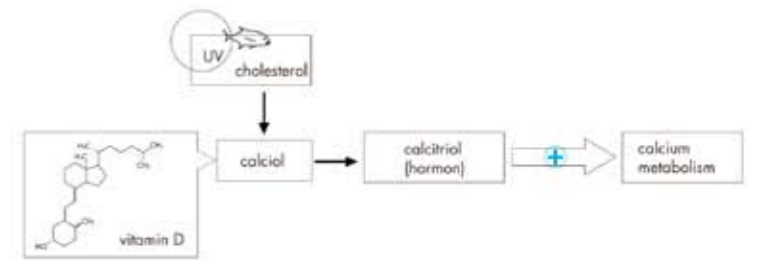
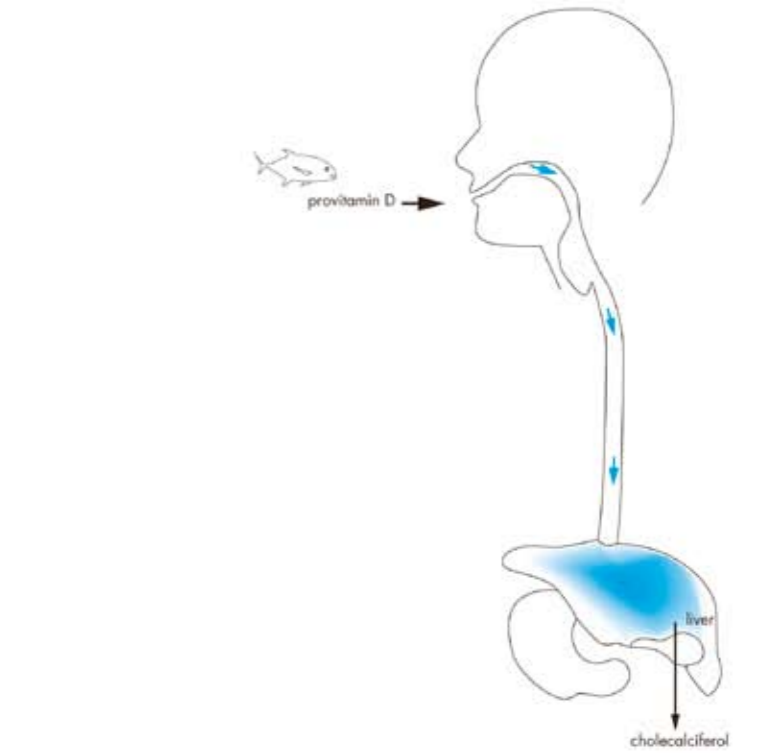
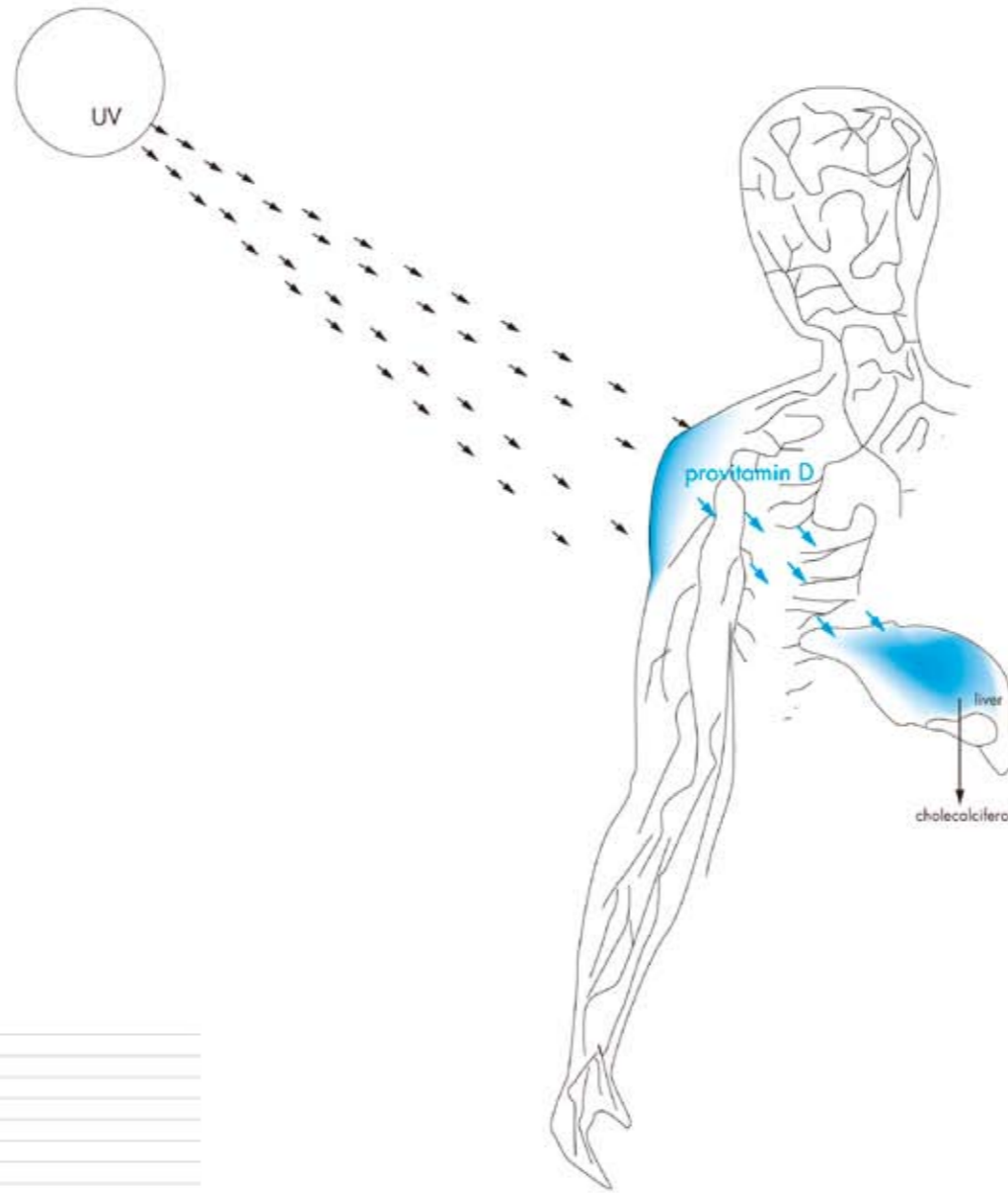
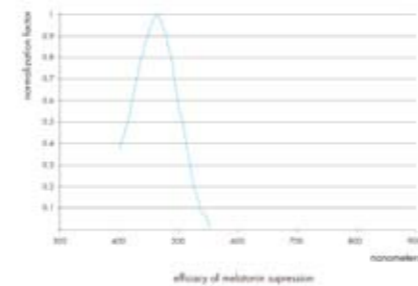
- a visible carrot field, which we can eat from to improve the night-vision and supplying vitamin A.

- a horizon of ultraviolet ray, to allow synthesis of vitamin D, missing because of the short duration of winter days in Denmark.

- an electromagnetic radiance in 470 nanometers to block secretion

of melatonin engendered by the weakness and absence of daylight.

- a rectangular table (polyethylene) covered with oily fishes like salmon, trout, halibut, herring, sprat and mackerel uncooked presented in sashimi, to be eaten to bring to the body vitamin D, normally brought by the sun.



+ more cold

A grating platform under which is a field of mint plants (heating in the earth if necessary). Menthol stimulates Ionic channel and neurotransmitter TRPM8, the one that detects temperature under to 15°C and also bustles in presence of «menthol», a molecule we find in the mint. The «menthol» and temperatures under to 15°C stimulate the TRPM8 which activates the sensation of coldness.

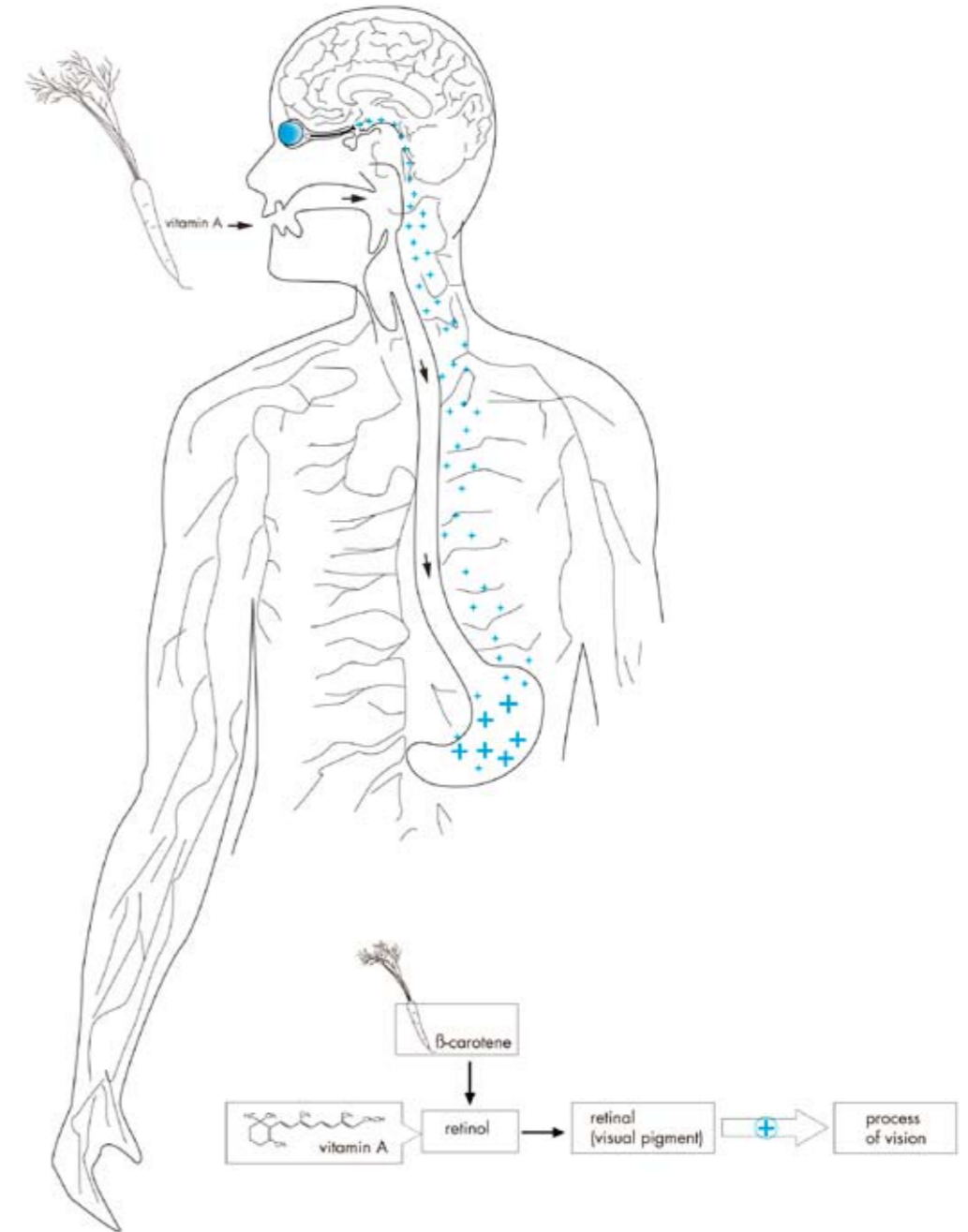
- a fountain of fresh water with mint infusion.

- a fan which create a movement of the air which provide a feeling of freshness to the body

- a wardrobe with coat hangers to strip ourself for removing the ther-

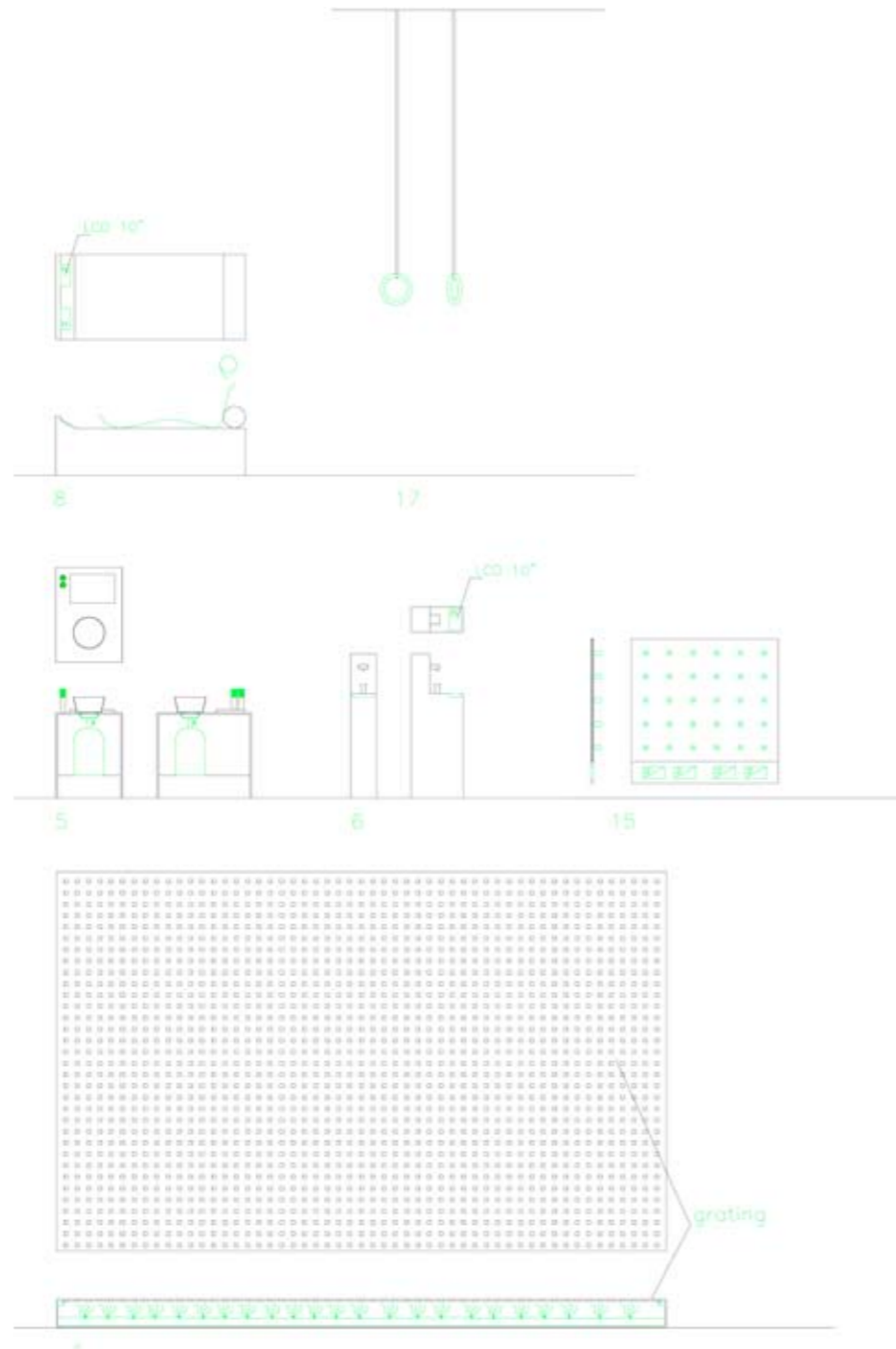
mo isolation layer of the clothes

Inside the three spots, flat screens, books and posters will present different architectural projects done by the students of The Royal Danish Academy of Fine Arts, School of Architecture related to climate.



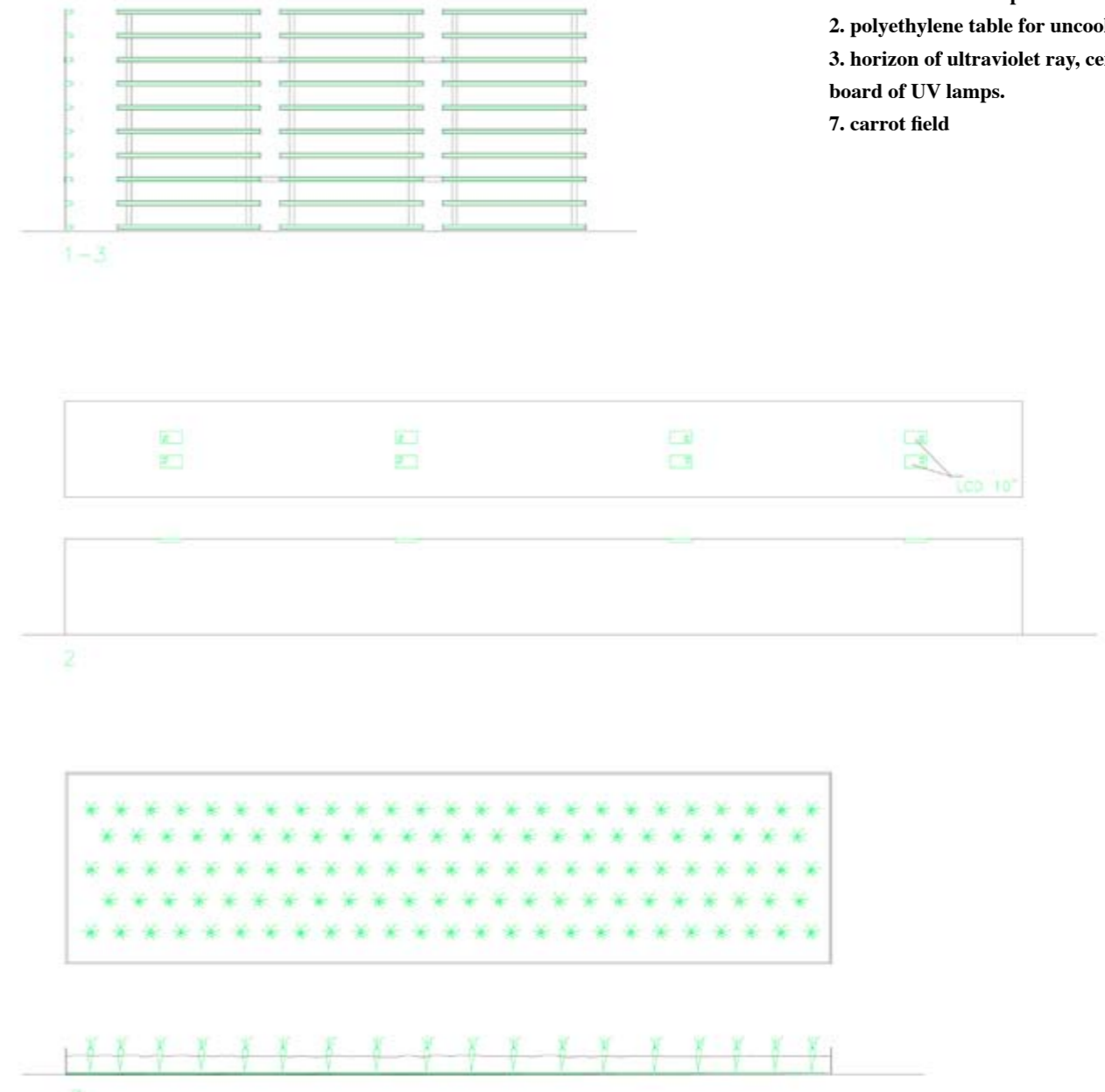
+ warm

1. pepper vat with biolux light under grating
2. meat cooking
6. chili tea
8. black polyethylene platform, black bed
9. compact bench
10. techno music spread
15. board of incandescence lamps
17. aparatus, rings



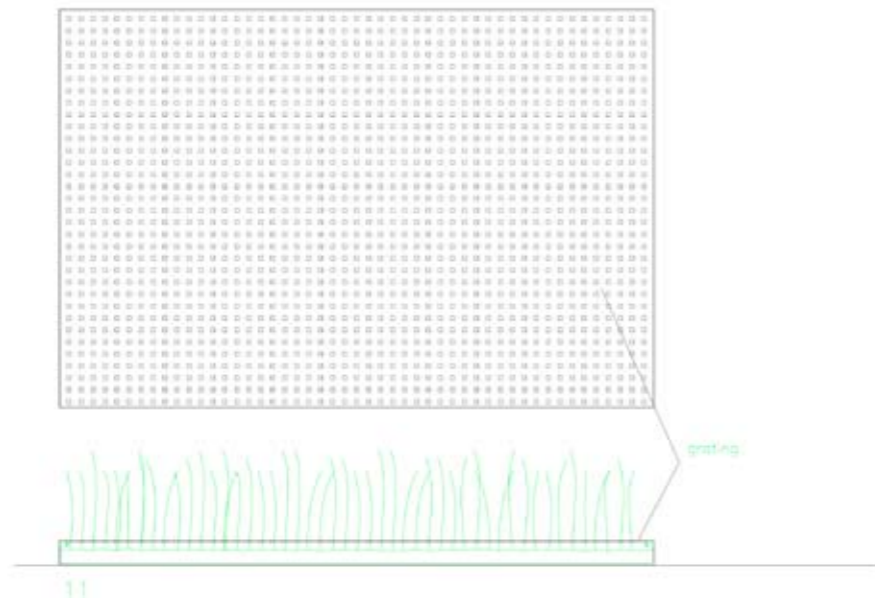
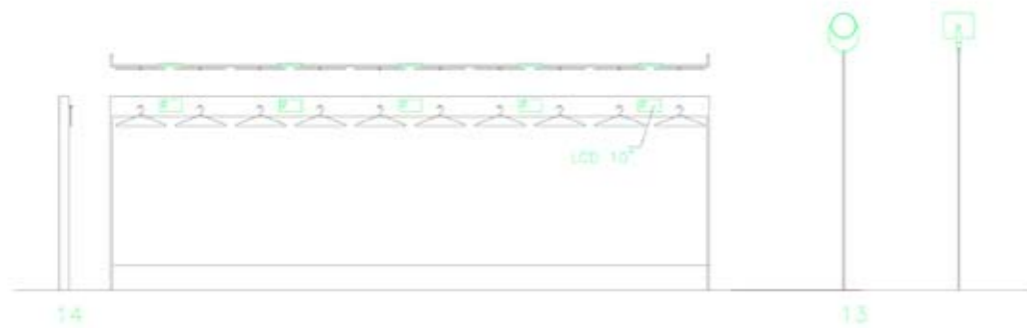
+ day

1. electromagnetic radiance, board of fluorecent blue lamps.
2. polyethylene table for uncooked fish
3. horizon of ultraviolet ray, ceiling board of UV lamps.
7. carrot field



+ cold

- 11. mint plantation
- 12. mint cordeal
- 13. fan (wind machine)
- 14. hallstand
- 16. board of fluo compact lamps



Sargasso Cloud

Environment and response

Mette Ramsgaard Thomsen

The collaborative Sargasso Cloud project by CITA (Centre for IT and Architecture) and Waterloo Architecture investigates how concepts of interactivity and responsiveness can suggest new relationships between buildings and environments. We need sustainable solutions for our built environment. But how do these challenge the way we think and design space? How do we challenge our under-

standing of sustainability from being a set of posterior technological implementations to become part of the intellectual thinking and culture of architecture? Where formalist design traditions uphold the autonomy of the architectural artefact, we ask how ideas of interfacing and actuated behaviour can allow a re-conceptualisation of core architectural terms such as context, shelter, programme and extension.

The summer school asks:

- If interactivity presents us with an inherent openness towards the exterior, how can new models of permeability and exchange challenge the way we think site and enclosure?
- If embedded actuation allows for adaptable structures, how does this challenge the primacy of permanence in architectural design?
- What are the technologies and materials that can enable the re-

alisation of this new architecture of responsiveness: what is energy, how can we harvest it and how do we exploit it?

The structure is the product of two-week intensive workshop, staged August 2009 at CITA, led by experimental architects and educators Philip Beesley and Mette Ramsgard Thomsen. Extended dialogues included researchers from the University of Southern Denmark and the Bartlett School of Architecture. Twenty-five architecture students investigated primary qualities of a responsive, sensitive architecture through cycles of making and designing, exploring models for future living architectures.

The expanded, lightweight layers within the kinetic field created within the studio are organized like a coral reef, using densely populated resilient, expanded meshworks. Calls and responses ripple throughout the environment, stirring diffuse ripples of filtered air that trickle through the space. Power cells arrayed within a bamboo and silk 'geotextile' array at the lower levels of this stratified environment create their

own power, that call the upper lightweight structure. Suspended proximity sensors and touch sensors from the upper layer register these weak signals and amplify them through arrays of micro-processor-driven actuated components that stir the air in peristaltic waves of breathing motion.

Within a layer of glass counterweights, protocell structures are formed. These serve as portents for future development of this building system. A protocell is a primordial molecular globule, situated in the environment through the laws of physics and connected through the language of chemistry. Uniquely, protocell technology possesses a material simplicity that forms through self-assembly. Yet the globule can become dynamic because it has an embedded chemical metabolism. Protocells are engineered as a material but possess life-like properties. This gives this type of matter the ability to communicate with and integrate into existing developing natural and architectural systems, imparting an ecological responsive character.

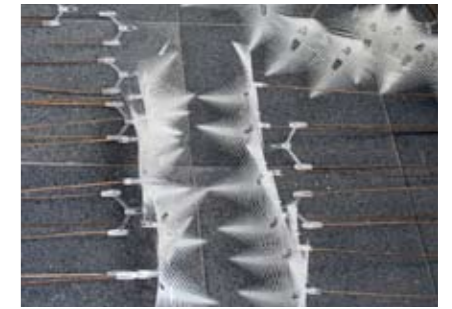
Generous support is acknowledged:

The Royal Academy of Fine Arts,
School of Architecture
Dreyers Fonden
Waterloo Architecture
Social Sciences and Humanities
Research Council
Natural Sciences and Engineering
Research Council

Also: Aalborg University, Dept. of
Architecture and Design
Center for Fundamental Living
Technology (FLinT), University of
Southern Denmark
AVATAR Group, Bartlett School of
Architecture
Interactive Architecture.org

Credits:

Waterloo: Waterloo & PBAI: Philip
Beesley, Hayley Isaacs, Rob Gorbet,
Jon Gammell, Kirsten Robinson,
Eric Bury, Andrew Edmundson,
Manuel Kretzer, Elie Nehme, Julia
Padvoiskis, Robin Paxton, Adam
Schwartzentruber, Jane Wong
CITA: Mette Ramsgard Thomsen,
Martin Tamke, Phil Ayres, Karin
Bech, Aurelie Mosse, Bartlett:
Rachel Armstrong, FLINT: Martin
Hanczyc, Hans Toftlund Nielsen.





Participating were:

Sofie Aandahl, Daniel Baumann, Max Gerthel, Kristine Jensen, Belinda Langsdalen & Frederik Seehusen from The Royal Academy of Fine Arts, School of Architecture.

Anna Beznogova, Newsha Ghaeli, Ian Huff, Lily Nourmansouri, Richard Taehyung, Simeon Rivier & Tyler Walker from the University of Waterloo.

Diana Bico, Jonathan Nestler & college tutor Stefan Neudecker from the Braunschweig University of Technology.

Professor Vera Doerk from the Academy for Fashion and Design, Hamburg.

Architect Paul Hasselberg, working for Snøhetta, Oslo.

Teacher Vincent Hui from the Ryerson University, Canada.

Architect Terry Peters from the Aarhus School of Architecture

Andrea Wong from the Bartlett School of Architecture, University College London.

College tutor Anders Deleuran, architect Isak Foged & tutor Esben Poulsen from the Aalborg University, School of Architecture and Design.



Encyclopedia - Climatic elements and meteorological compositions

Frans Drewniak &
Philippe Rahm

Today, architects are aware that one of the most important negative collateral effects of their practice is the release of greenhouse gases produced by building, heating, cooling, etc. Political and ethical responsibility connected to global warming makes reduction of these emissions one of the primary missions of the architect.

Regarding this problem two atti-

tudes are explored today by architects. The first one, a necessary but not very satisfactory one, consists of doing a “traditional” kind of architecture in a language inherited from the 21st century with modernism, post-modernism, or deconstructivism, and then adding different “green” elements. Solar panels, wind power, vegetation, renewable energy, systems for rainwater recovery, etc., are therefore added to an architectural project

like a new, ecologically correct layer on a classic design.

The second attitude, which we wanted to develop in our workshop, is the one which pays attention to the renewal of architectural language. This attitude takes onboard the technical challenges of sustainable development, not merely as a layer which is superimposed on the architecture, but as the motor of a radical renewal of



urban and architectural form, and consequently the possible invention of new functions and usages. A radical work that questions root and branch the essence of architecture and remodels its constituting elements in relation to sustainable development. The formula “form and function follow climate” might sum up this attitude. “Form and function follow climate” foregrounds the idea that architectural form and function might not precede the architectural project but come afterwards. Form and function would emerge as the formal and programmatic consequences of environmental and climatic factors, the latter becoming the driving force of the project.

The urban history of Venice provides a perfect example in which

an urban form and the uses are the unexpected consequences of a physiological need and a geographical reality: that of drinking in a place without drinking water. Venice owes its urban form and the labyrinthine multiplication of its squares, known as campi, exclusively to the absence of fresh water: built in the brackish water of the lagoon, there is neither an immediate underground source of drinking water, nor a river of fresh water. If each of us may benefit today from the charm of the campo, of their restaurant terraces, when admiring the tremendous social attractiveness of these little squares, it has to be remembered that nothing was originally conceived for such social activities. The campo is above all the space of an ingenious system for filtering rain-

water, which was then collected by a well at the centre of the square in order to be drunk. The form of these squares, their spatial dimension, is the outcome of an adequation between the quantity of rainwater that could be collected as per a certain surface area and the number of inhabitants occupying the surrounding houses who need it in order to live. The number of inhabitants is thus directly linked to the amount of rainwater collected. The latter therefore fixes a density, building heights, and a rate of occupation not according to political rules but to geographical and physiological equations. Venice is the most beautiful city in the world even though its urban structure might be, in point of fact, but a contingent response to the absence of drinking water.

Would it be possible, then, that from the prosaic techniques linked to the reduction of greenhouse-effect gases, there might emerge new landscapes and new forms as well as unforeseen uses?

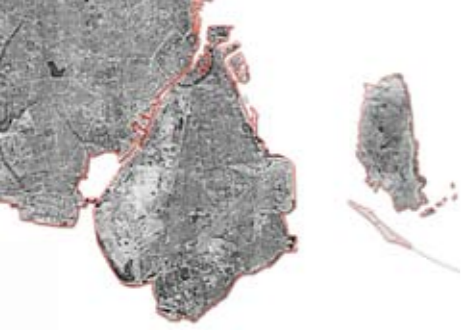
Might the lesson of Venice, in which a physiological problem has invented a kind of beauty, become the expression of a manifesto? To honestly accept the new reality of techniques linked to sustainable development, to let oneself be led without presuppositions by geographical and physiological constraints and to let oneself be surprised. To discover in this radical questioning of architectural language, the unsuspected and unforeseen forms and functions of a Venice of the 21st century. To let new forms of beauty emerge.

Architecture as meteorology opens to other dimensions and space definitions: at a large scale, it explores the atmospheric qualities of the space (temperature, air pressure, water, vapor, light, etc) as physical and chemical phenomena dealing with the new climatic building techniques like ventilation, heating, air, conditioning, insulation, radiation. On the microscopic scale, it will explore new fields of reception (cutaneous, olfactive, hormonal, digestible, breathable), as biological and chemical perceptions dealing with the invisible qualities of the environment such as air, ions, electromagnetic waves, light or radiations.

The ambition of this dictionary is to renew and reinvent the architectural language according to

weather and physiological dimensions. The dictionary adopts a traditional method of description, studies and of classification of the urban and architectural elements and compositions.

The dictionary is the result of a workshop held with more than 100 students at The Royal Danish Academy of Fine Arts, School of Architecture, department 10 in October 2009. The workshop was led by guest professor Philippe Rahm and assistant lecturer Frans Drewniak.



Resilient Cities

Copenhagen, the New Frontier

Only few weeks before COP15 dealing with climate changes, the same anxious question is present in all discussion, “What does it imply?”

The increasing awareness of climate changes and of global warming has brought the question of sustainable urbanism into the foreground. Energy saving, low CO2 emissions, environmentally friendly transportation modes are the current mantras of Eco-Urbanism. Although they are essential and relevant issues worldwide, they shadow an even more primordial and local issue regarding Danish cities: the subsistence of the coastal cities in the event of sea level rise.

Denmark with over 7000km of low-

lying coast, most of its population living in coastal cities, will be with The Netherlands one of the most affected countries in the EU and Copenhagen certainly one of the most endangered European capitals.

Undoubtedly the sustainability of Denmark depends on how its major cities will react and address the potential risk of the sea level rise. When focusing on coastal urban regions like Copenhagen, the term “sustainable city” gets a different meaning. It brings into the foreground an essential parameter that generally has been overlooked in the 20th century: durability.

At a time when most buildings are conceived for a life expectancy of

40 years and infrastructures for a life expectancy of 150 years, vital infrastructures such as water barriers force us to think much further and reconsider our decisions not as disposable future but as durable foundation and as conditions for securing the future.

The model presented here is part of a PhD research titled “Copenhagen, Resilient City”. This research investigates which infrastructure could be designed to foster a durable and sustainable development of the Danish Capital region under the threat of a sea level rise. How the threat of catastrophe can be turned into a catalyser for a positive redeployment of the city? After the wake of industrialisation and deindustrialisation could the rise of the sea level become the



best opportunity for Copenhagen as a coastal city to reweave a qualitative and sustainable dialogue with the sea?

The expected geographical, economical, social, environmental, and cultural impacts of such an infrastructure are deep enough to create the opportunity of rethinking the coastal urbanism of Copenhagen. In our times of rapid economical, societal, and environmental changes, flexibility, adaptability and evolutionarity are the conditions of durability. This research approaches the littoral not as a fixed and linear boundary but as a territory animated on one hand by the cycles of the sea level and on the other hand by the development cycles of the city. Like the floods of the river Nile ferti-

lising the ground, the rise of sea level is understood as a process of “urban fertilisation” creating new conditions and opportunity to generate a qualitative encounter between the land and the sea.

The model presented shows in animation the evolution of the littoral zone of Copenhagen. The cycles are timed on the tempo of a human breathing at a resting position. This recognisable rhythm conveys on one hand the sense of calmness and the slowness of large-scale natural phenomena such as the rise of sea level and on the other hand underpins the fragility of life.

The research is funded by the Danish Ministry of Science Technology and Innovation and held at the

Research Institute 3 of the Royal Danish Academy of Fine Arts; it runs for a period of three years.

Charles Bessard is currently undertaking a PhD research titled “Copenhagen, Resilient City” at The Royal Danish Academy of Fine Arts, School of Architecture, Institute 3. He is also the co-founder of the Powerhouse Company, a design office specialised in architecture planning and research based in Copenhagen and Rotterdam.

Sustainable Living

a student competition

Anne Beim

Sustainable Living refers to the human responsibility of creating and developing physical settings and ways of living which ensure a sustainable consumption of natural resources, without polluting or exterminating the natural species. The ambition of this student competition has been to root the complex concept of sustainability in the minds and working processes of the architectural students at the Roy-

al Danish Academy of Fine Arts – School of Architecture. Secondly, it also tries to invigorate the general discussion at the school and among professional architects on how to develop architectural edifice, human settlements, and societies in the future.

When designing our physical surroundings, the architect creates the settings and conditions of our daily life. In this way the architect contributes to the defining of the

possibilities that the individual has for acting sustainably. Cities and buildings are not passive frameworks of given functions, but critical aspects in the creation of living patterns and habits that form our every day lives. The physical designs that we are surrounded by have a direct impact on our living conditions and activities. Hence, architecture is a key to sustainable ways of living in future society on all levels and scales.

For the competition 111 proposals were handed in and approved. The projects were mainly focused on human aspects, nature, technology, and their interrelations.

Sustainable Living was meant as a conceptual competition, however, most projects were quite pragmatic answers to the brief. In that sense the majority of the projects do not seriously challenge the concept of space, but stick to a classical/conventional perception of architecture. Also the role of technology could have been stressed further and confronted in terms discussing the value and the use of existing technologies. All together, the jury found that the aspects of living sustainably – the very core of the competition – could have been discussed much more critically.

Partly this could be explained by the difficulties of defining sustainability in general. The concept has unfortunately over the past centuries become a buzzword, as innovation was a few years ago. Extensive use or misuse of the concept blur the meaning, resulting in misunderstanding or misinterpretation of the core of the problem.

However, there is a growing awareness towards the fact that we cannot continue down the road we have been chasing over the past 50 years. A revolutionary progress only seems possible by full integration of various fields of knowledge in order to accomplish a true sustainable culture.

The proposals were evaluated according to different themes or

ways of looking at sustainability: Contextual and cultural sustainability; social sustainability; methodological sustainability; technological or environmental sustainability.

Most of the projects concentrate on aspects of contextual and cultural sustainability and merely few manage to unfold and integrate several themes convincingly. The awarded projects reflect a range of themes, and consequently there is neither a single first prize, nor a single second, nor a third prize – but three first prizes, three second prizes and four third prizes. Furthermore, there are seven honourable mentions; so we are proud to present a total of 17 awards!

Sustainable Living Winners

1st Prize

- Filsø - Transformation of a Cultural Landscape
Signe Jul Andersen
- The Habitability of Industrial Environments
Trude Mardal
- Linking the Complex City
Hanna Birgisdottir and Magnus Reffs Kramhøft

2nd Prize

- Meme/Monad The Memory about the Sustainable Room
Madeleine Sembring
- The Landscape of Events; Studies of an Adaptive Architecture
Frederik Emil Seehusen
- A Sustainable Idea of the Building Envelope as the

Human Skin

Frederikke Hallundbæk Gregersen

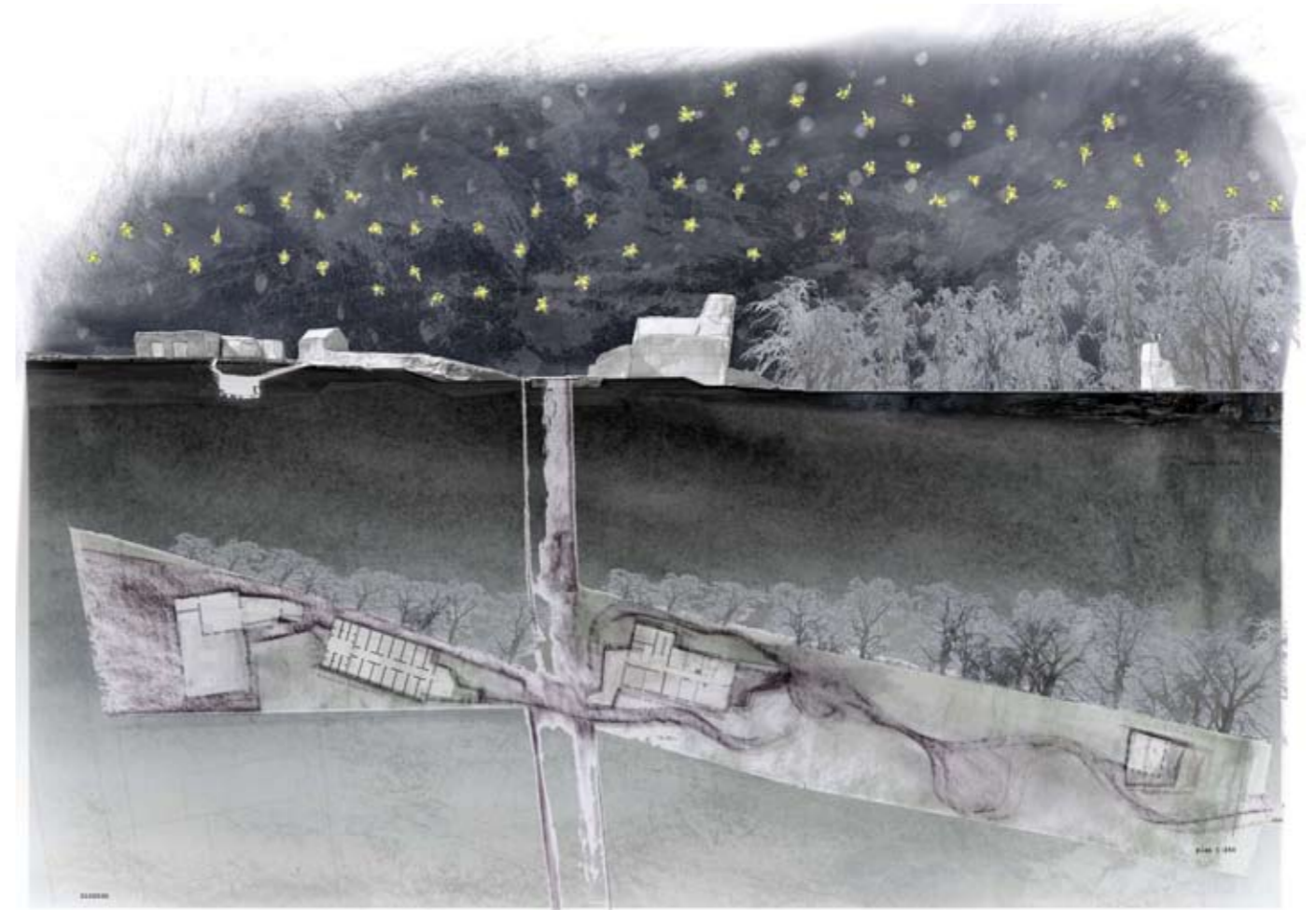
3rd Prize

- Inhabited Bridges of Nature
Morten Schultz
- Arctic Compact House
Kasper Lyneborg
- Suburban Morphosis
Sandra Gonon
- Managing Sustainable Development
Martin Winther Nielsen and Esben Thorlacius

Honourable mention

- Windmills along the Roads
Louise de la Motte Berg
- Abildgaarden
Anders Suhr Laustsen
- Living in Urban Gaps
Amanda Hedman

- Centre of Renewable Energy
Mads Nygaard
- The Vertical Farm
Jesper Bendix Andreasen
- Cluster
Aet Ader
- Large: 'Visions - Situations - Prospects'
Pernille Faber, Mikkel Kjærgaard Christiansen, Flemming Strandsbjerg, Martin Toyberg-Frandzen, Jakob Faaborg Hattesen, Zazia Wihlborg Bigom





A greener city adapted to the sustainable road users



A greener city with a new and living urban environment

THE MICRO HUB

The system are made for the daily usage. It's a local hub to accommodate the daily needs. The electrical car for work, the packages send from abroad and the staple goods ordered on the internet the day before.

Every hub are build in a fixed modular system of boxes. It is made of galvanized steel, and has of rough and weather-resistant looks. On most of the naked surface planes, a planting dissolves the cold exterior.



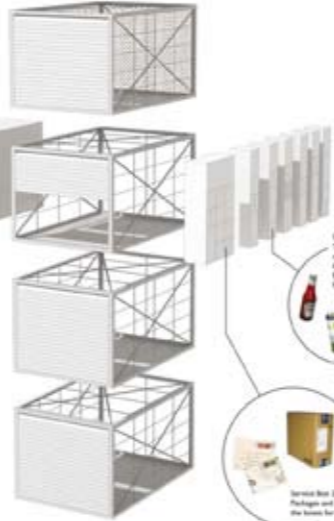
Boxes are raised to fit in the form houses completion



Bicycle parking
For the commuters to park their bikes and for the public rental ones



Car parking
The public electric cars are located on the corners and fully equipped when needed



Service Box 1
The daily staple goods are packed and delivered in a chilled box to keep the food fresh when needed. Everything can be collected online from home.

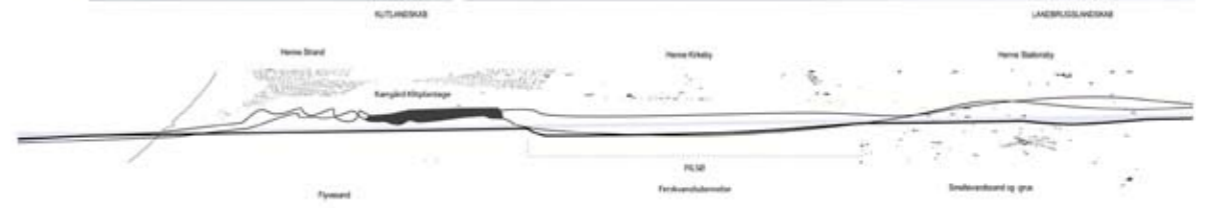


Recycling
The resources of used items such as batteries, bottles, cardboard, cans and papers are gathered in a single box, with appropriate marks for every object.

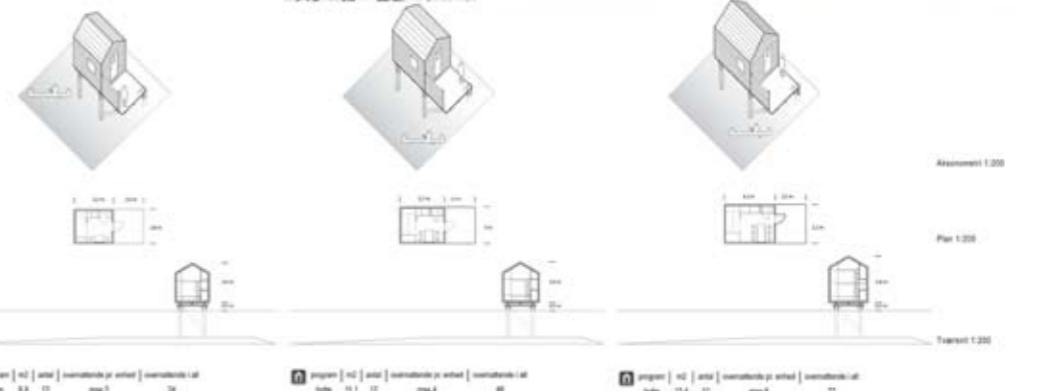
Service Box 2
Packages and deliveries are placed in the boxes for pick-up.



The system situated together in an urban context



SPØR De nye rekreative elementer fortæller sig til dem nye natur og den rum og karakter. Det mest markante træk er valget af lys og mørke, der bliver udsendt ud over den nye belysning på de nye vandkantede strukturer. Herfra kan man opleve det store rummelige rum og den store og den store lys og mørke. Dermed udfordring og udfordring lærer sig den nye lys og udfordring der udfordrer i deres planlægning. Systemet er planlagt med en gennemsnitslængde på 100 m væksten mellem 02 og 200 m. Denne system sig til samme generelle udgangspunkt, der giver mulighed for at give rekreative tætte rum i overgangen mellem kanten og søens store rum.





visualisering av livsbilbyggplanens rum



idrottsby



lundensvatten på floden



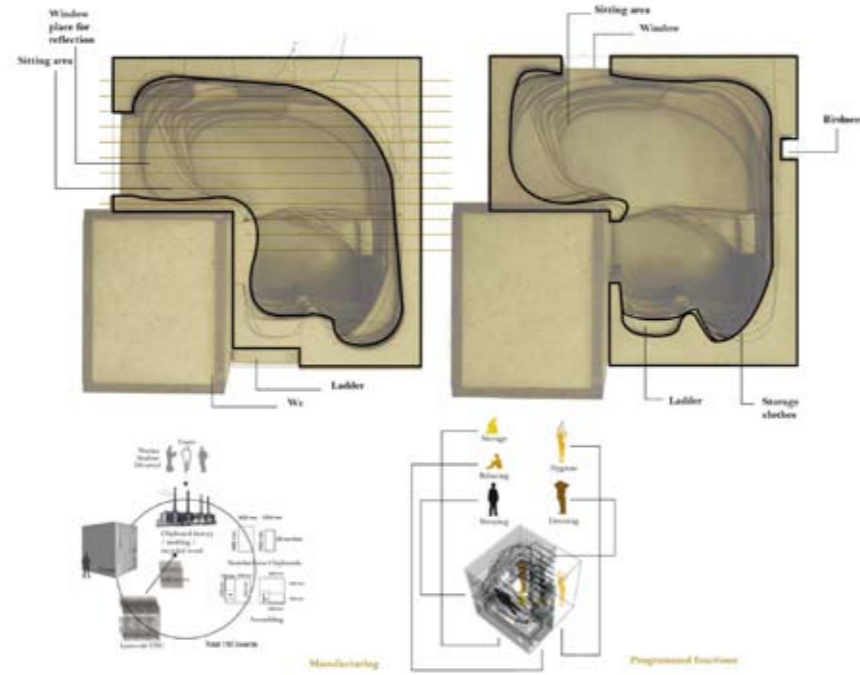
The collage consists of several elements:

- Top Left:** A technical architectural drawing showing a grid-like structure.
- Top Right:** A photograph of a white, rectangular structure with a grid-like pattern, possibly a prototype or material sample.
- Middle Left:** A photograph of a white, textured material, possibly a fabric or paper-based material.
- Middle Center:** A photograph of a white, textured material with a grid-like pattern, similar to the one in the top right.
- Middle Right:** A photograph of a white, textured material with a grid-like pattern, similar to the one in the top right.
- Bottom Left:** A photograph of a white, textured material with a grid-like pattern, similar to the one in the top right.
- Bottom Center:** A photograph of a white, textured material with a grid-like pattern, similar to the one in the top right.
- Bottom Right:** A photograph of a white, textured material with a grid-like pattern, similar to the one in the top right.

Text annotations within the collage:

- Top Left:** "The material can be used in a variety of ways, depending on the weight of the material. The structure is designed to maintain an equilibrium of a material in the space."
- Middle Left:** "These include the layered fabric, which is made of a material that can be used in a variety of ways, depending on the weight of the material. The structure is designed to maintain an equilibrium of a material in the space."
- Middle Right:** "The structure is designed to maintain an equilibrium of a material in the space. The structure is designed to maintain an equilibrium of a material in the space."
- Bottom Left:** "The structure is designed to maintain an equilibrium of a material in the space. The structure is designed to maintain an equilibrium of a material in the space."
- Bottom Center:** "The structure is designed to maintain an equilibrium of a material in the space. The structure is designed to maintain an equilibrium of a material in the space."
- Bottom Right:** "The structure is designed to maintain an equilibrium of a material in the space. The structure is designed to maintain an equilibrium of a material in the space."

Living in Urban Gaps
Amanda Hedman



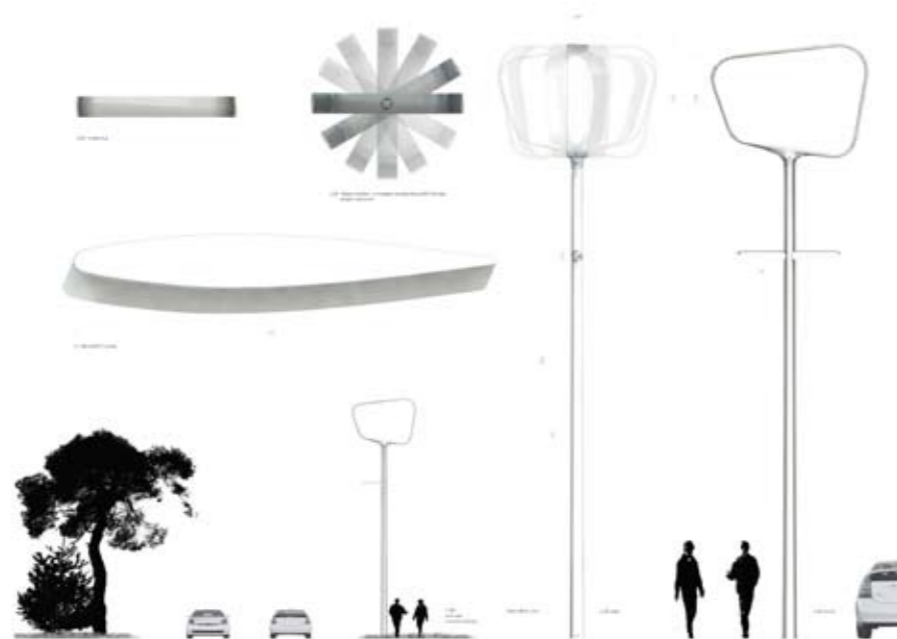
Cluster
Aet Ader



ORGANIZATION

On the other side there are more private functions. Kitchen is shared between 2 parents, dining and livingroom between 4 and laundry between 8 parents and their children. So it's like a matrix of shared space. The bedroom units for every member are connected to shared space.

Windmills along the Roads
Louise de la Motte Berg



Centre for Sustainable Energy
Mads Nygaard



PRODUKTION PÅ ÅRSBASIS:
 150.000 LITER BIOETHANOL
 75 TONN BIOMASSA
 10.000 KWH/ÅR
 75 TONN VED/ÅR
 1000 TONN
 1000 TONN

Illustrations:

Page 6: *Climate and Architecture*,

Torben Dahl, Routledge, 2009

Page 10-22: Philippe Rahm

Page 25-29: CITA, School of Architecture,

Copenhagen

Page 31: Philippe Rahm

Page 34-35: Charles Bessard

Page 36: Peter Sørensen

Page 41-47: Student Competition

Sustainable Living