Design with Climate Change

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Architectural Engineering, University of Parma +
Institute of Architectural Technology, The Royal Danish Academy,
School of Architecture, Copenhagen, Denmark

Associate Professor of Climate Change and Regenerative Architecture. The University of Parma
2020

Associate Professor of Sustainable Design. Institute of Architectural Technology (now part-time)
The Royal Danish Academy. Since May 2010

Invited Professor at ETH. Future Cities Lab Singapore
2019

Visiting Researcher at EPFL
2016 / 2017

Visiting Professor at Architectural Association
2013

Visiting Professor at The University of Nottingham
2015

architectural and science researcher at UC Berkeley, CED, College Of Environmental Design
2012

architectural and science researcher at LBNL
2011

Sustainable Design Tools Development Consultant for Autodesk
2010 – 2012

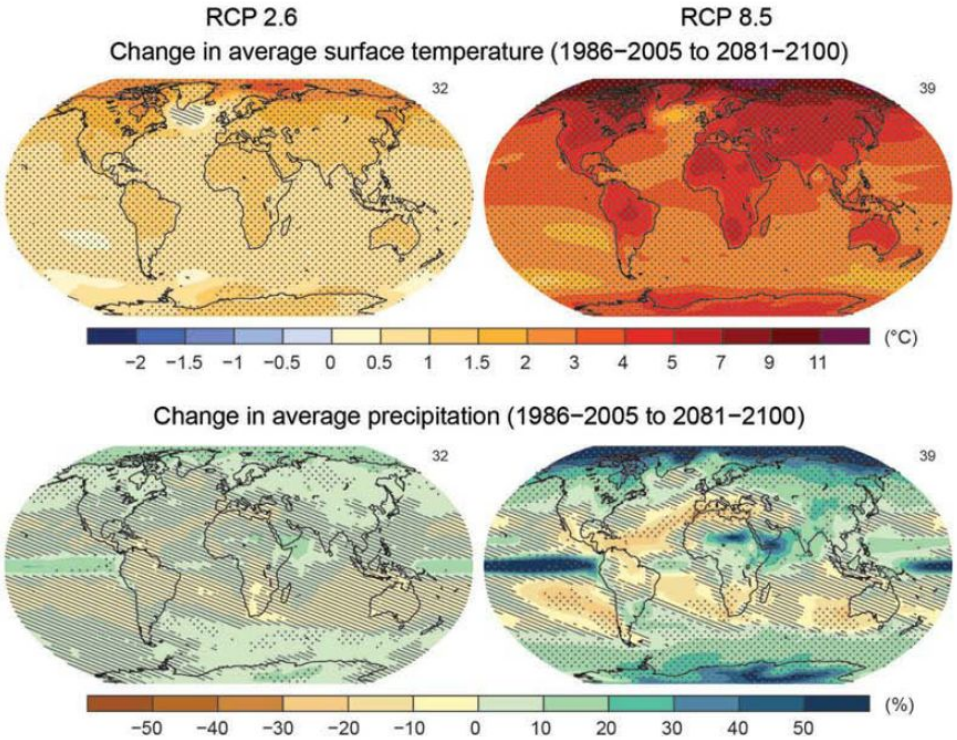
Sustainable Design Specialist at SOM (Skidmore Owings and Merrill, Llp)
2006 – 2010

Sustainable Design Specialist William McDonough and Loisos + Ubbelhode
2005

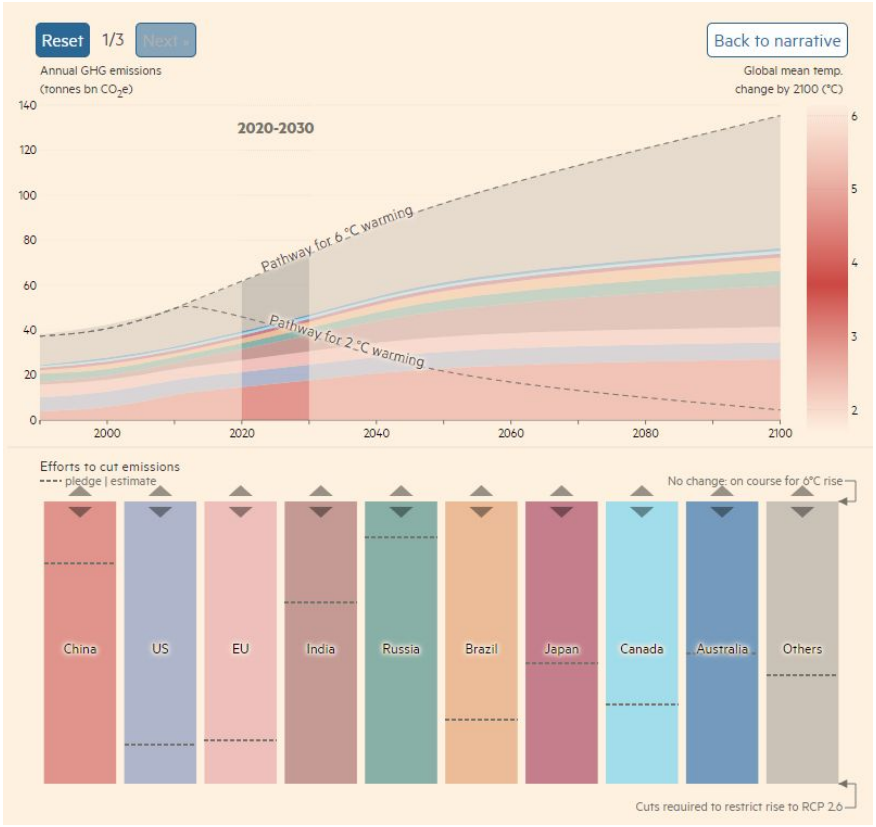
Gehry Technology Spin-off
2005

Phd Building Science, Politecnico di Milano + University of California
2005

Representative concentration Pathways

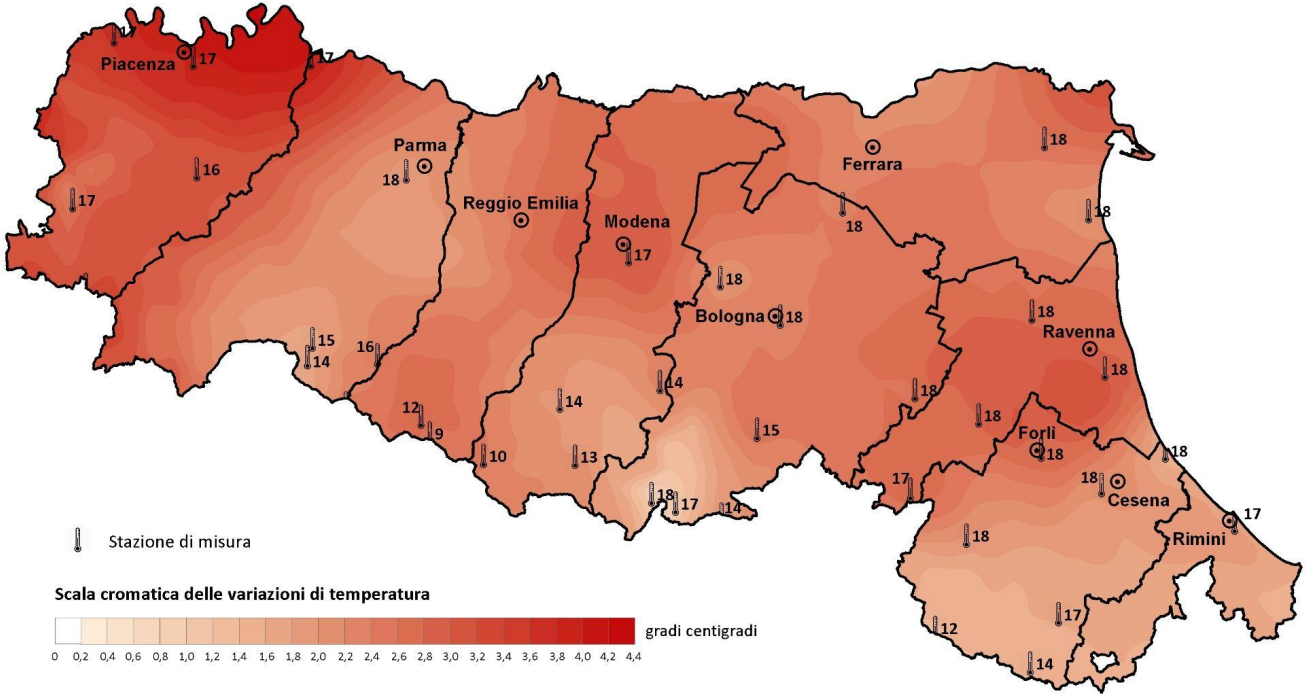


https://ig.ft.com/sites/climate-change-calculator/



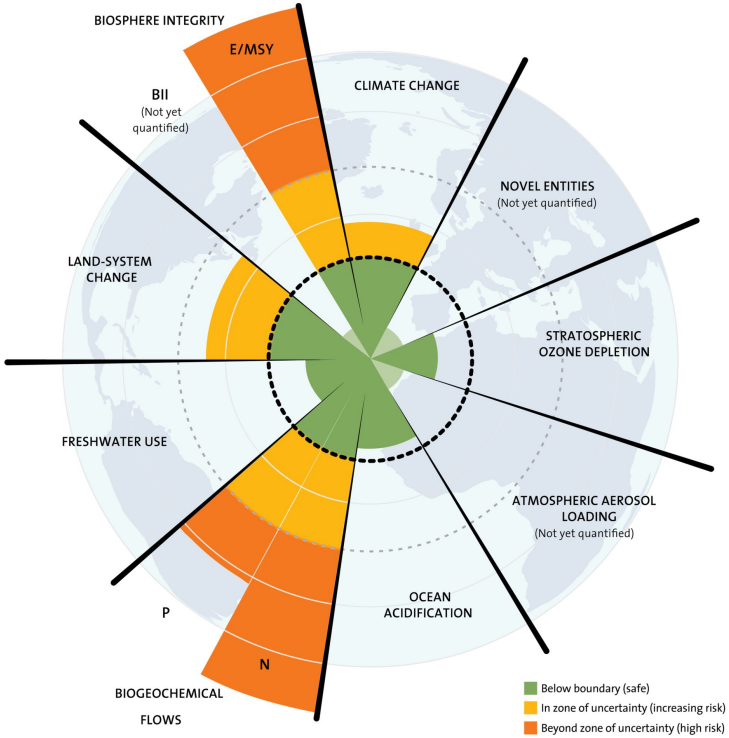
Local Changes Given by Climate Change

(Arpae Emilia Romagna - Italy)



Breaking Planet Boundaries

(Stockholm Resilience Center)




BREAKING
BOUNDARIES
THE SCIENCE OF OUR PLANET
NETFLIX | 4 JUNE

Thank you so much
Mrs. Brundtland

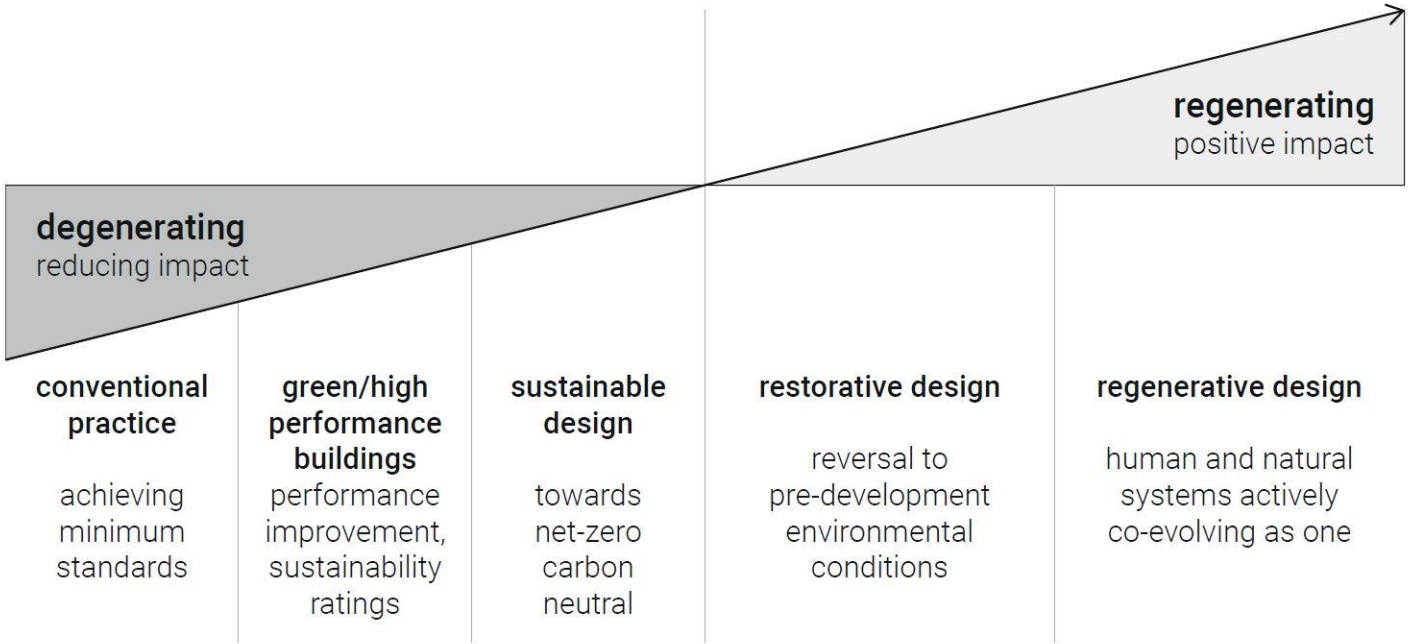
- 1987

"*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*“

No, it’s not enough. And if it was nothing but an oxymoron?

Photo: Skoll Foundation

From Sustainable to Regenerative

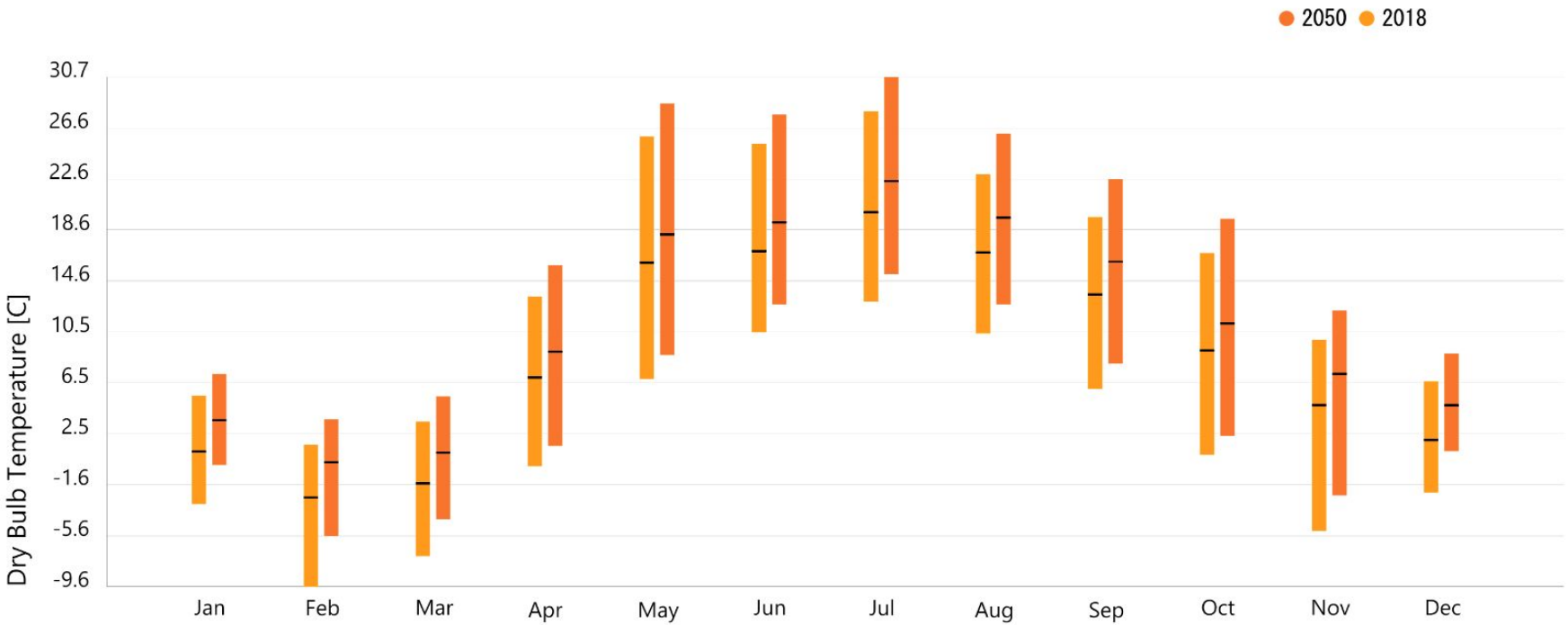


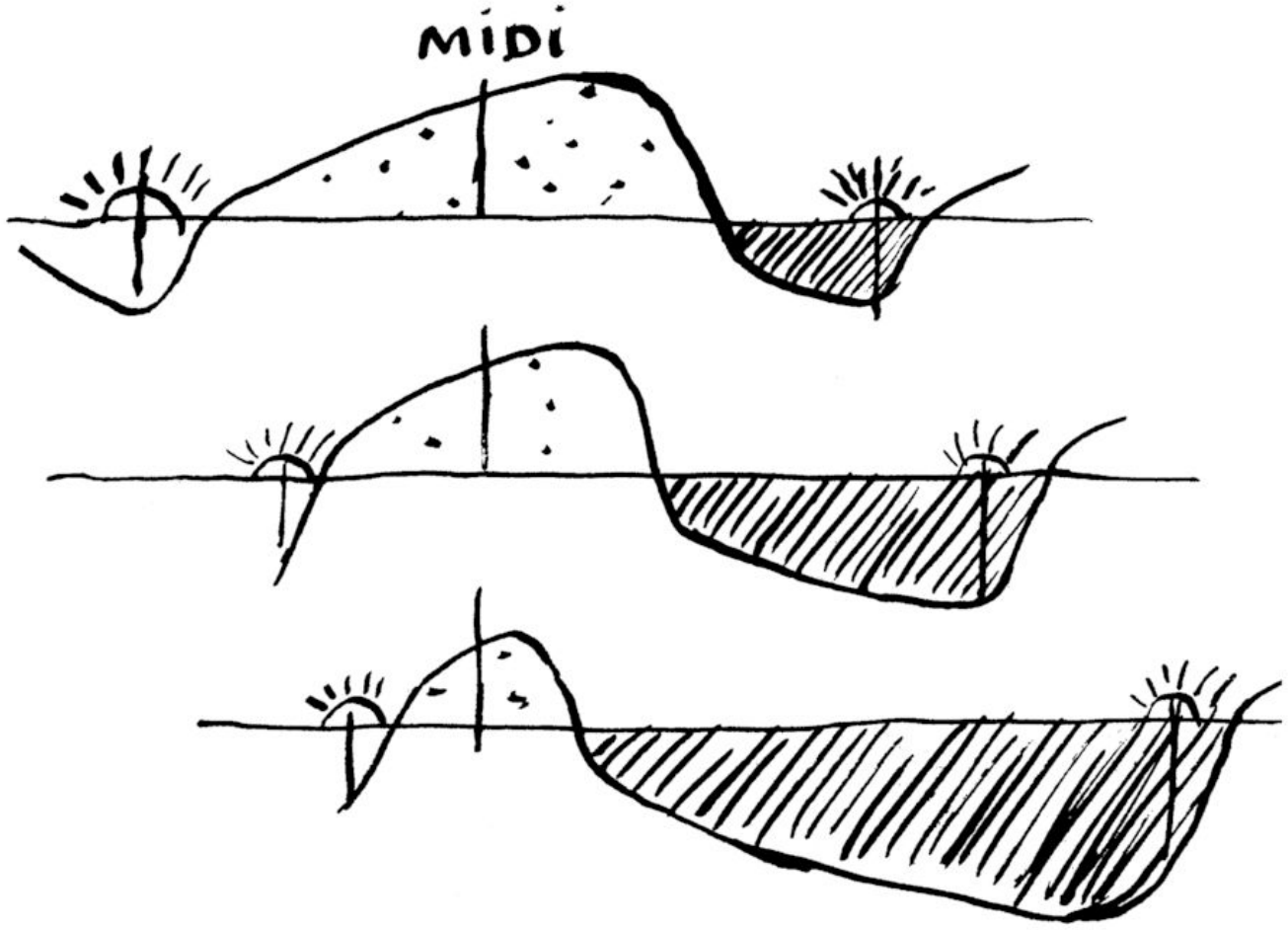
The 10 Scales of Architecture of Climate Change

1) Mesoscale
2) Large District
3) Block
4) Outdoor
5) Outdoor / Indoor
6) Building Form
7) Facade design
8) Retrofit
9) the issue of insulation
10) Personal Devices

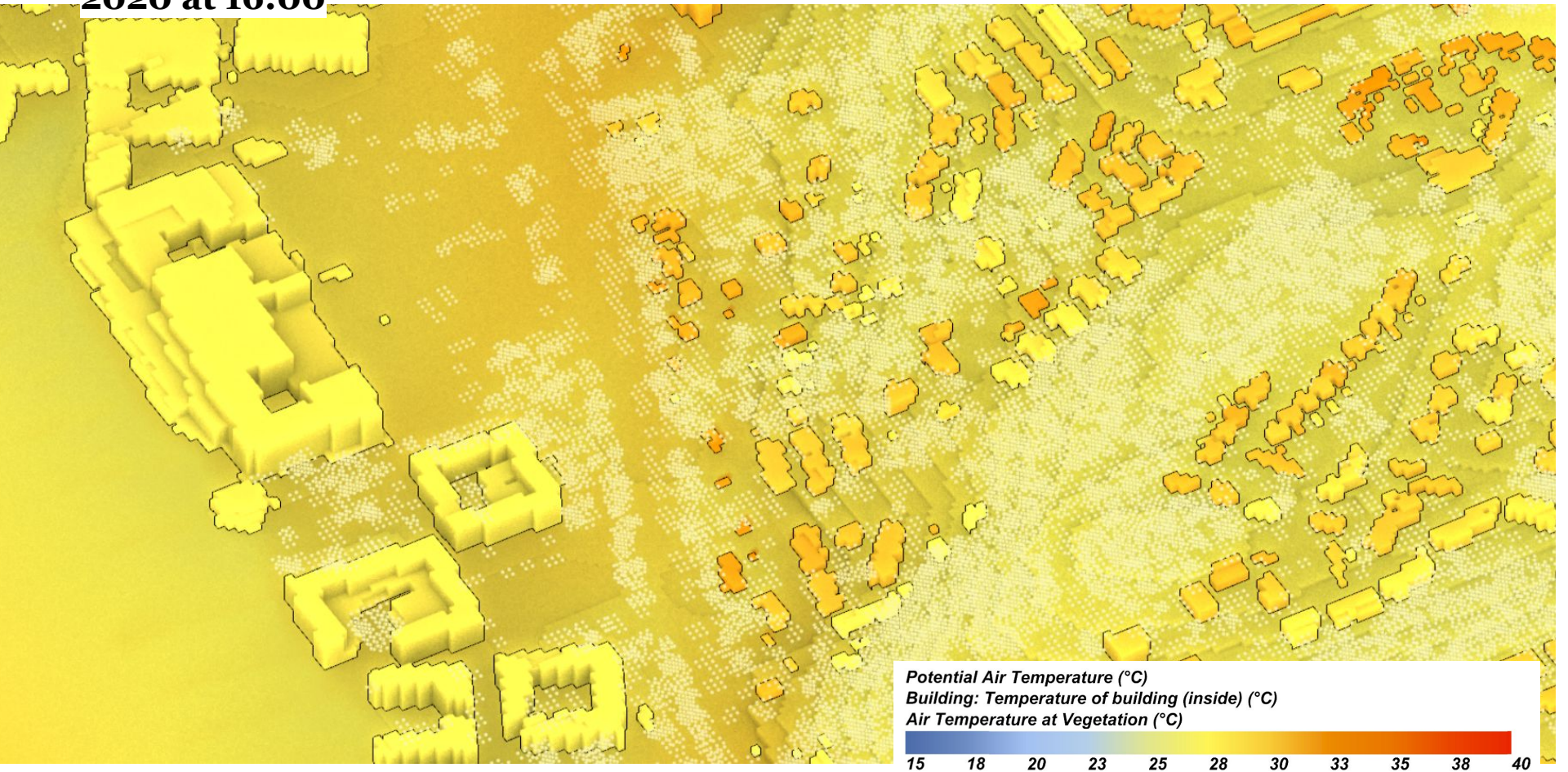
1) MESOSCALE

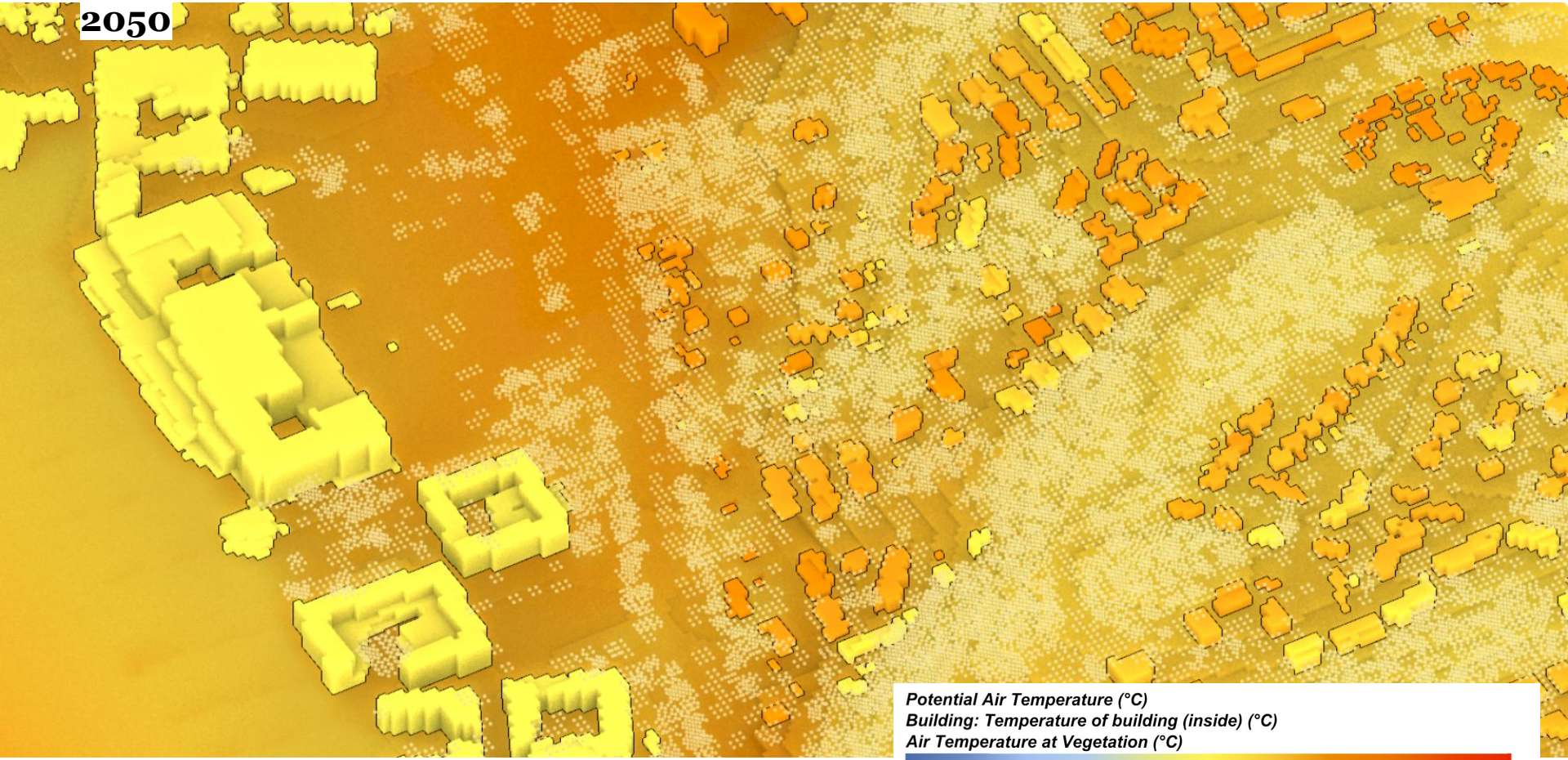
Dry Bulb Temperature



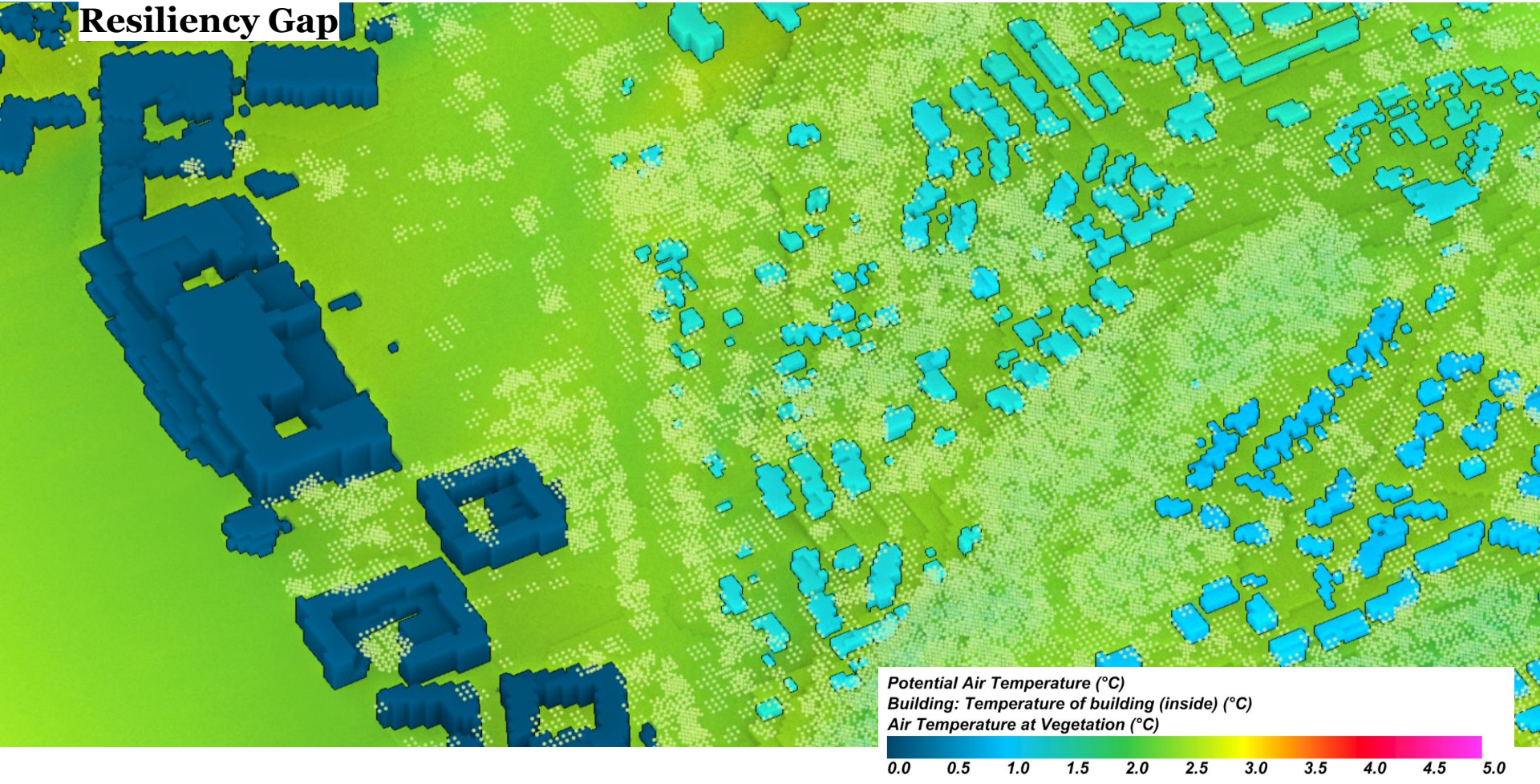

MIDI

2020 at 16:00


Potential Air Temperature (°C)
Building: Temperature of building (inside) (°C)
Air Temperature at Vegetation (°C)
15 18 20 23 25 28 30 33 35 38 40


2050
Potential Air Temperature (°C)
Building: Temperature of building (inside) (°C)
Air Temperature at Vegetation (°C)
15 18 20 23 25 28 30 33 35 38 40

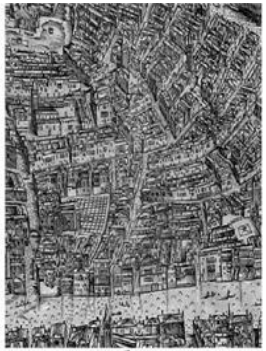
Resiliency Gap



Venetian Campi Resilience to Climate Change

Complex case. Geometrically and Thermodynamically

a



b

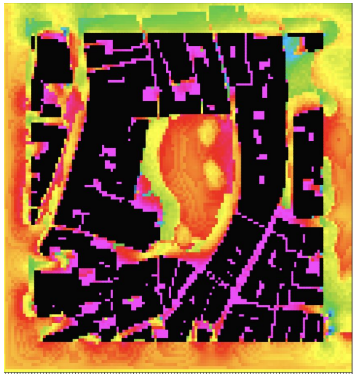
c

d

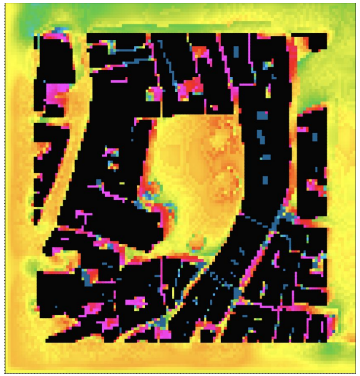
e

Aerial view of Venice (a); San Polo in de' Barbari illustration (1541) (b); view of San Polo (c); SS. Giovanni e Paolo in de' Barbari (1541) illustration (d); view of SS. Giovanni e Paolo (c).

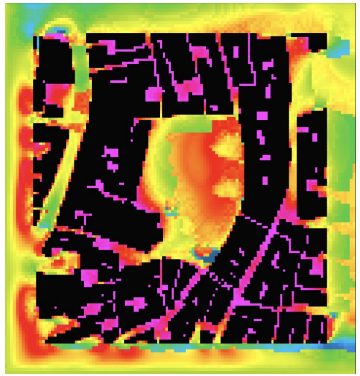
Thermal Resilience: Current (2020) and projected scenario (2050) PET delta



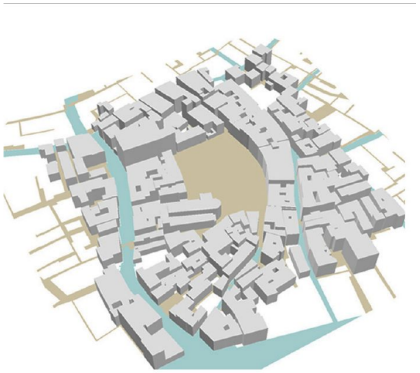
San Polo PET h:10

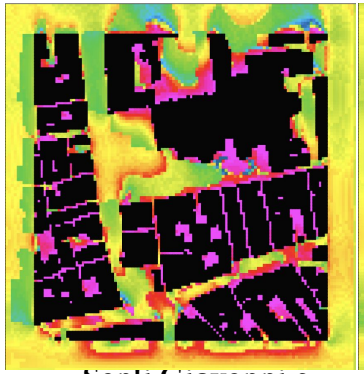


h:13

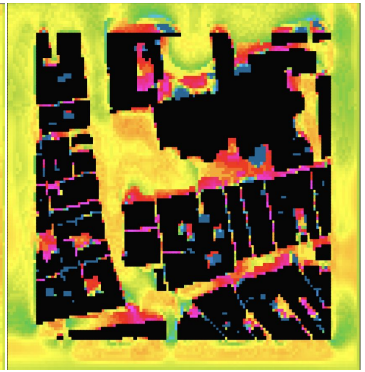


h:16

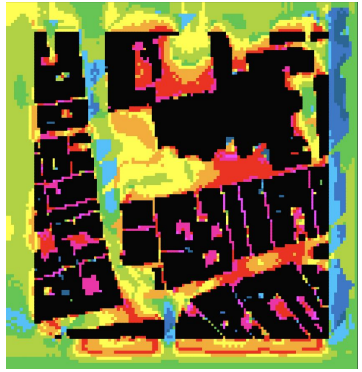




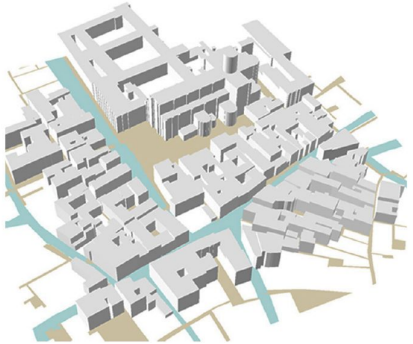
Santi Giovanni e Paolo PET h:10

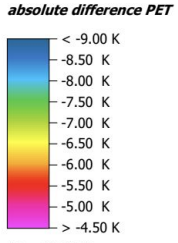


h:13



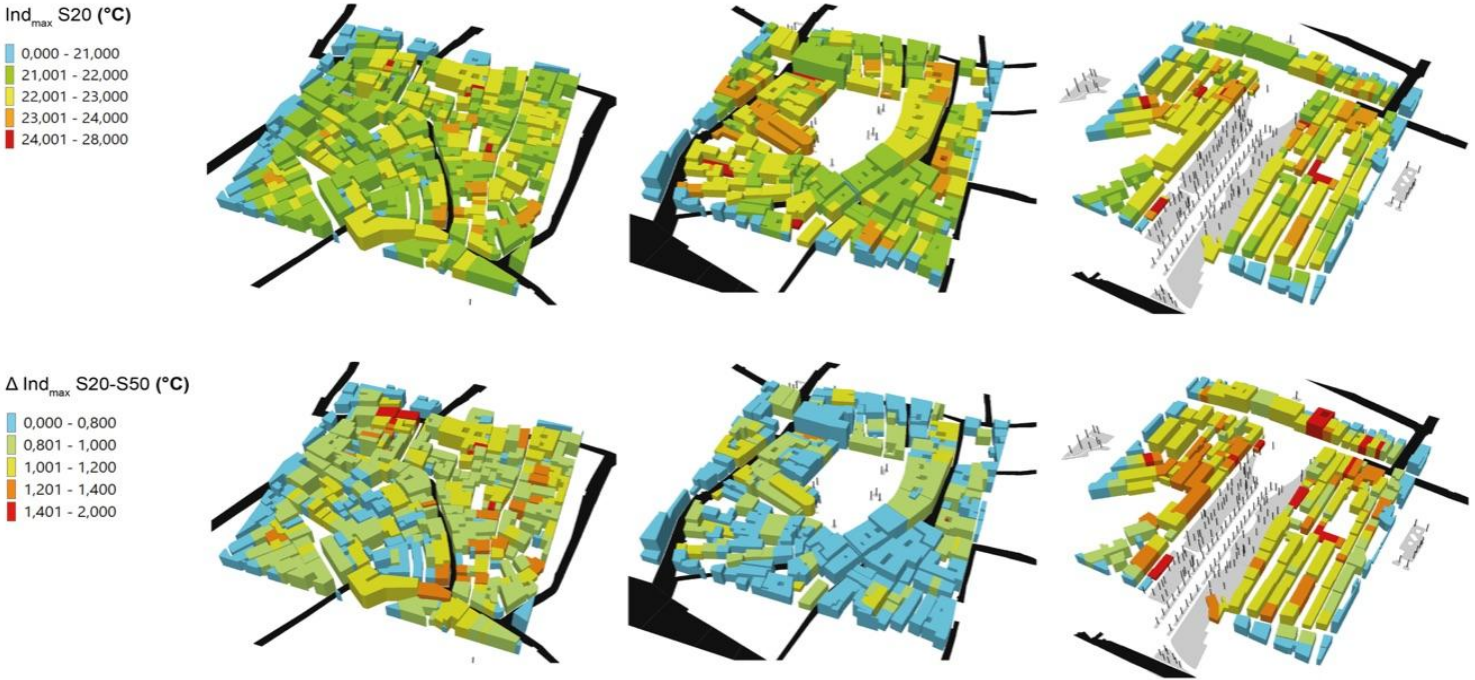
h:16





Building Resilience

average outdoor temperatures in 2050 (avg. 6°C), all the fabrics maintain relatively low indoor temperatures (avg 0.7°C, range 2°C)
the higher the urban fabric compactness, the lower the frequency of high indoor temperatures

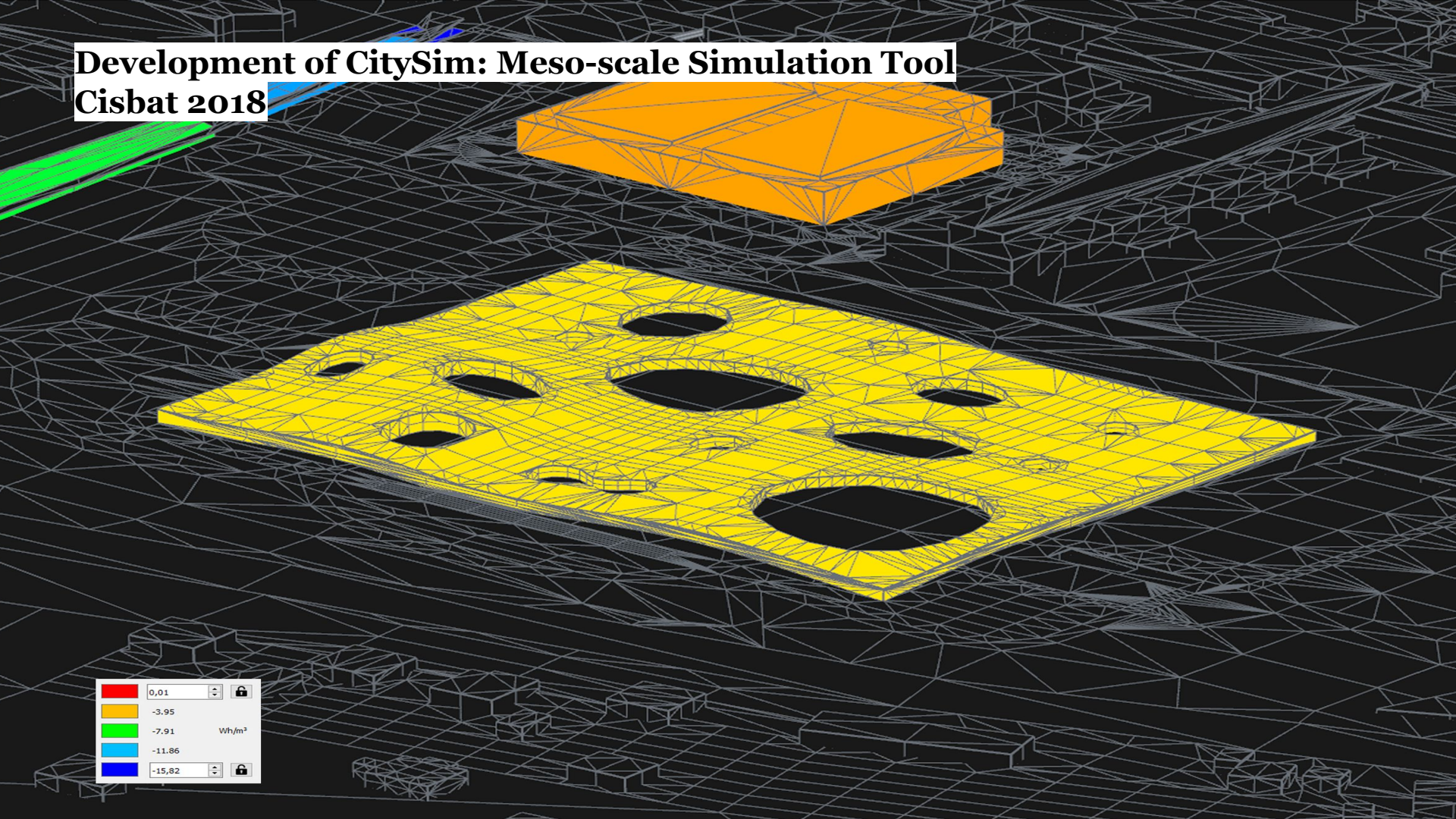


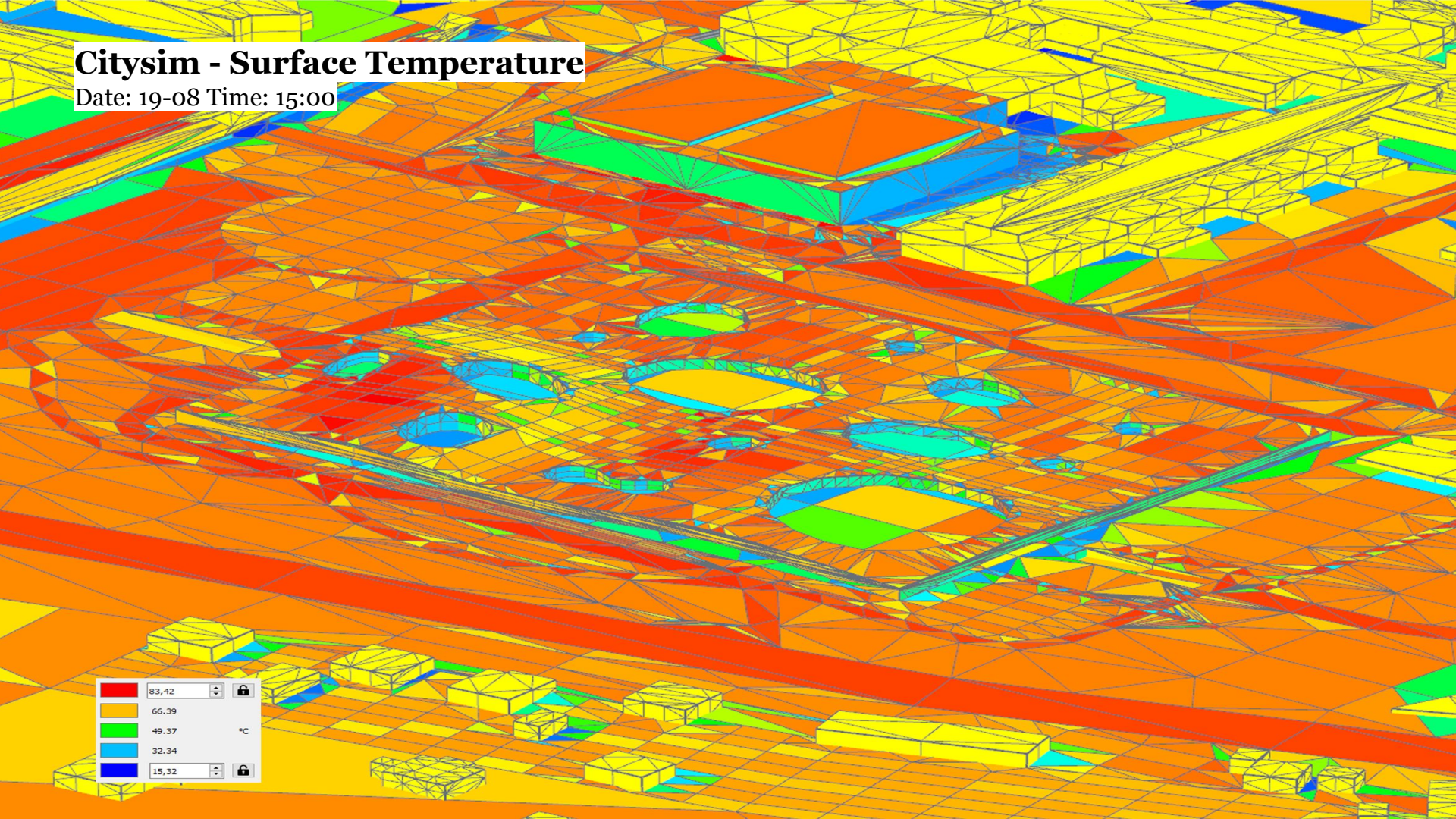
2) LARGE DISTRICT

EPFL Campus Regenerative Design Tools Development

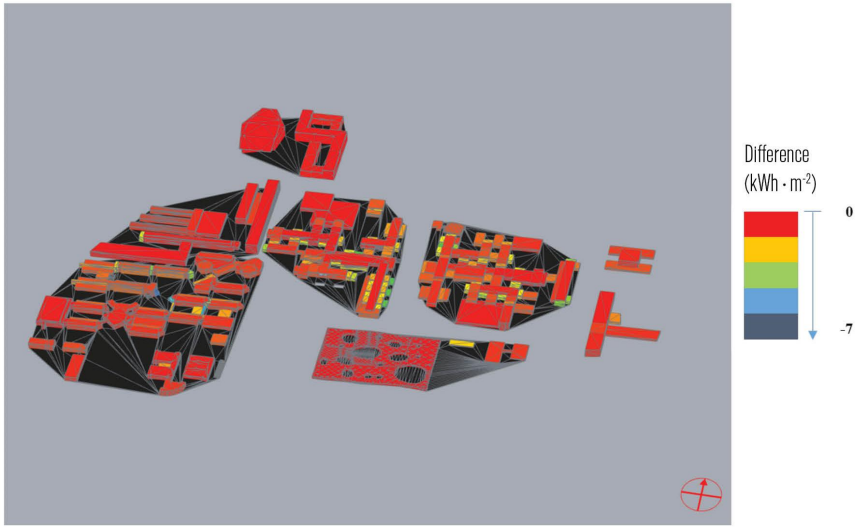
Complex case. Geometrically and Thermodynamically

Development of CitySim: Meso-scale Simulation Tool
Cisbat 2018

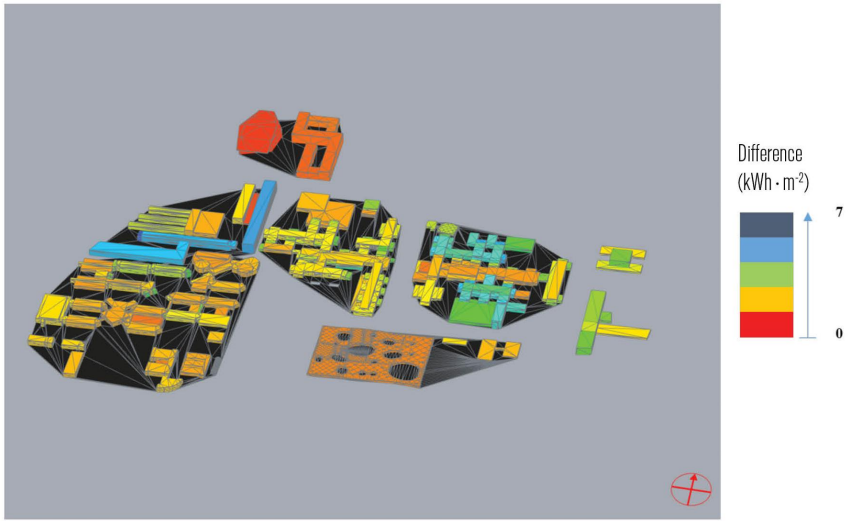



Citysim - Surface Temperature
Date: 19-08 Time: 15:00
83,42
66.39
49.37
°C
32.34
15,32

What will happen in 2039 as compared to today

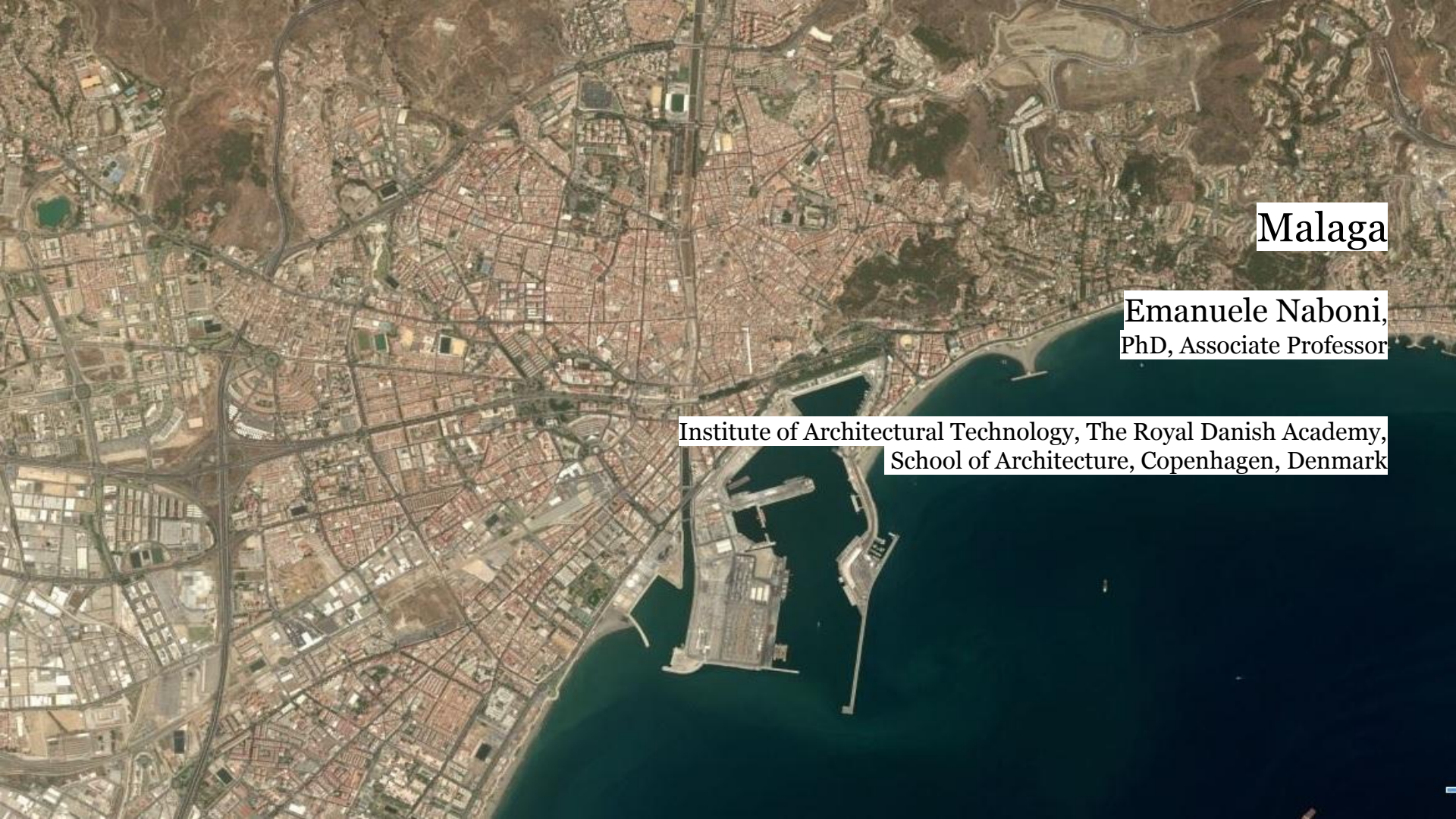


Difference in Heating Demand for 2039



Difference in Cooling Demand for 2039

3 Urban BLOCK



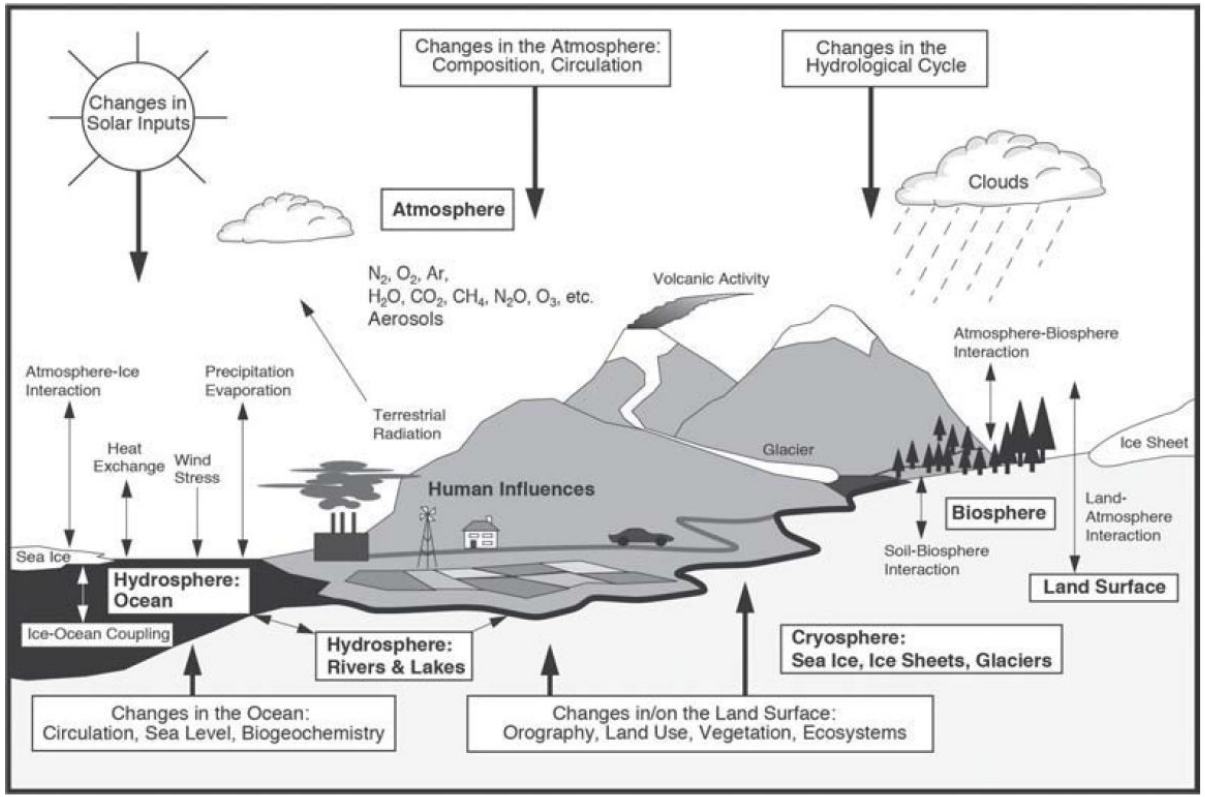
Malaga

Emanuele Naboni,
PhD, Associate Professor

Institute of Architectural Technology, The Royal Danish Academy,
School of Architecture, Copenhagen, Denmark

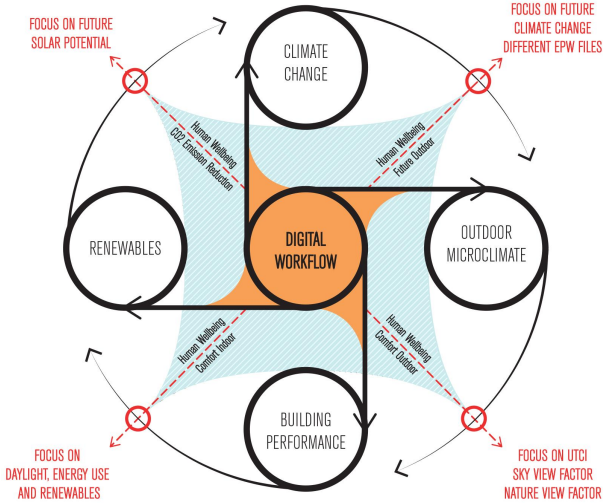

MIMART

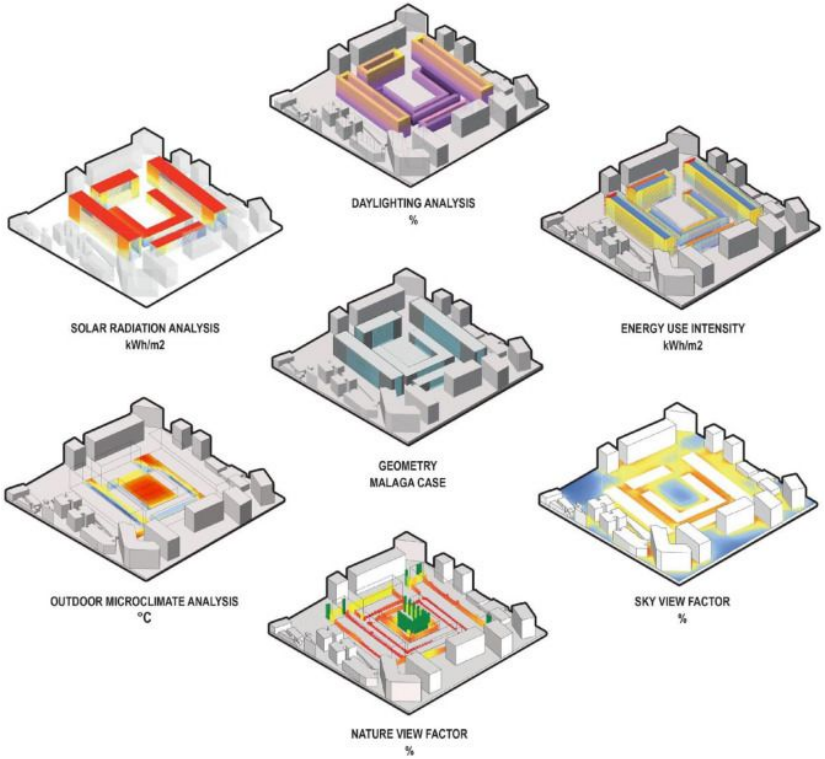
Changes Given by Climate Change



Towards multiple Regenerative Performance Integration

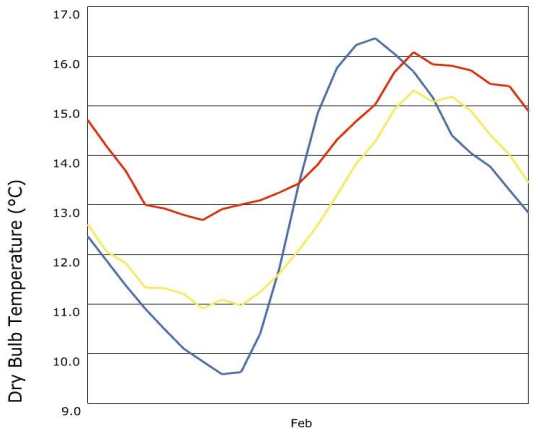
with TUM and Pietro Florio



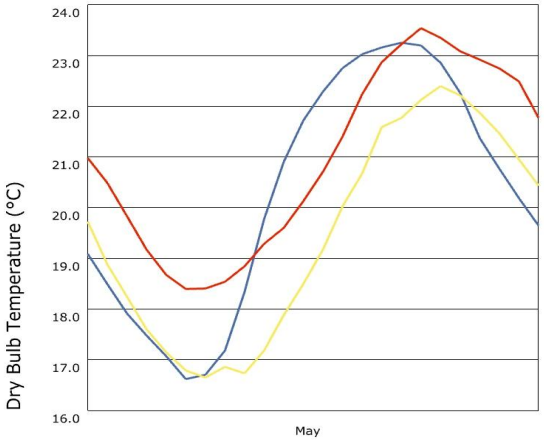


Comparison with Future Weather Files

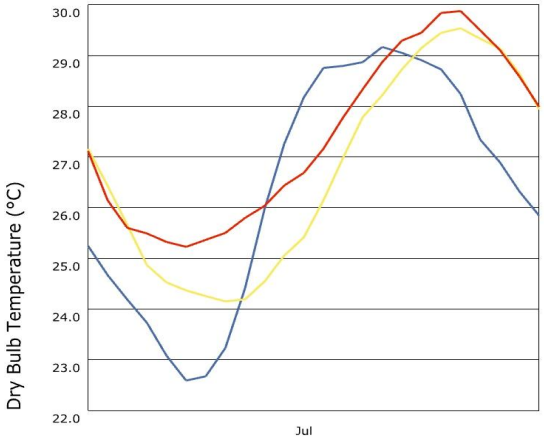
Cold Month

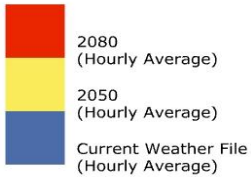


Typical Spring Month

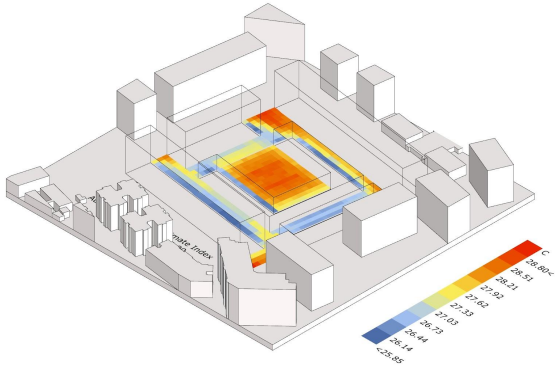


Hot Month

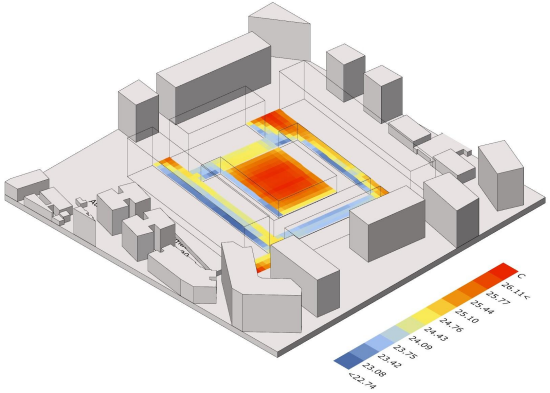




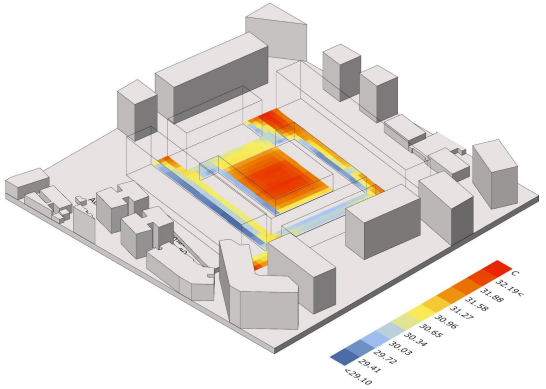
UTCI Variation in Hot Week (2018/55/85)



2018

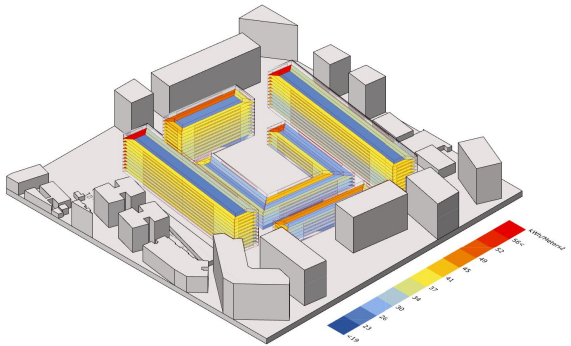


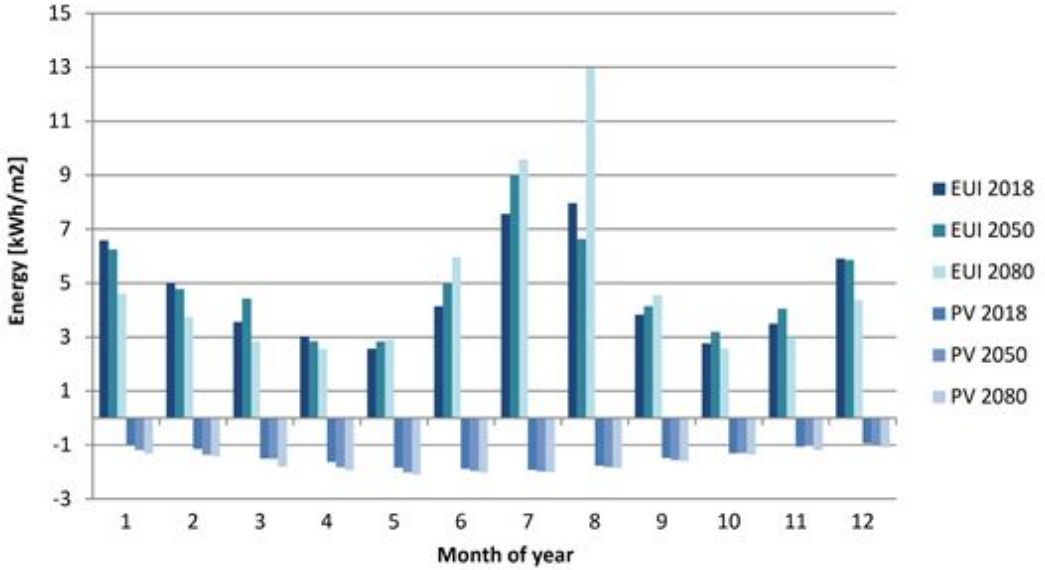
2055



2085

Energy Use Intensity and Climate Change





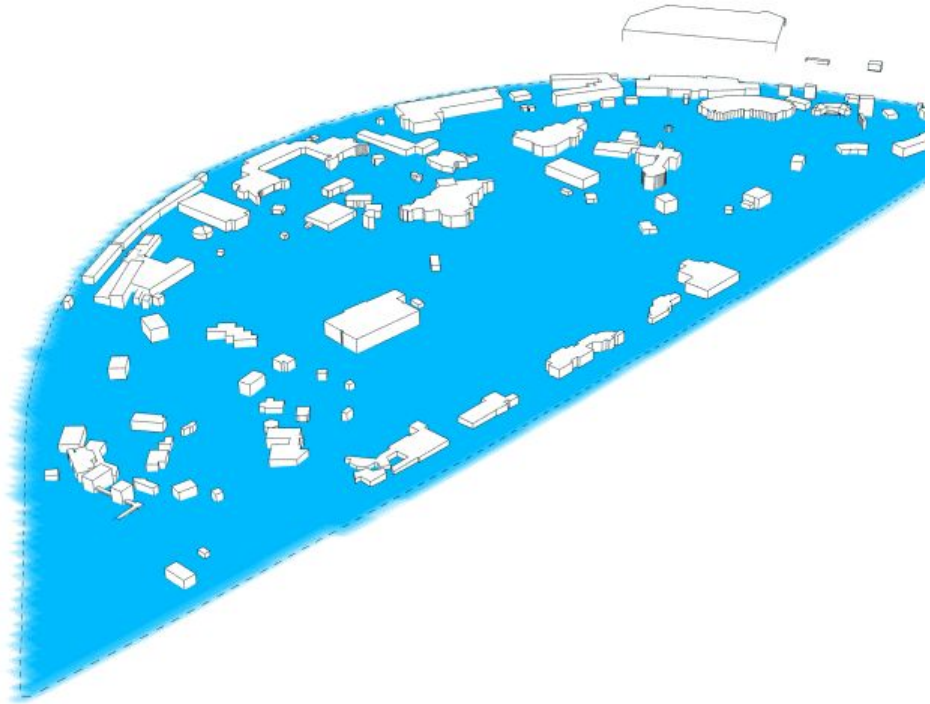
4) OUTDOOR

The Livestock Grasshopper Plugin
with Christian Kongsgaard

The Livestock Grassopher Plugin

Christian Kongsgaard

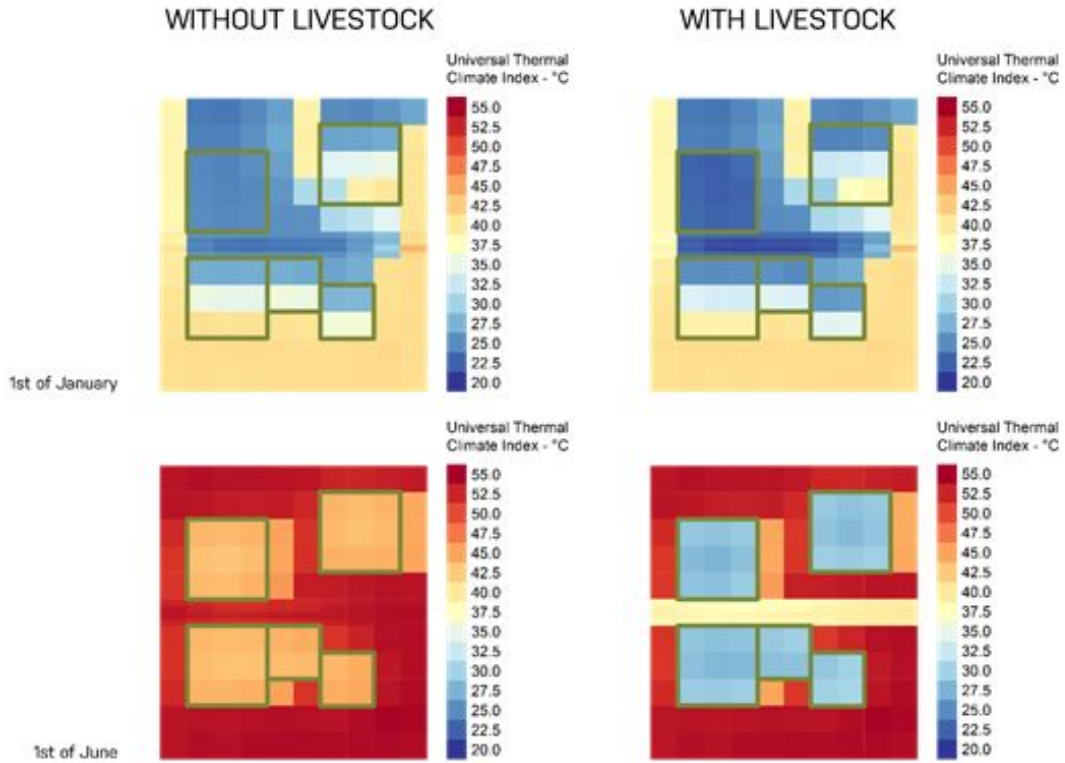
-



The Livestock Grassopher Plugin

Christian Kongsgaard

-

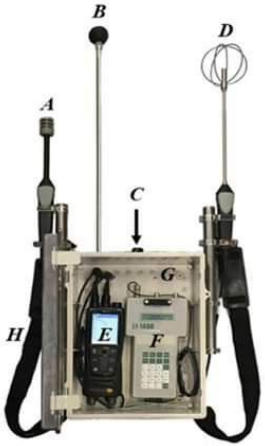


Climate Cycling in Copenhagen

With TU Munich and TU Delft

Sensing Copenhagen Microclimates trough combined measurements and modelling

With TU Munich and TU Delft



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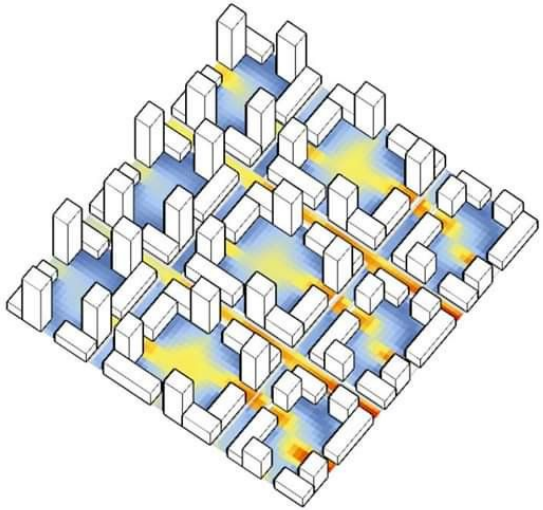
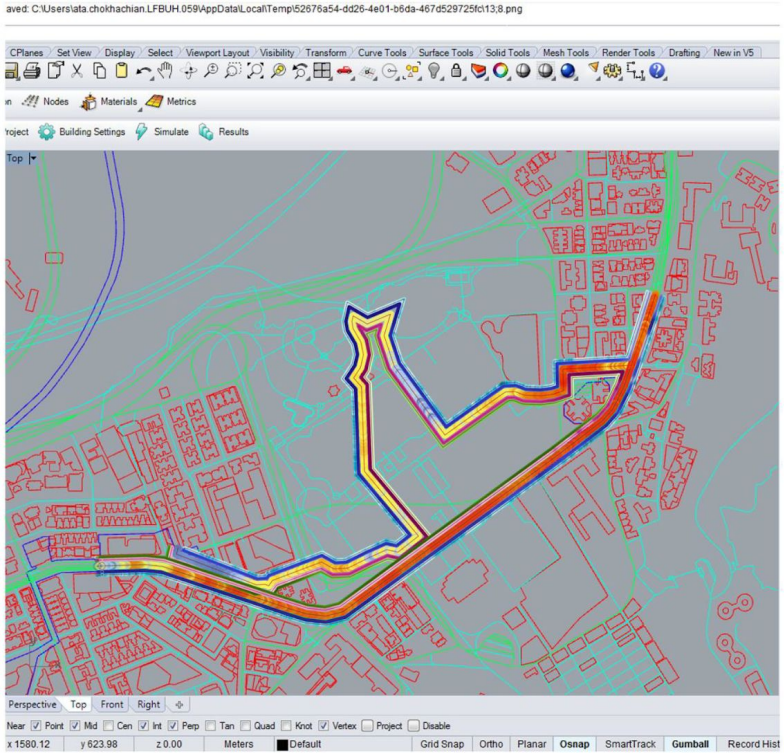
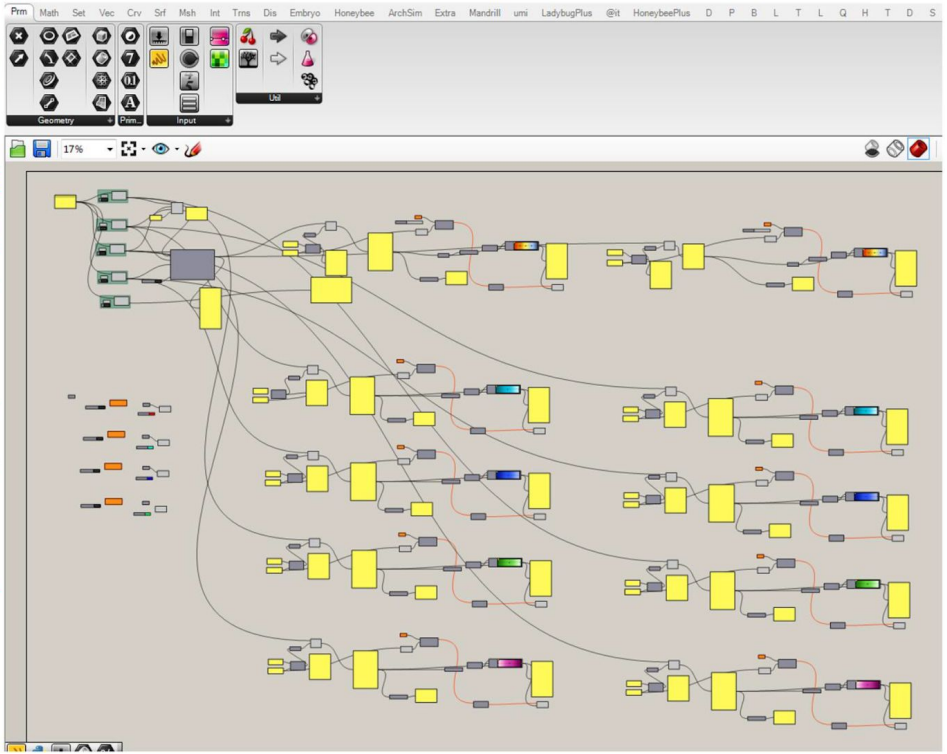


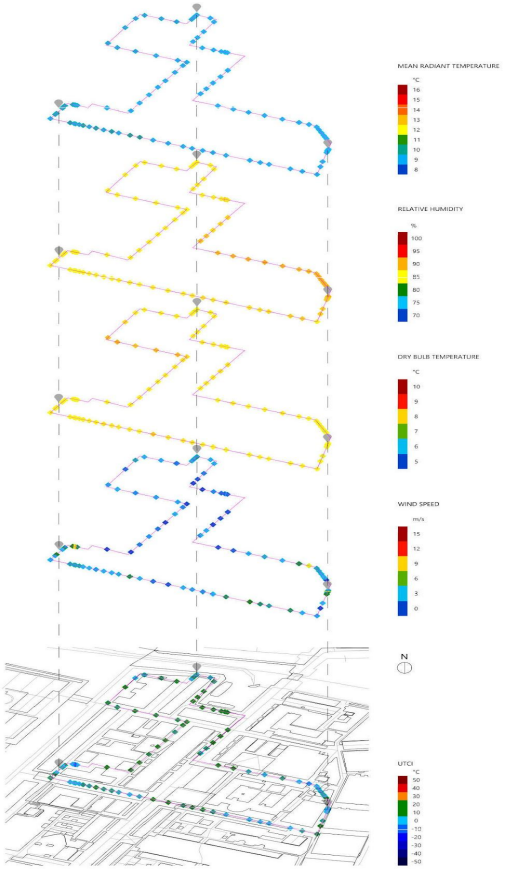
Information Visualization and Workflow



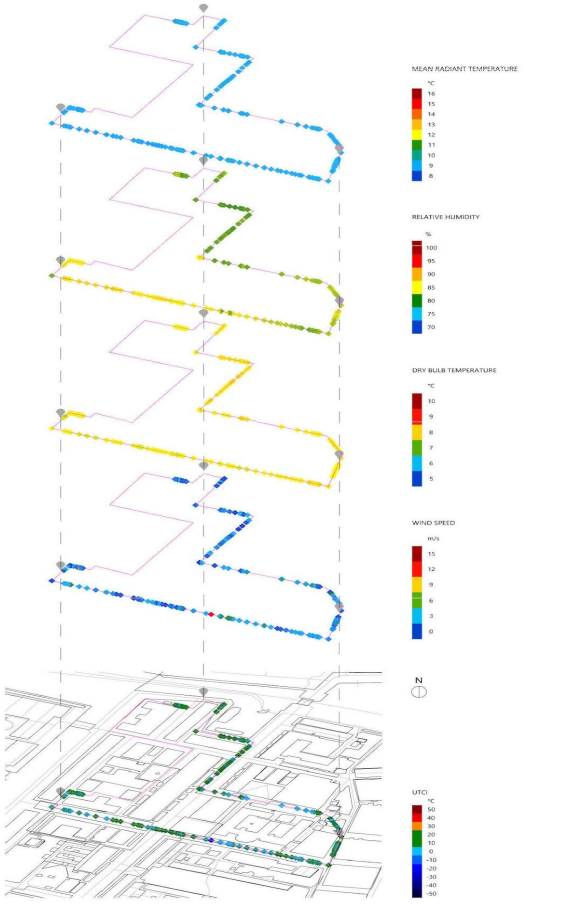



KADK Area
TAKKELOFTVEJ
START
PER KNUTZONS VEJ
PHILIP DE LANGES ALLÉ
DANNESKIOLD-SAMSØES ALLÉ
Cycling Path
Walking Path

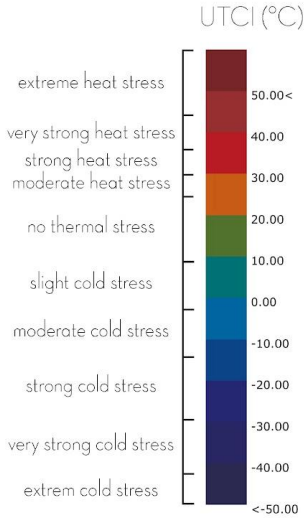
CYCLING

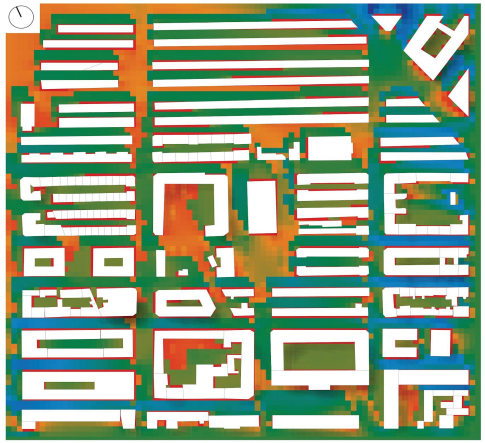


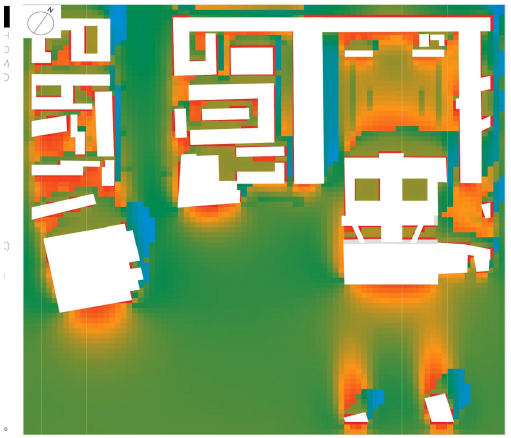
CYCLING

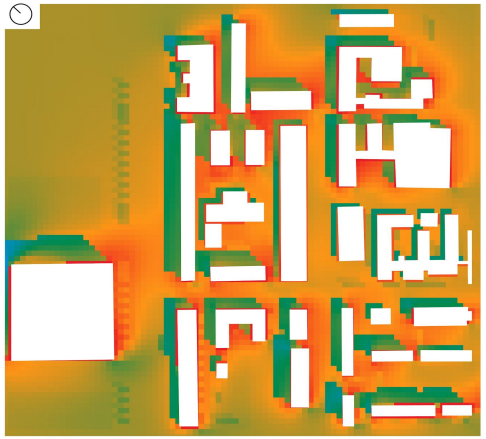


WALKING


UTCI (°C)
extreme heat stress
very strong heat stress
strong heat stress
moderate heat stress
no thermal stress
slight cold stress
moderate cold stress
strong cold stress
very strong cold stress
extrem cold stress
50.00<
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
-40.00
<-50.00







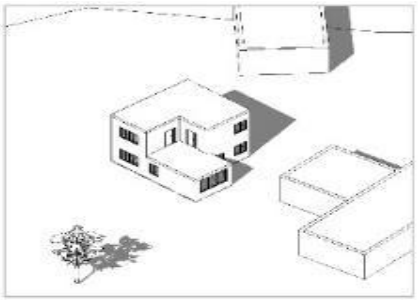
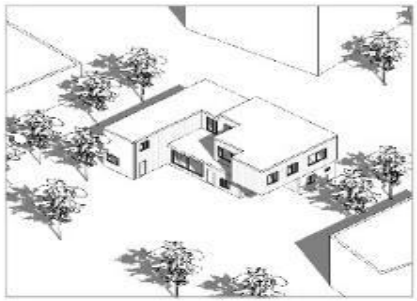
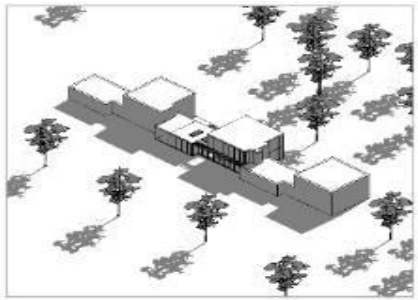
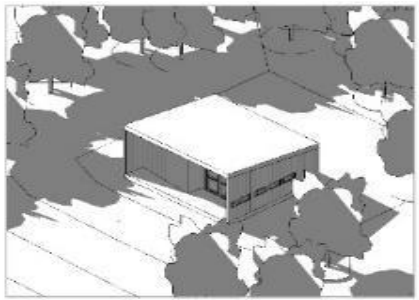
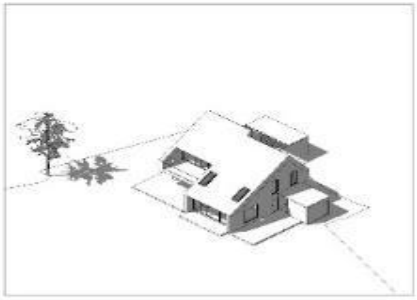
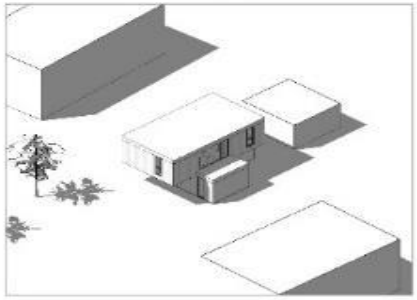
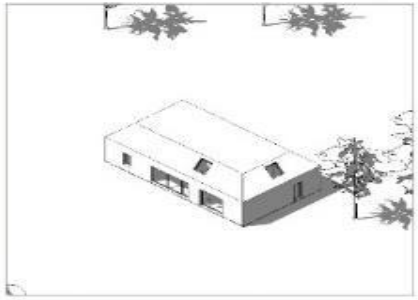
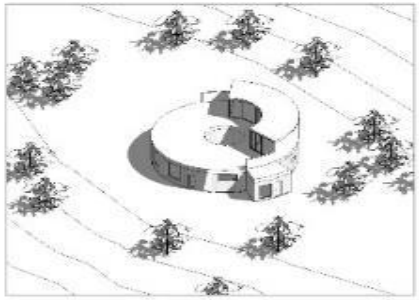
5) OUTDOOR / INDOOR

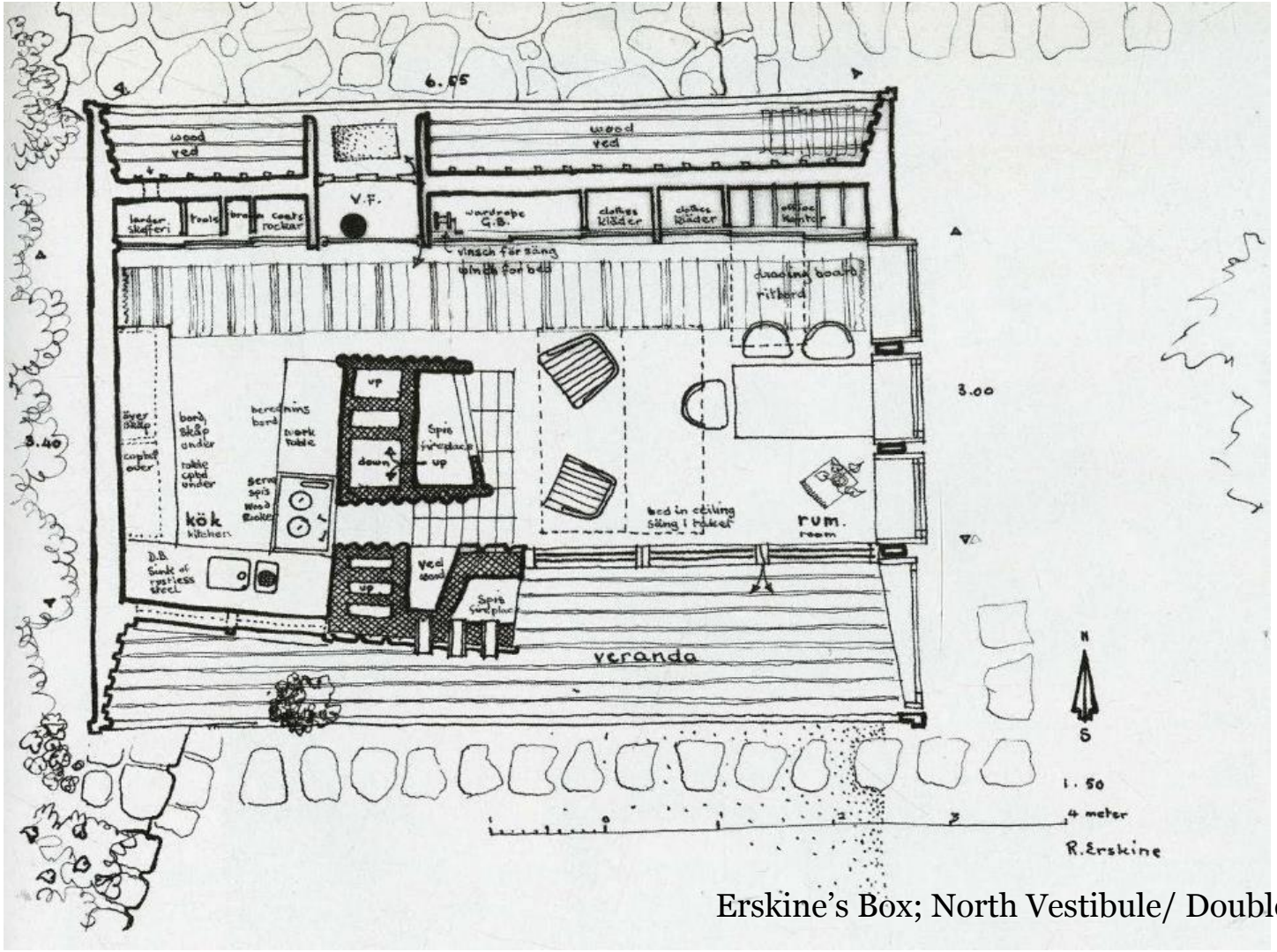
Functionalist Nordic Houses and Recent Houses



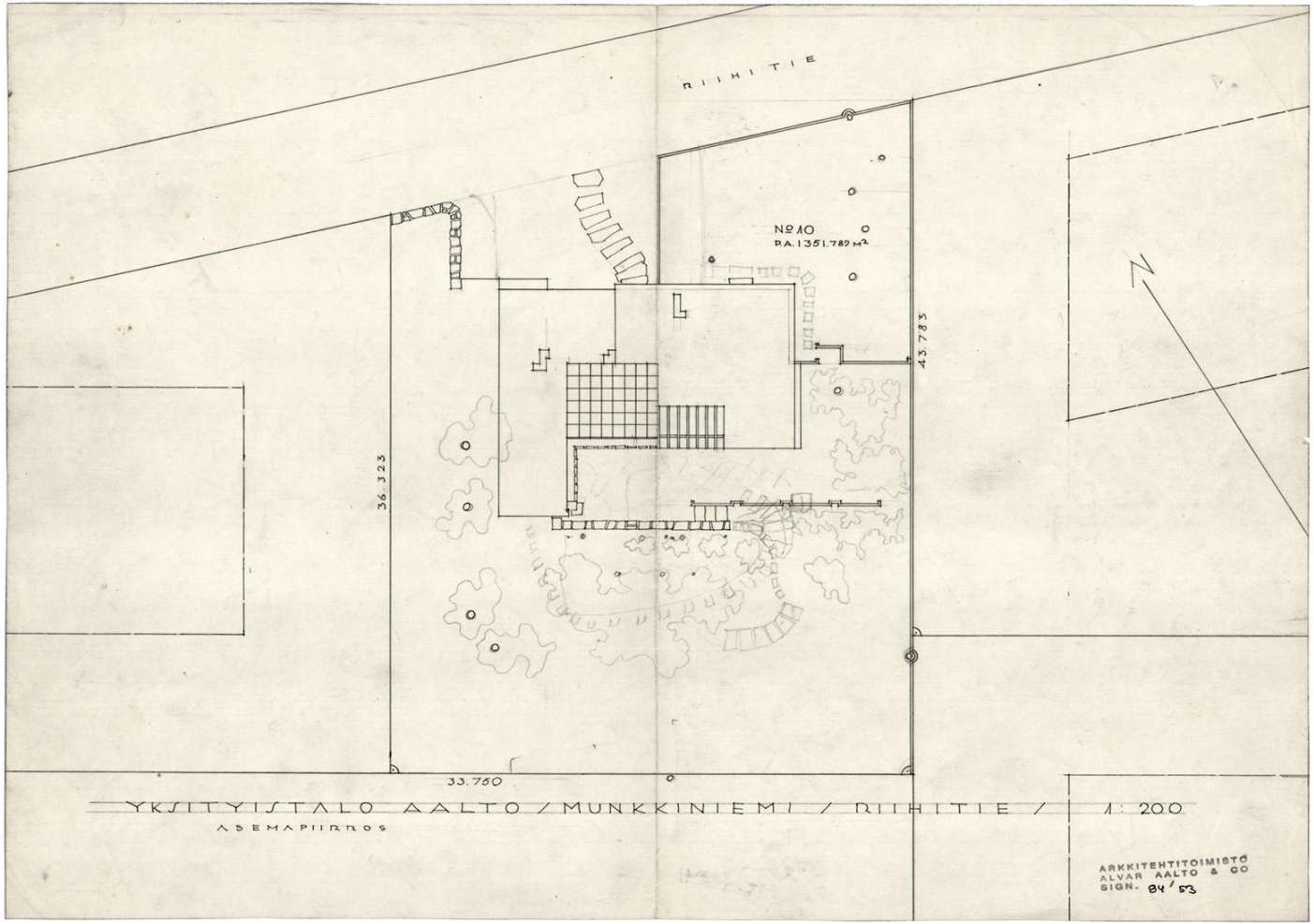






Erskine's Box; North Vestibule/ Double door



YKSITYISTALO AALTO / MUNKKINIEMI / RIIHITIE / 1:200

ASEMAPIIRROS

ARKKITEHTITOIMISTO
ALVAR AALTO & CO
SIGN. 84/53


Korsmo’s Planetveien House (West facing deck)

$5.95
ARCHITECTURE

Thermal Delight in Architecture
by Lisa Heschong

Our thermal environment is as rich in cultural associations as our visual, acoustic, olfactory, and tactile environments. This book explores the potential for using thermal qualities as an expressive element in building design.

Until quite recently, building technology and design has favored high-energy-consuming mechanical methods of neutralizing the thermal environment. It has not responded to the various ways that people use, remember, and care about the thermal environment and how they associate their thermal sense with their other senses. The hearth fire, the sauna, the Roman and Japanese baths, and the Islamic garden are discussed as archetypes of thermal delight about which rituals have developed—reinforcing bonds of affection and ceremony forged in the thermal experience. Not only is thermal symbolism now obsolete but the modern emphasis on central heating systems and air conditioning and hermetically sealed buildings has actually damaged our thermal coping and sensing mechanisms. This book for the solar age could help change all that and open up for us a new dimension of architectural experience.

As the cost of energy continues to skyrocket, alternatives to the use of mechanical force must be developed to meet our thermal needs. A major alternative is the use of passive solar energy, and the book will provide those interested in solar design with a reservoir of ideas.

about the author
Lisa Heschong earned a degree in Environmental Planning from the University of California at Berkeley and one in Architecture from MIT. She is at present affiliated with Total Environmental Action, a solar energy design, research, and consulting firm based in New Hampshire.

The MIT Press
Massachusetts Institute of Technology
Cambridge, Massachusetts 02142

HESTP

Thermal Delight in Architecture

Lisa Heschong

Thermal Delight in Architecture

BRI Building Research & Information 2014
http://dx.doi.org/10.1080/09613218.2015.989662
Routledge

INFORMATION PAPER

Thermal pleasure in built environments: physiology of alliesthesia

Thomas Parkinson and Richard de Dear

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International standards that define thermal comfort in uniform environments are based on the steady-state heat balance equation that posits 'neutrality' as the optimal occupant comfort state for which environments are designed, but thermal perception is more than an outcome of a deterministic, steady-state heat balance. Thermal alliesthesia is a conceptual framework to understand the hedonics of a much larger spectrum of thermal environments than the more thoroughly researched concept of thermal neutrality. At its simplest, thermal alliesthesia states that the hedonic qualities of the thermal environment are determined as much by the general thermal state of the subject as by the environment itself. A peripheral thermal stimulus that offsets or counters a thermoregulatory load-error will be pleasantly perceived and vice versa, a stimulus that exacerbates thermoregulatory load-error will feel unpleasant. The present paper elaborates the thermophysiological hypothesis of alliesthesia with a particular focus on set-point control and the origins of thermoregulatory load-error signals, and then discusses them within the broader context of thermal pleasure. Alliesthesia provides an overarching framework within which diverse and previously disconnected findings of laboratory experiments, field studies and even comfort standards spanning the last 40 years of thermal comfort research can be more coherently understood.

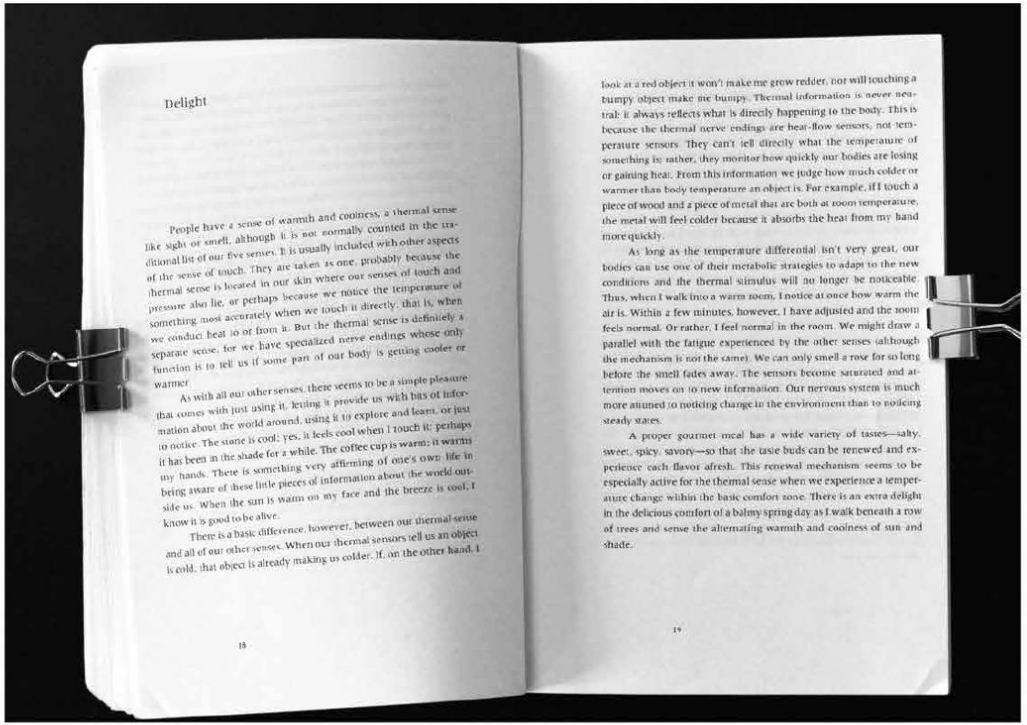
Keywords: adaptation; air-conditioning; alliesthesia; non-steady-state environments; physiology; thermal comfort; thermal pleasure; thermoreceptors

Introduction

The mainstreaming of adaptive comfort principles into the American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE) thermal comfort Standard 55 (ASHRAE, 2013) and EN15251 (2007) reflects a widespread awareness that thermal perception is more than an outcome of a deterministic, steady-state heat balance that has traditionally been used to define optimum indoor temperatures. Thermal alliesthesia has been proposed as a conceptual framework that differentiates the thermal pleasure in non-steady-state environments (de Dear, 2010) from the more thoroughly researched concept of thermal neutrality associated with steady-state environmental exposures (such as PMV/PPD). It may also offer a conceptual model of perceptual processes that determine why particular environmental configurations are unpleasant for some and pleasant for others.

This paper is the second in a series exploring alliesthesia in the context of indoor thermal comfort (de Dear, 2011). It begins with a brief summary of the hypothesis of alliesthesia and its potential to explain psychological states of thermal pleasure within the built environment. This introduction is based on a review of literature straddling the domains of thermal comfort, physiology and psychology. Subsequent papers in this series (1) will contribute empirical evidence from human subject laboratory experiments to support the hypothesis elaborated in this paper, and (2) translate this paper's hypothesis into a numerical model of thermal alliesthesia. The ultimate aim of the series of papers is to present alliesthesia as an overarching theoretical framework that reconciles previously contradictory strands of thermal comfort research and provides a more unified understanding of the many facets of thermal perception in the built environment.

Ref: Parkinson & de Dear 2014



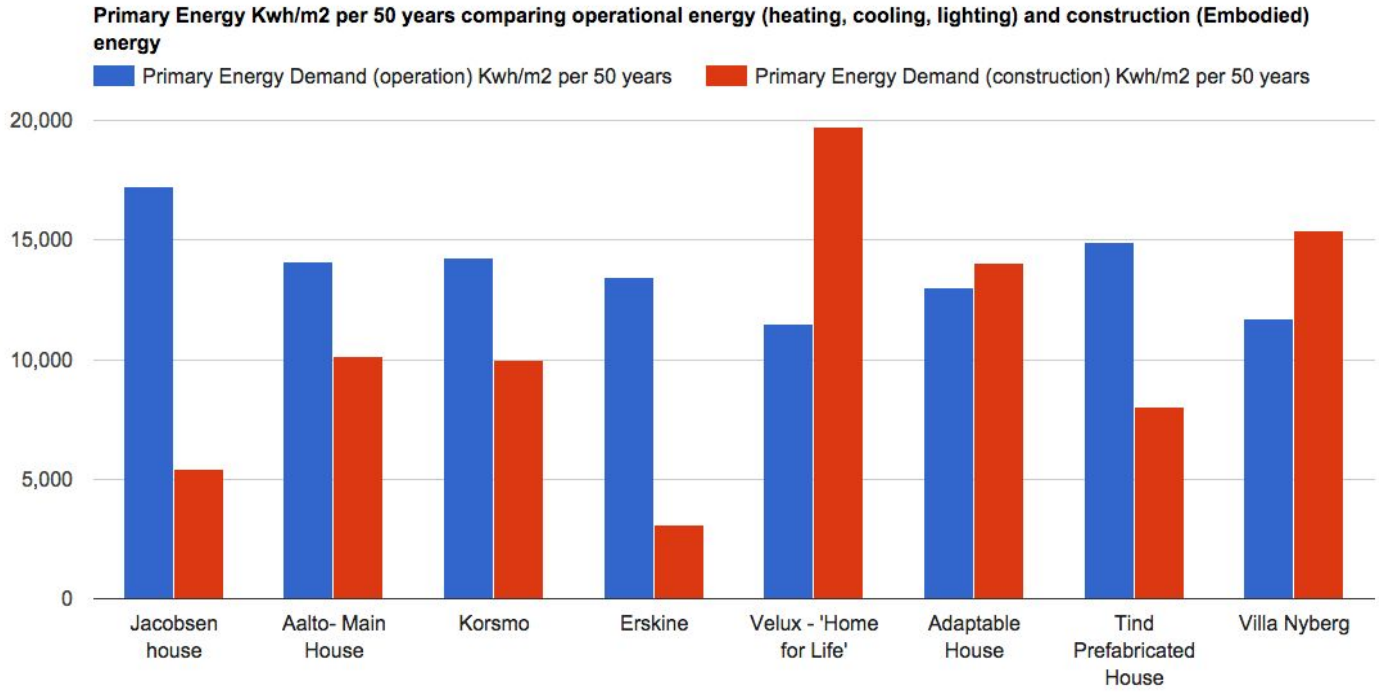
Ref: Lisa Heschong

Korsmo's Planetveien House; Fireplace; radiant floor heating

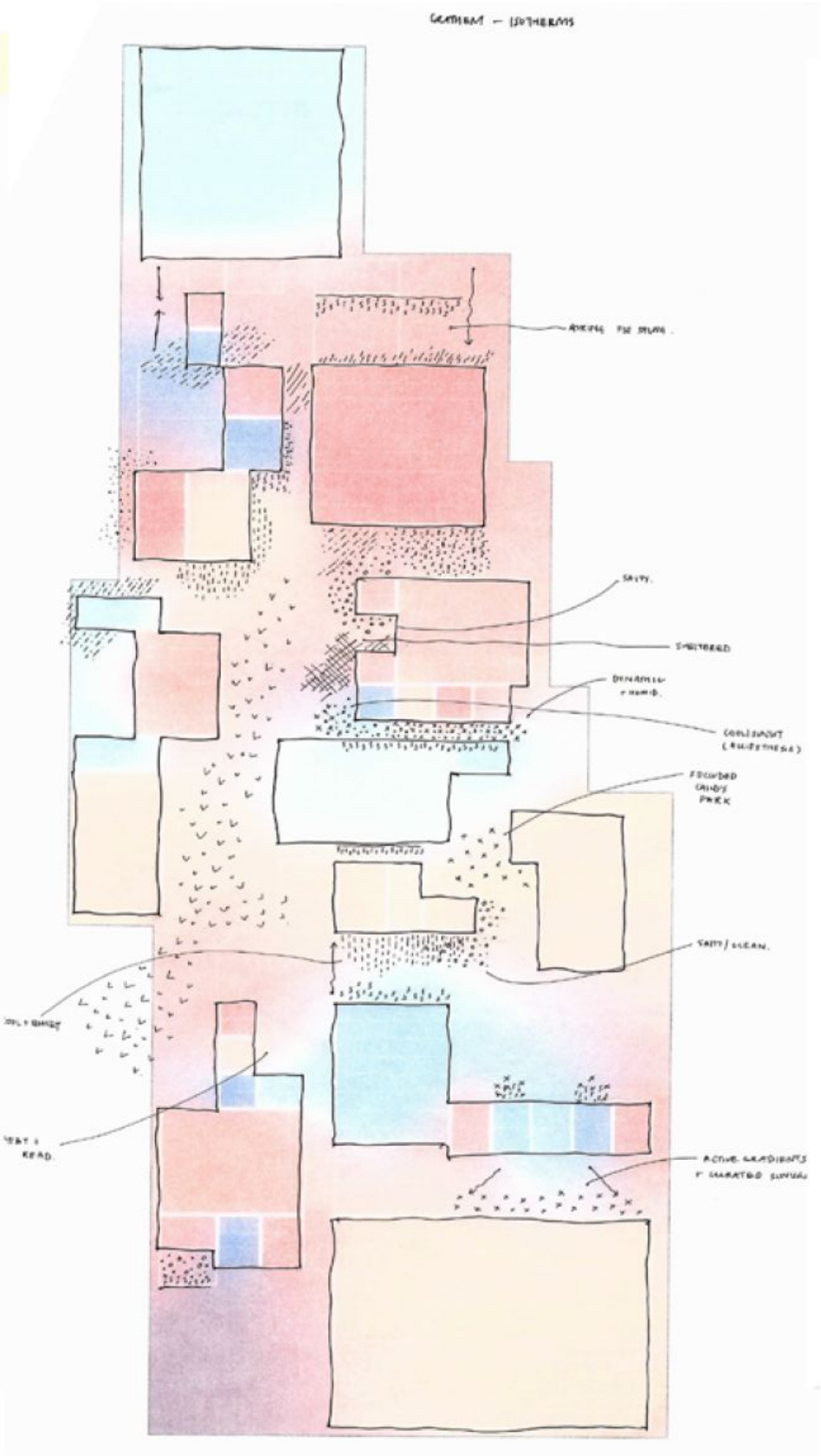
Aalto’s Helsinki House

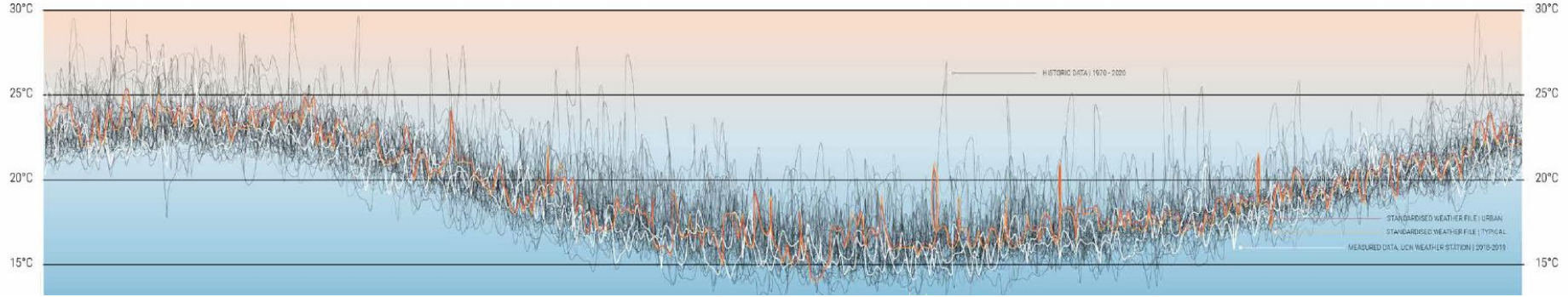
Henning Larsen’s Adaptable House

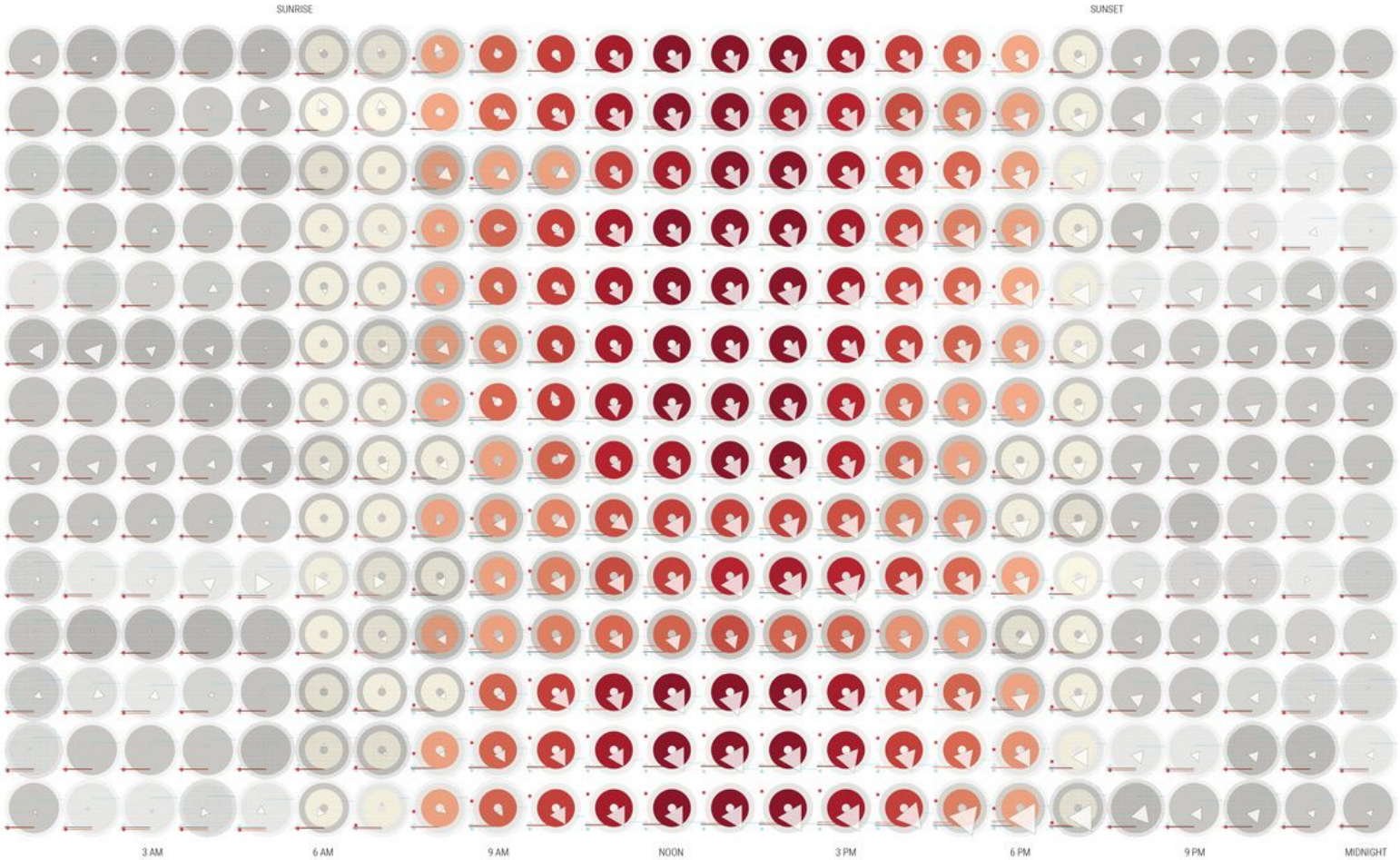
Operational and Embodied Energy over 50 years

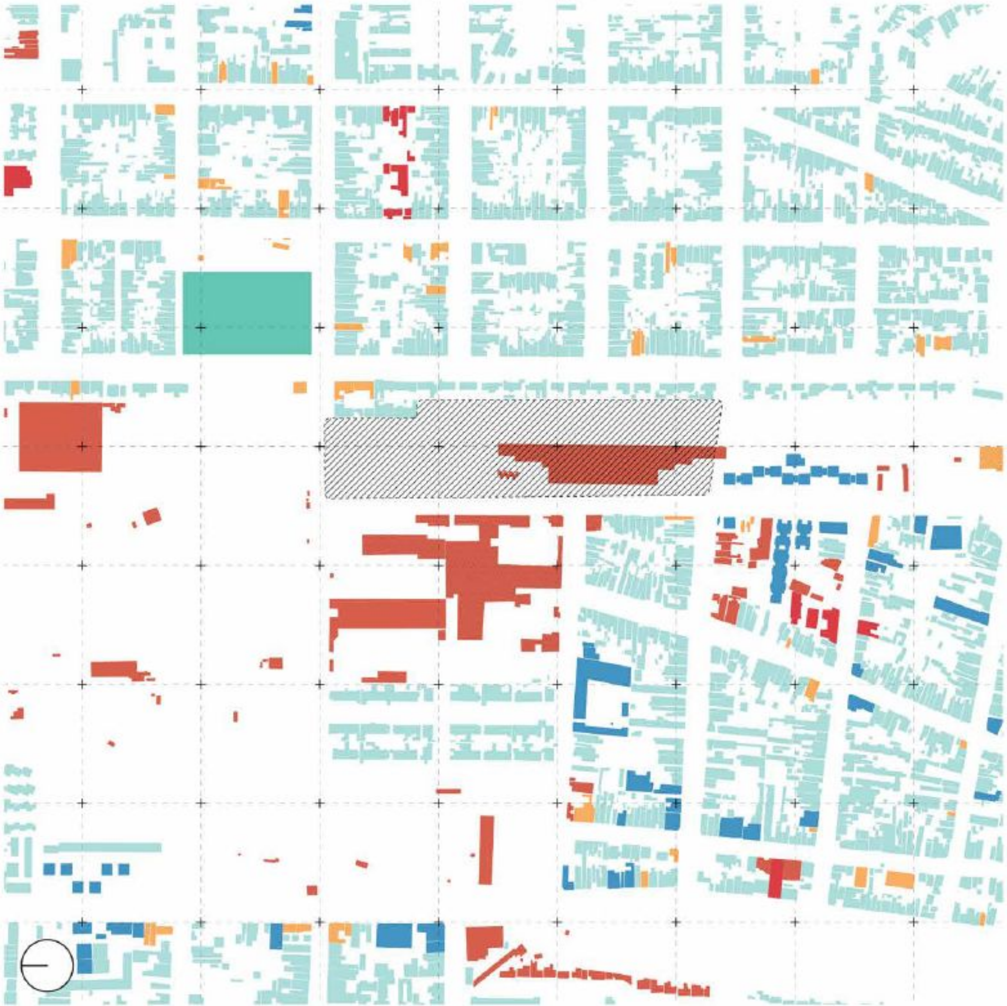


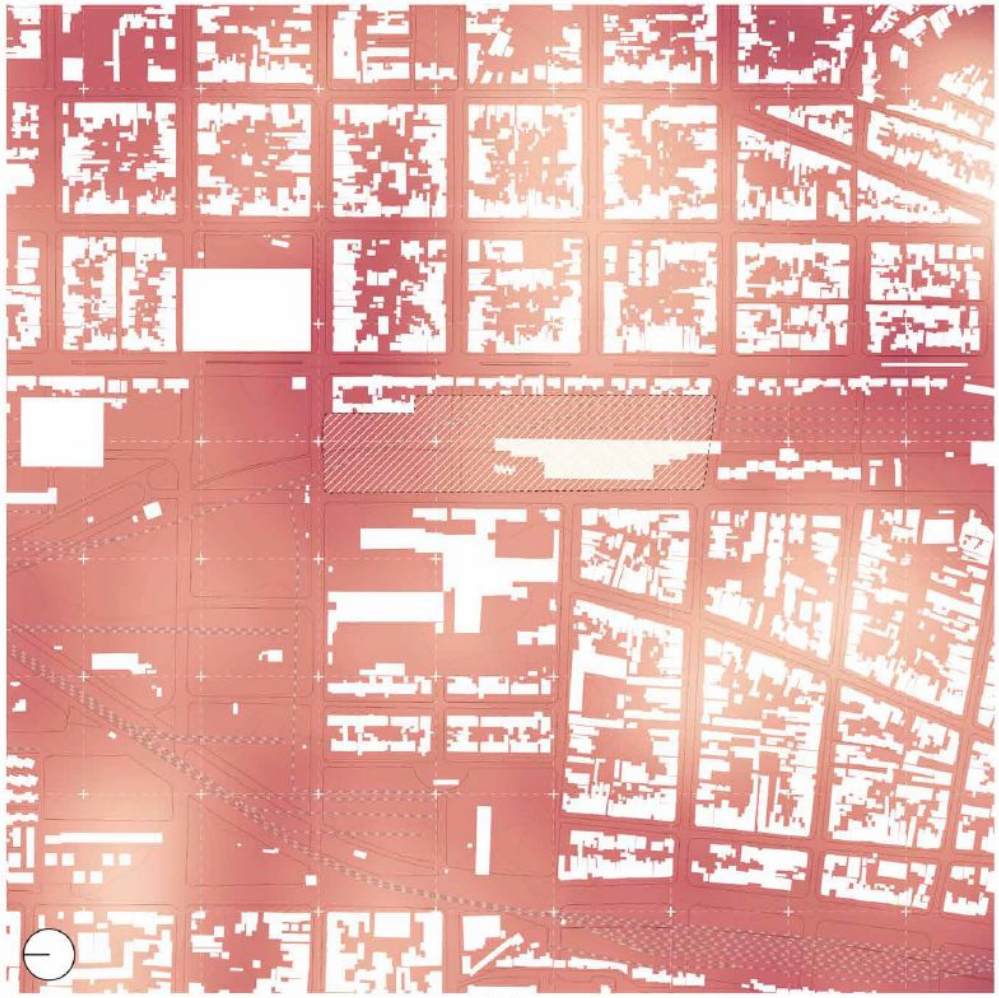
Operational and Embodied Energy over 50 years


GEOTHERM – ISOTHERMS
SALTY.
SHELTERED.
DYNAMIC + HUMID.
COOL SHADY (RAINFOREST)
FLOODED GRASSY PARK
SALTY / ALKALI.
ACTIVE GRADIENTS + SEASONAL SUNSHA

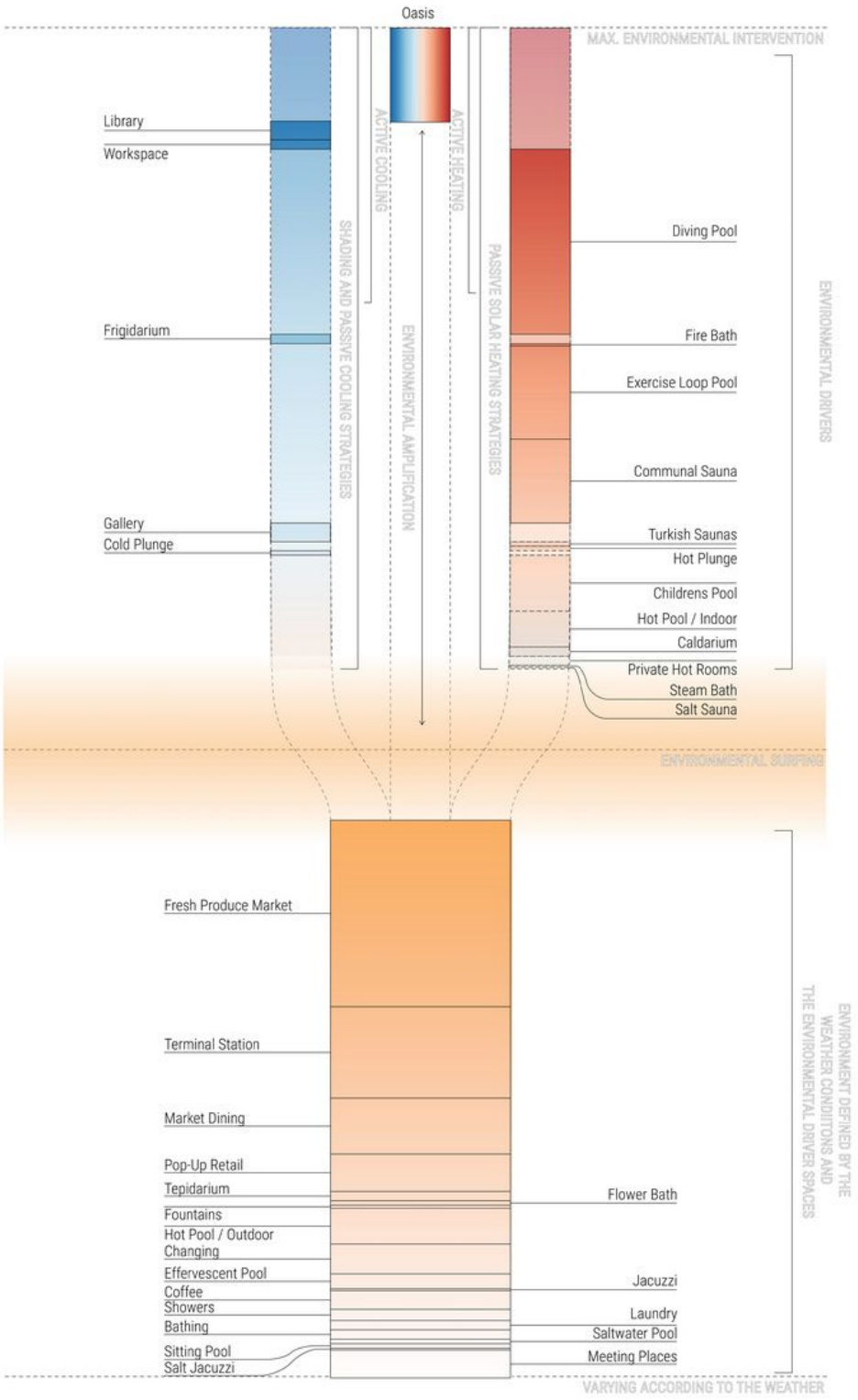

30°C
25°C
20°C
15°C
HISTORIC DATA | 1970 - 2020
STANDARDISED WEATHER FILE | URBAN
STANDARDISED WEATHER FILE | TYPICAL
MEASURED DATA, UCN WEATHER STATION | 2018-2019


SUNRISE
SUNSET
3 AM
6 AM
9 AM
NOON
3 PM
6 PM
9 PM
MIDNIGHT



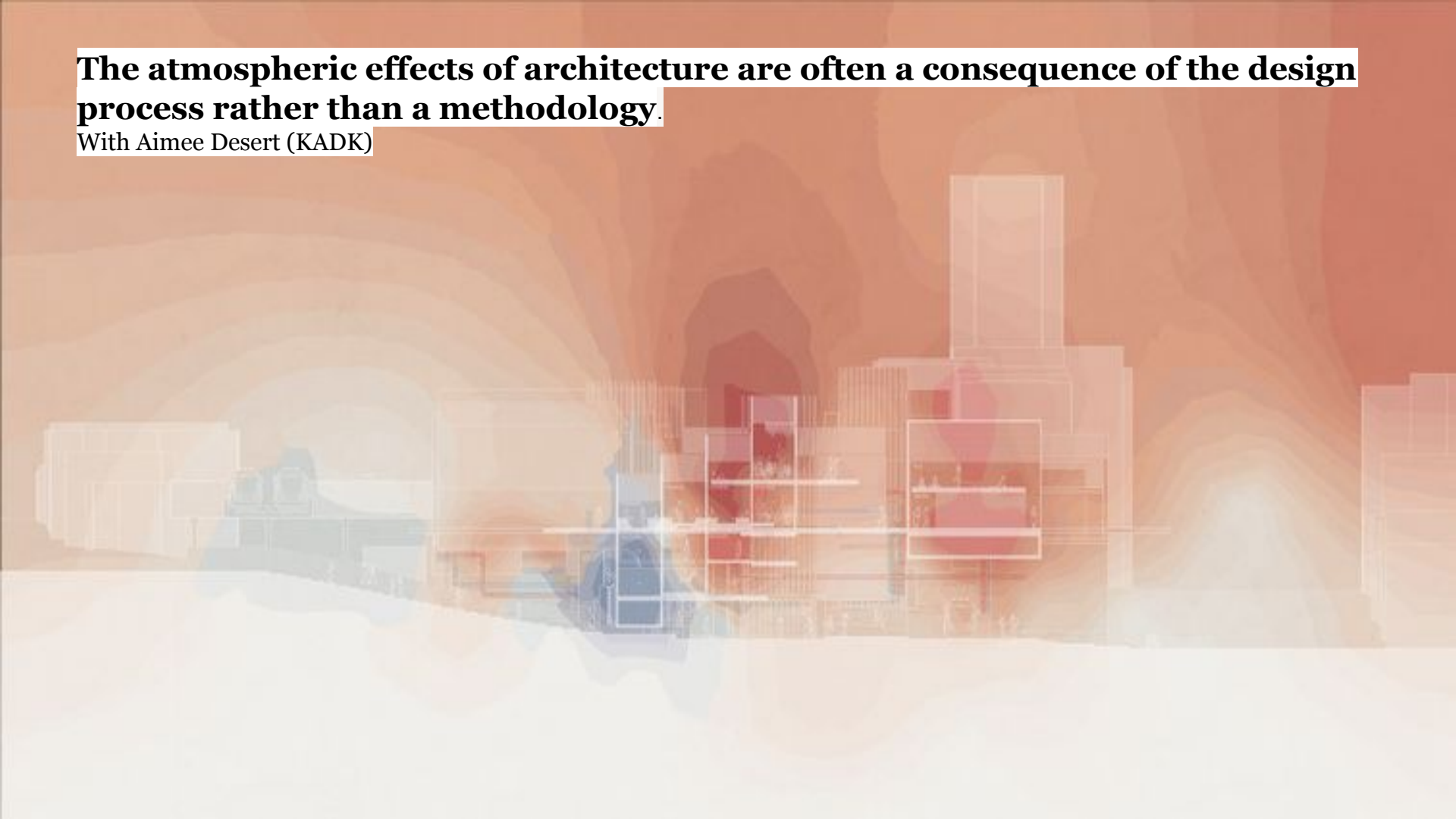


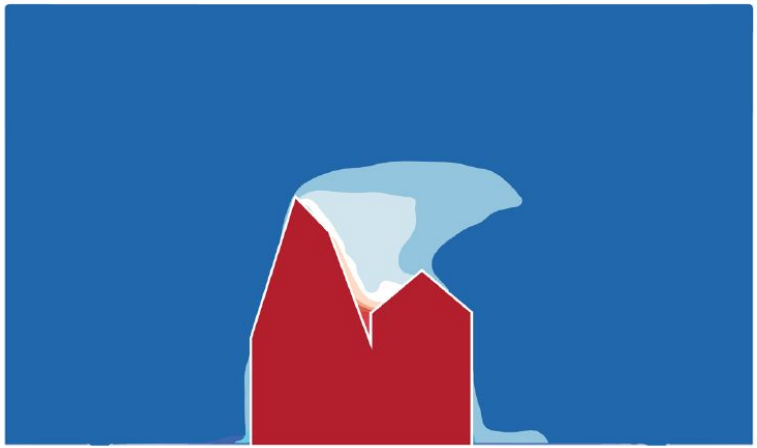
TEMPERATURE

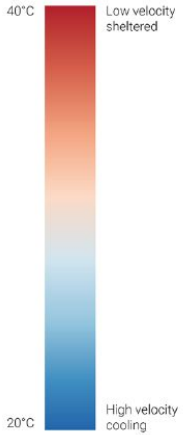

Oasis
MAX. ENVIRONMENTAL INTERVENTION
Library
Workspace
Frigidarium
Gallery
Cold Plunge
SHADING AND PASSIVE COOLING STRATEGIES
ACTIVE COOLING
ENVIRONMENTAL AMPLIFICATION
ACTIVE HEATING
PASSIVE SOLAR HEATING STRATEGIES
Diving Pool
Fire Bath
Exercise Loop Pool
Communal Sauna
Turkish Saunas
Hot Plunge
Childrens Pool
Hot Pool / Indoor
Caldarium
Private Hot Rooms
Steam Bath
Salt Sauna
ENVIRONMENTAL DRIVERS
ENVIRONMENTAL SUMPING
Fresh Produce Market
Terminal Station
Market Dining
Pop-Up Retail
Tepidarium
Fountains
Hot Pool / Outdoor
Changing
Effervescent Pool
Coffee
Showers
Bathing
Sitting Pool
Salt Jacuzzi
Flower Bath
Jacuzzi
Laundry
Saltwater Pool
Meeting Places
ENVIRONMENT DEFINED BY THE WEATHER CONDITIONS AND THE ENVIRONMENTAL DRIVER SPACES
VARYING ACCORDING TO THE WEATHER

The atmospheric effects of architecture are often a consequence of the design process rather than a methodology.

With Aimee Desert (KADK)





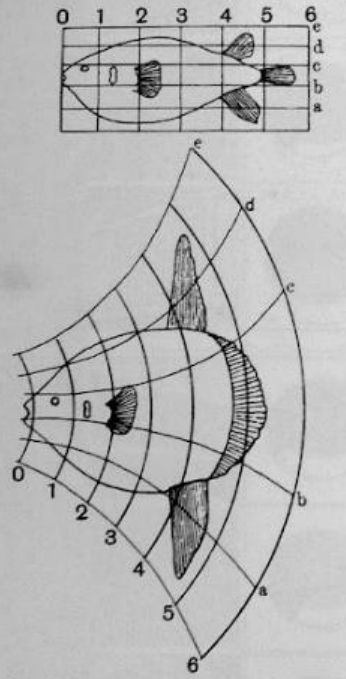

40°C
Low velocity
sheltered
20°C
High velocity
cooling

6) BUILDING FORM

Playing with new climatic extremes

BIG – FarOer Educational Center

VIII. ENVIRONMENT AND BUILDING FORMS



171. Diodon. Orthagoriscus. Transformation in biology through environmental impacts.

MORPHOLOGY IN NATURE

IT IS a recognized fact that the forces of nature have a direct effect on the formation of objects.

In natural history the rule is universal that only species are fit to survive which are in harmony with their environment, balanced with their tissue materials, and adapted to all internal and external forces to which they are exposed.

The living organisms occupy a field of force which is never simple and which indeed is of immense complexity. As sometimes in physics, the knowledge of form leads to the interpretation of forces that molded it, at other times the knowledge of the forces at work guides a better insight into the form itself. Therefore, the conception of form is ultimately the understanding of the forces that gave rise to it, as a representation of a form is a diagram of forces in equilibrium.

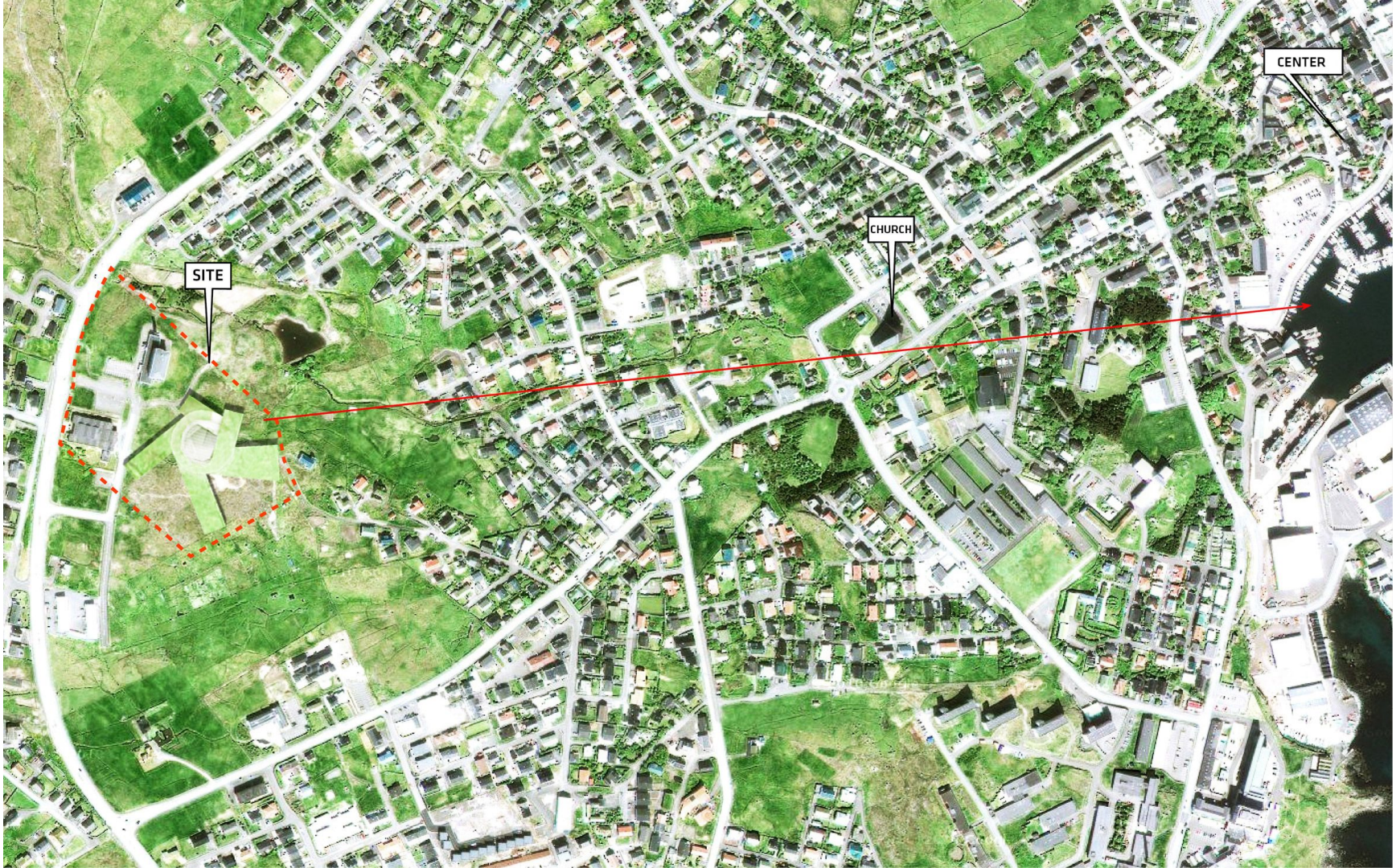
In organic life the forces, therefore the adaptation to them, are under a dynamically continuous change. "Ignorato motu, ignoratur Natura," wrote Oliver Lodge. This constant change constitutes the base of the theory of transformation, that is, when the same "genus" under different circumstances deforms in proportion, differs in relative magnitude, or in "excess and defect."

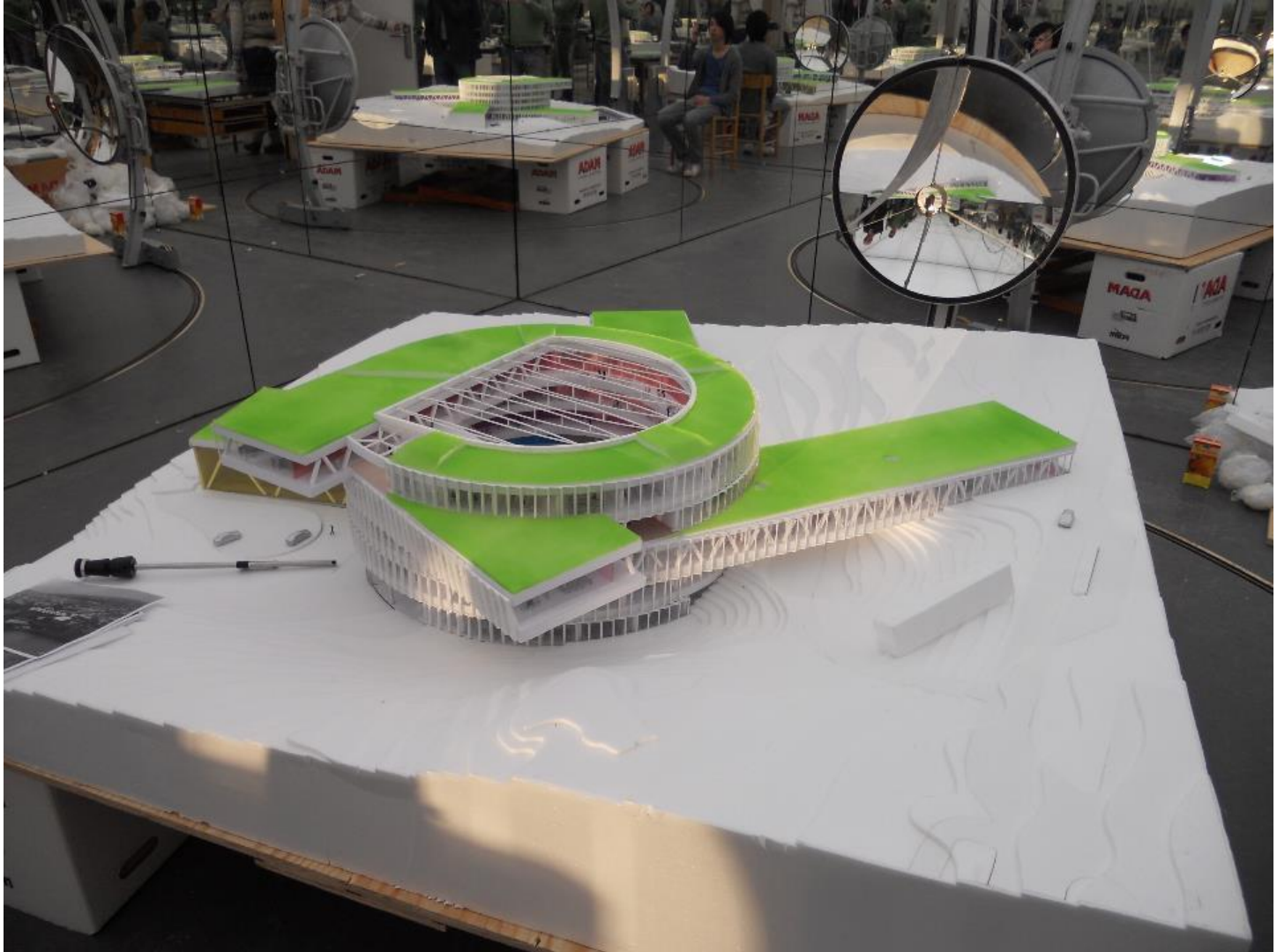
In the diagram a Diodon, or porcupine-fish is shown. Deforming its vertical coordinates into a system of concentric circles, and the horizontal coordinates into approximate hyperbolas, the new network shows a representation of the closely allied but very different looking sunfish, Orthagoriscus Mola, shaped by the influence of his chosen habitat.

Turning from the complexity of the zoological world, plant life shows a closer relationship to the specific thermal environmental problem. The plant morphology in various climates seems to bear an analogy to the formation of buildings, as a few of the shaping forces (such as temperature range) are somewhat similar to human environmental needs.

The illustrative examples of cross sections of leaves (shown at the opposite page with typical sections, however not necessarily drawn from the same plants as shown above) can draw attention to interesting synonymity. According to either favorable or adverse environment, plants open or close their surfaces. The plants of cool and hot-arid regions show similarities with their massive sections; i.e., large content with relatively small surface. This is their defense response against the excessive cold or torrid heat. Conversely, the plants of more temperate zones are free to communicate with their seasonal environments, and the growth of hot-humid vegetation is liberal in size and shape.

In the approach to regional building characteristics described further, the two main thermal factors—the combined effect of air temperature and radiation—lead the investigations. Since not the particular local conditions but rather the general regional character was aimed for, the effect of air movement in the convection calculations was held as a constant and directionless value. The results point towards shapes under which specific conditions stand up better, hence are preferable in their thermal environments.


CENTER
CHURCH
SITE


ADAM
ADAM
ADAM
ADAM

creation of dynamic visual relations from inside to outside and vice versa

linking to the outdoor

7) FACADE

Embrace Climate Change

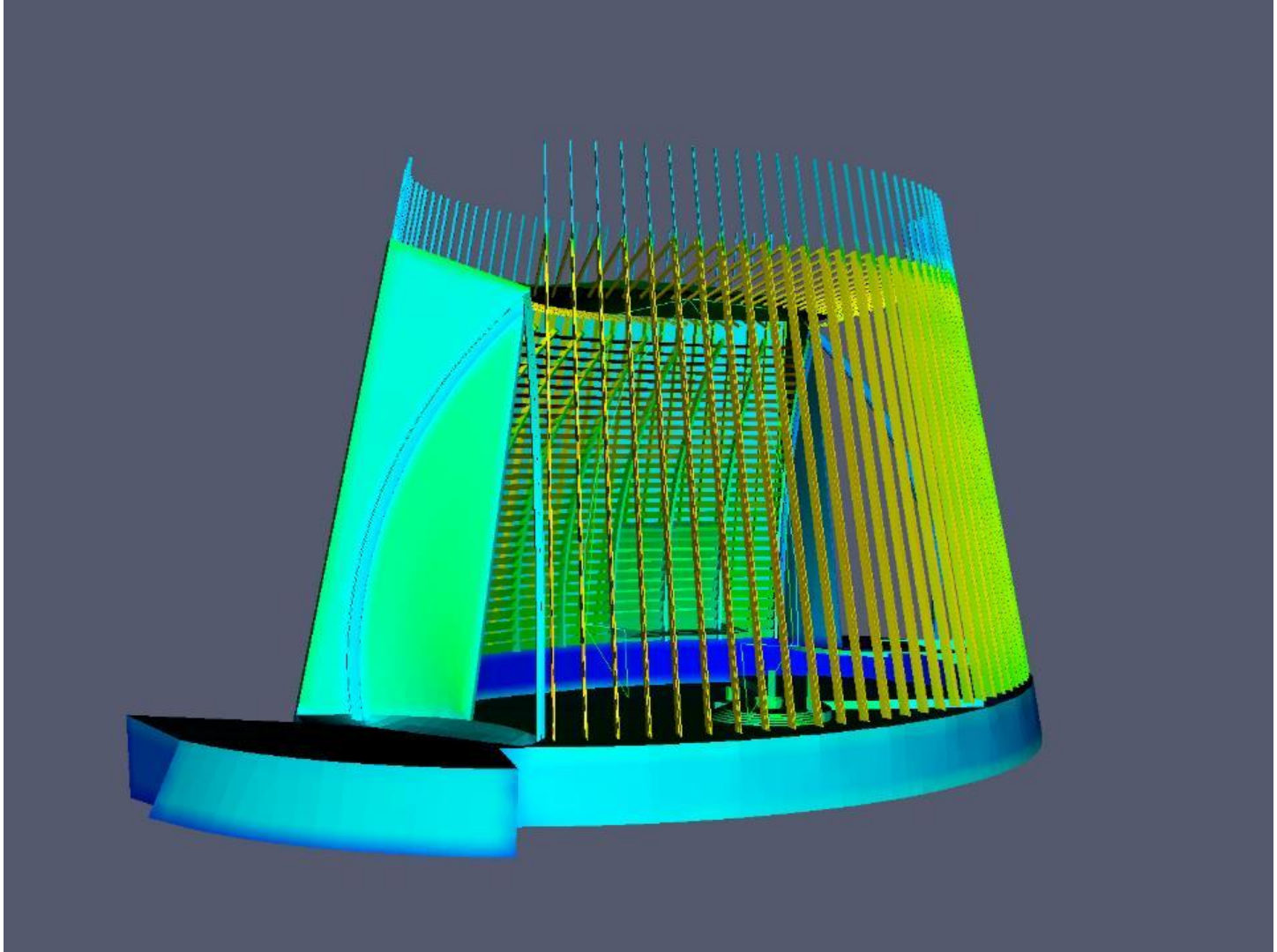
Oakland Cathedral with SOM

Biophilic Design

Oakland Cathedral with SOM

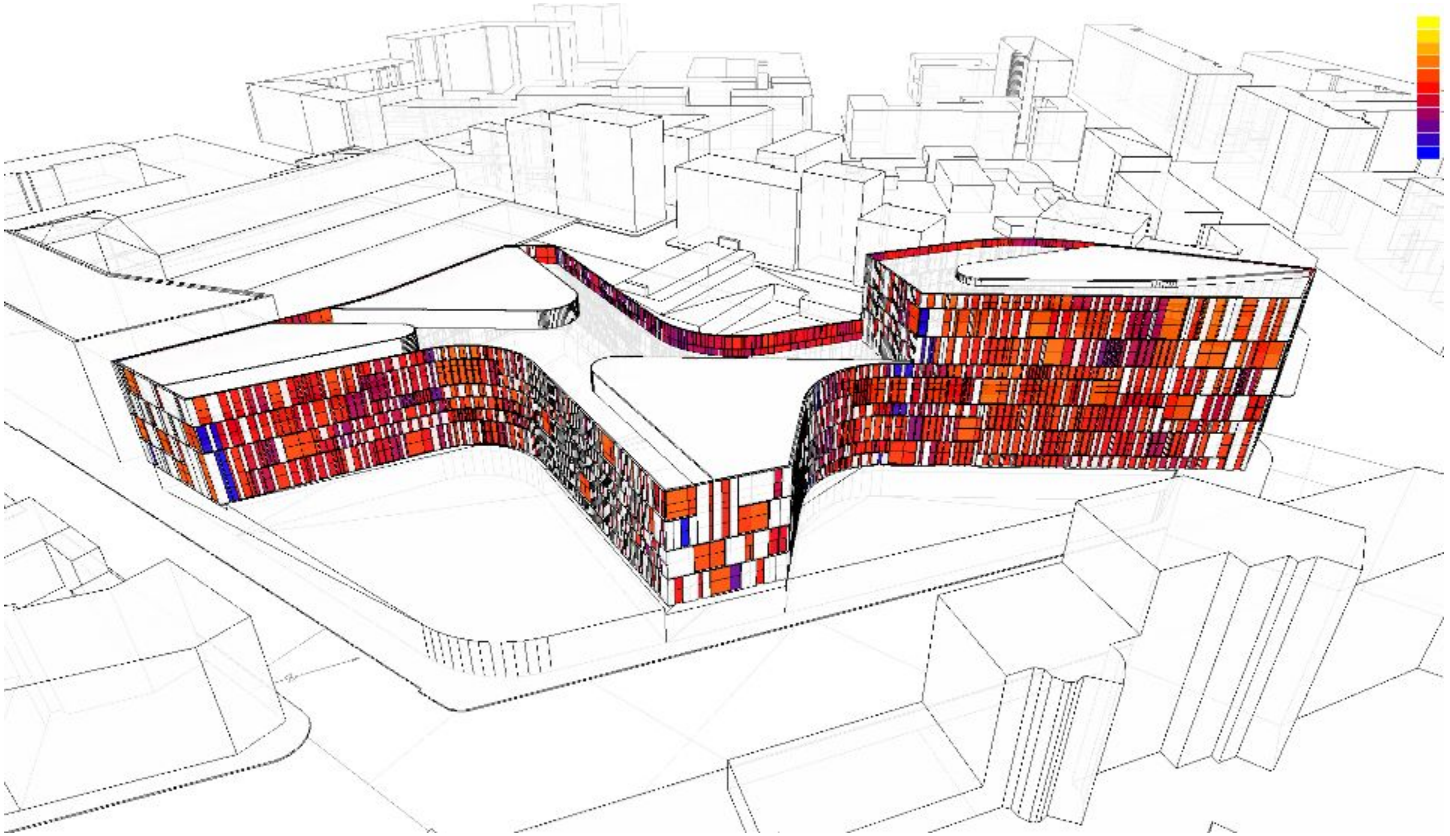
Example of Regenerative interior dynamics

It stimulates physiological comfort and connection to outdoor



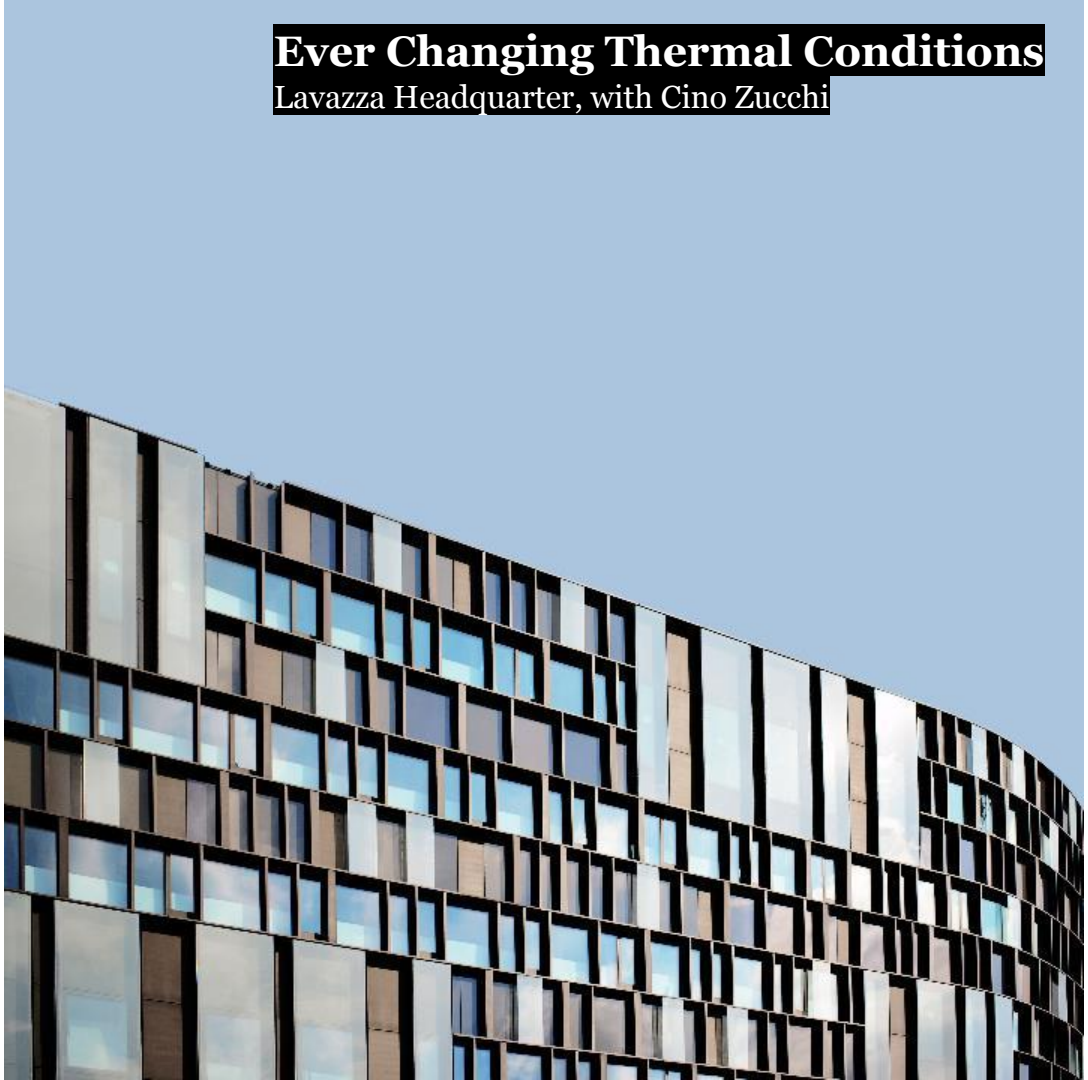
Climatic variations

Lavazza, with Cino Zucchi



Ever Changing Thermal Conditions

Lavazza Headquarter, with Cino Zucchi

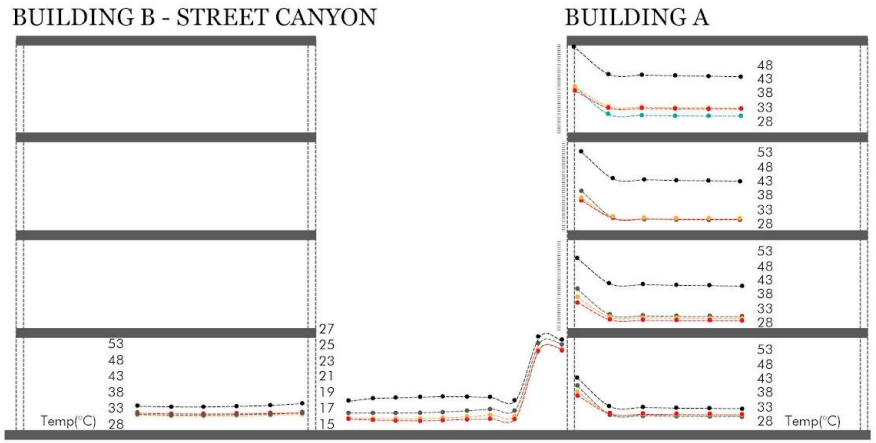


Manipulated Variables

Façade Layout - Proposal 2

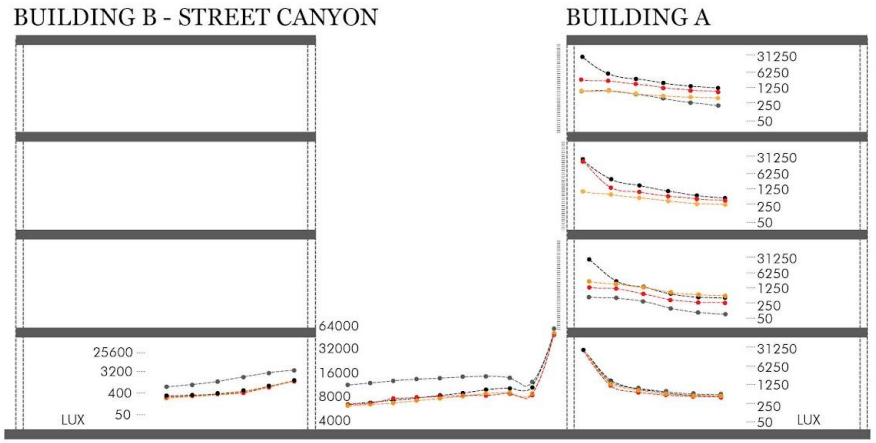
KADK Daylighting Room Digital Model.

Facade as an Outdoor and Indoor Climate Giver



RESULTS - THERMAL COMFORT 15:00-16:00 4TH AUGUST

- no shading
- steady state
- dynamic venetian blind
- adaptive facade
- the applied adaptive facade

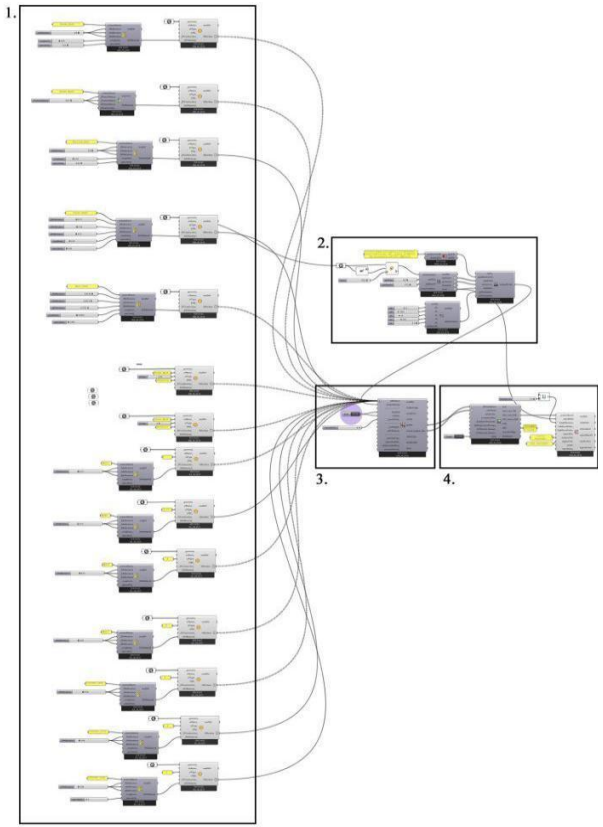


RESULTS - DAYLIGHT URBAN CANION 15:00 4TH

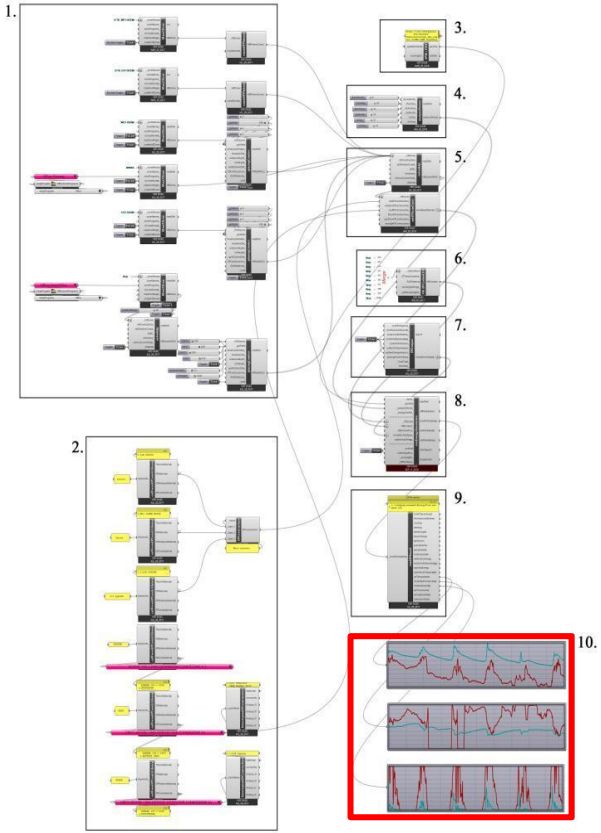
- no shading
- steady state
- dynamic venetian blind
- adaptive facade
- the applied adaptive facade

LadyBug Customized Scripts (8 simulation tools invoked)

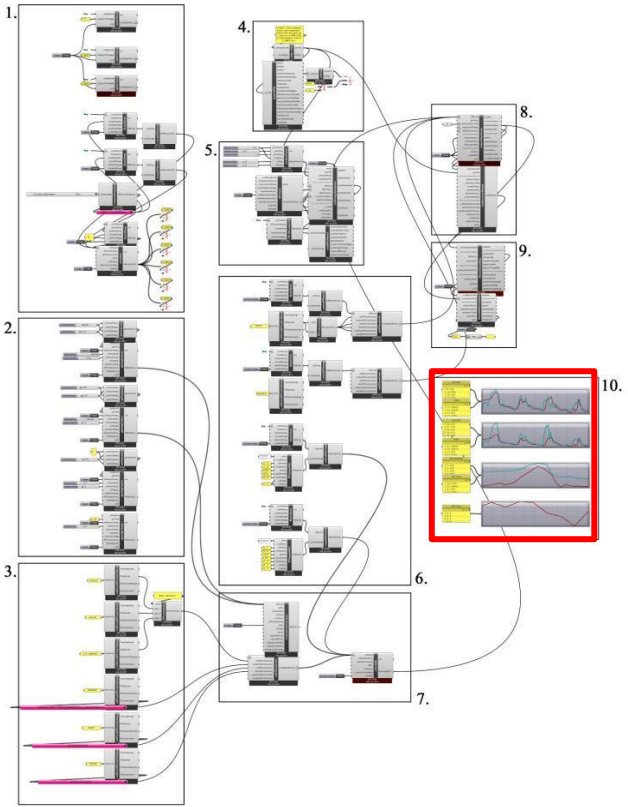
Daylighting Script



Indoor Thermal Script

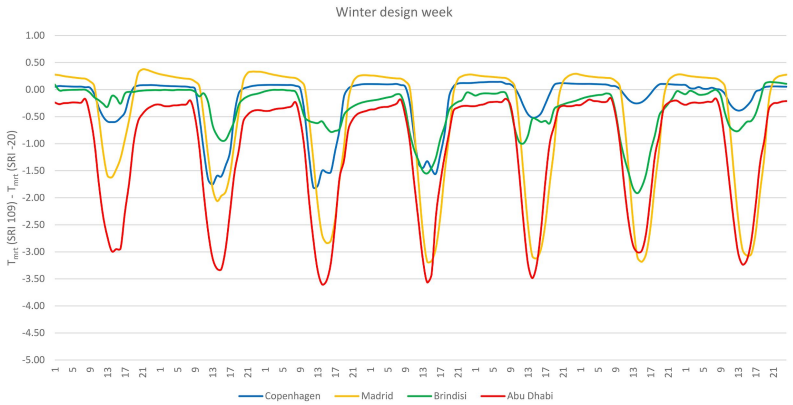


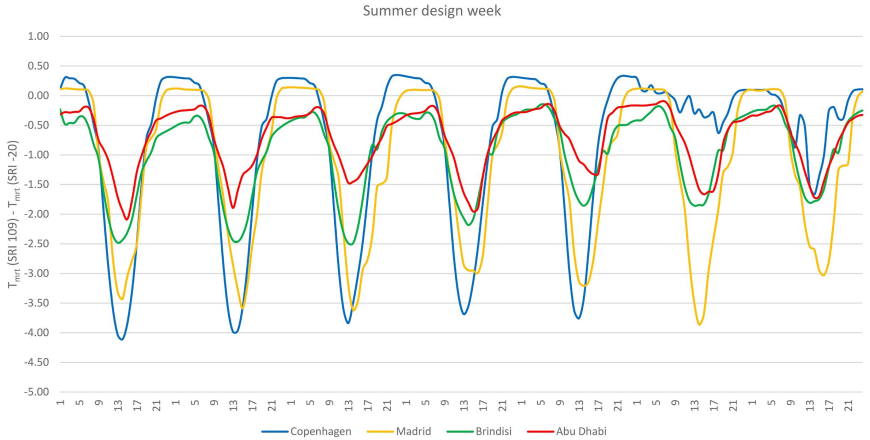
MRT Outdoor Script

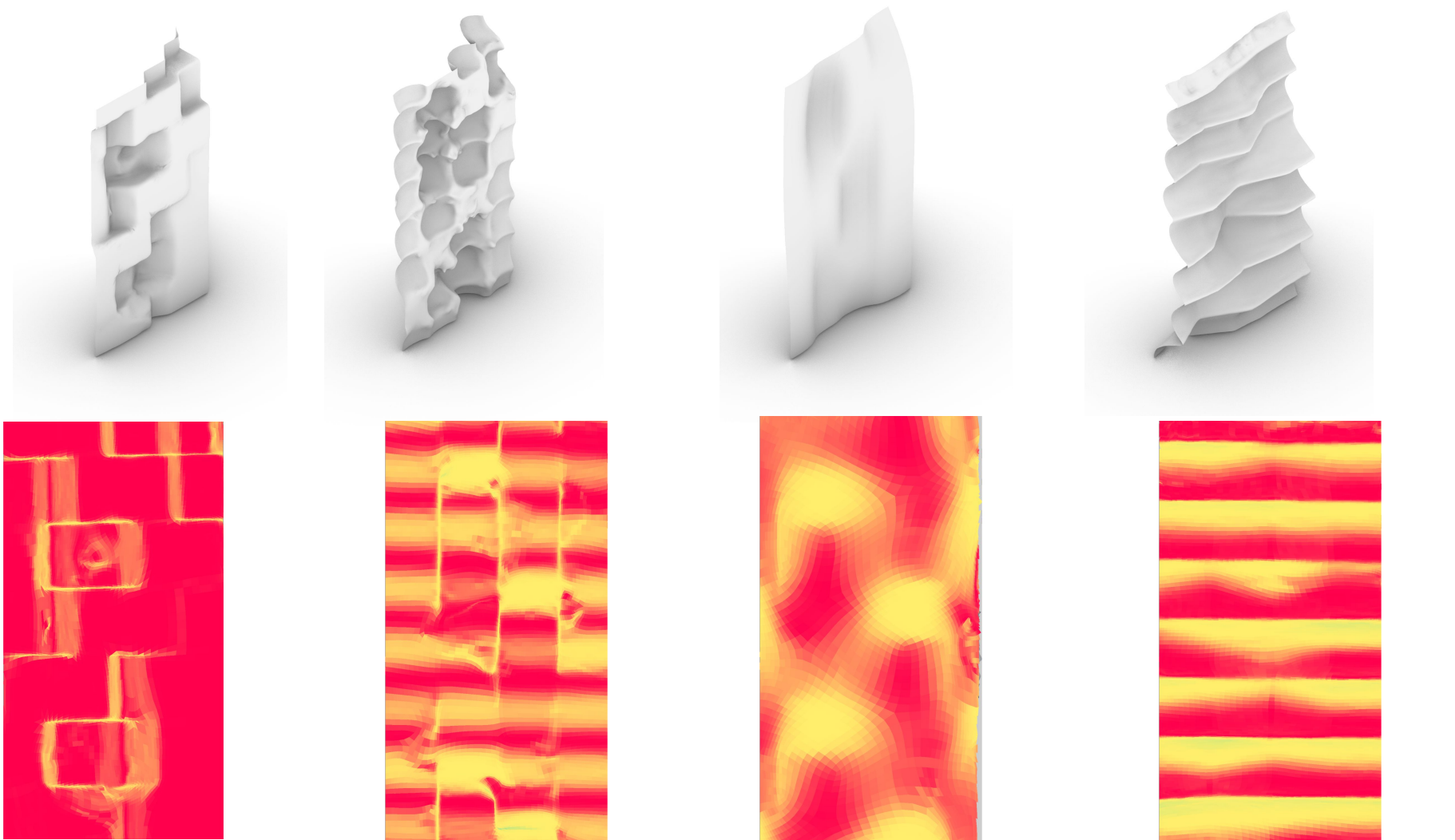


Facade as an Outdoor and Indoor Climate Giver. Systematic Studies

Thermal Emittance (0.1 - 0.9) Solar Reflectance (0.1 - 0.9)

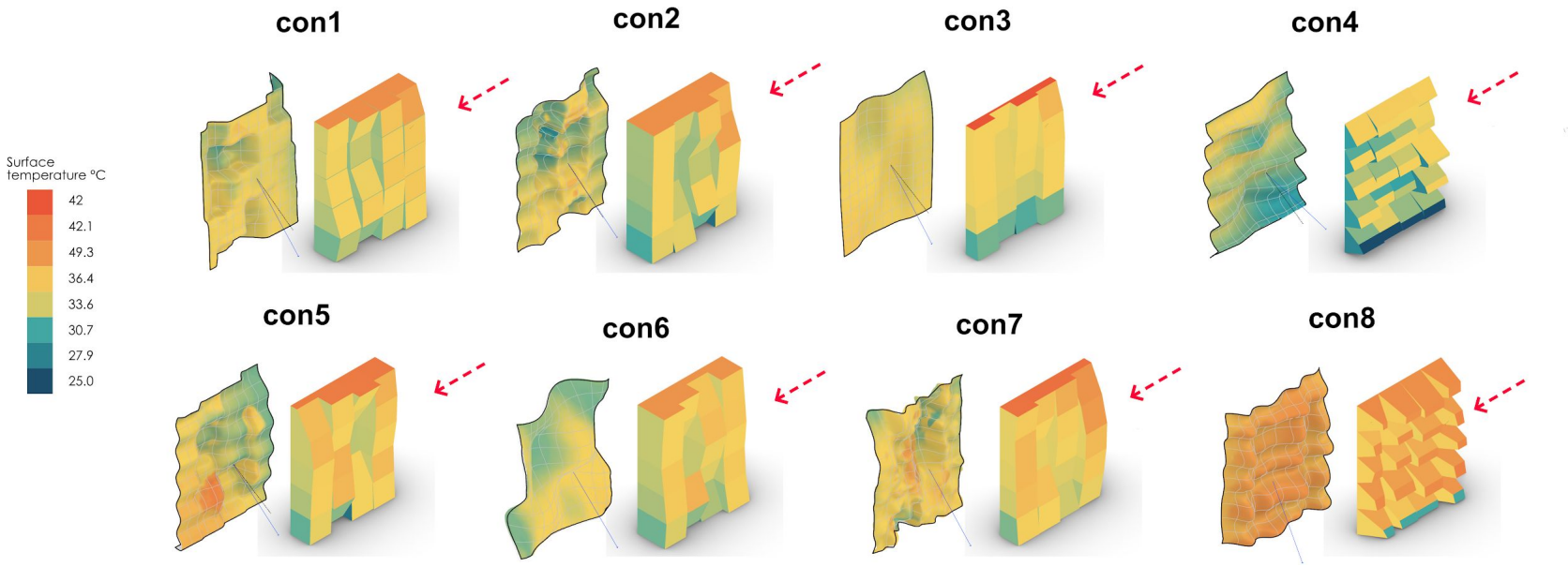




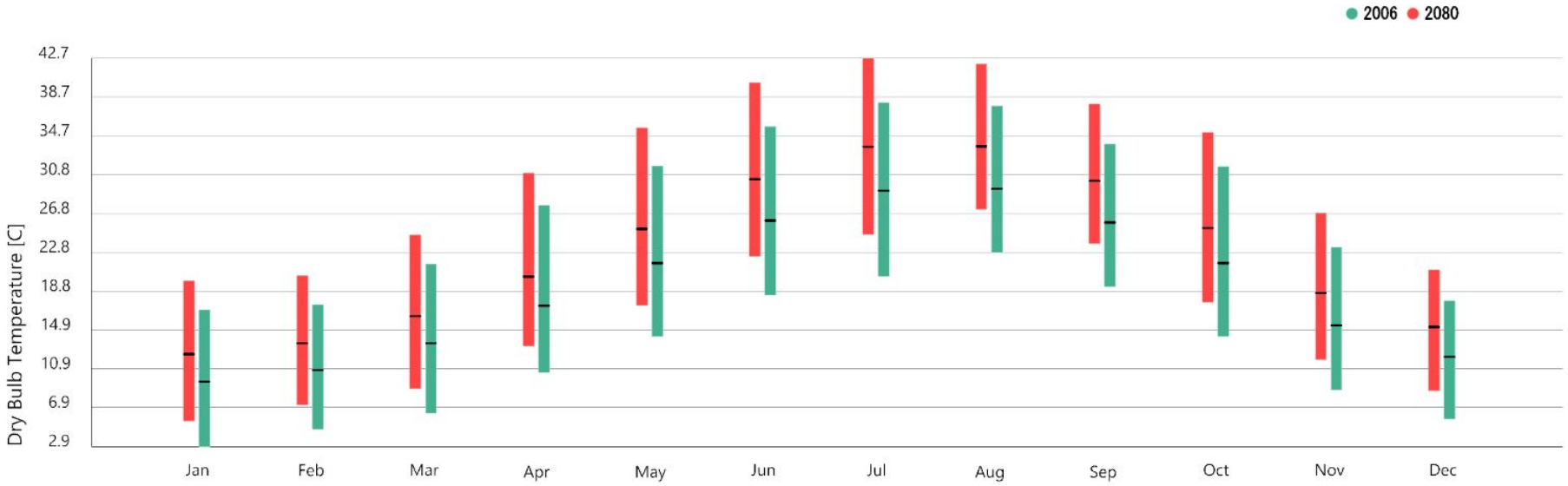


Research by Design. Geometry and Climate Change

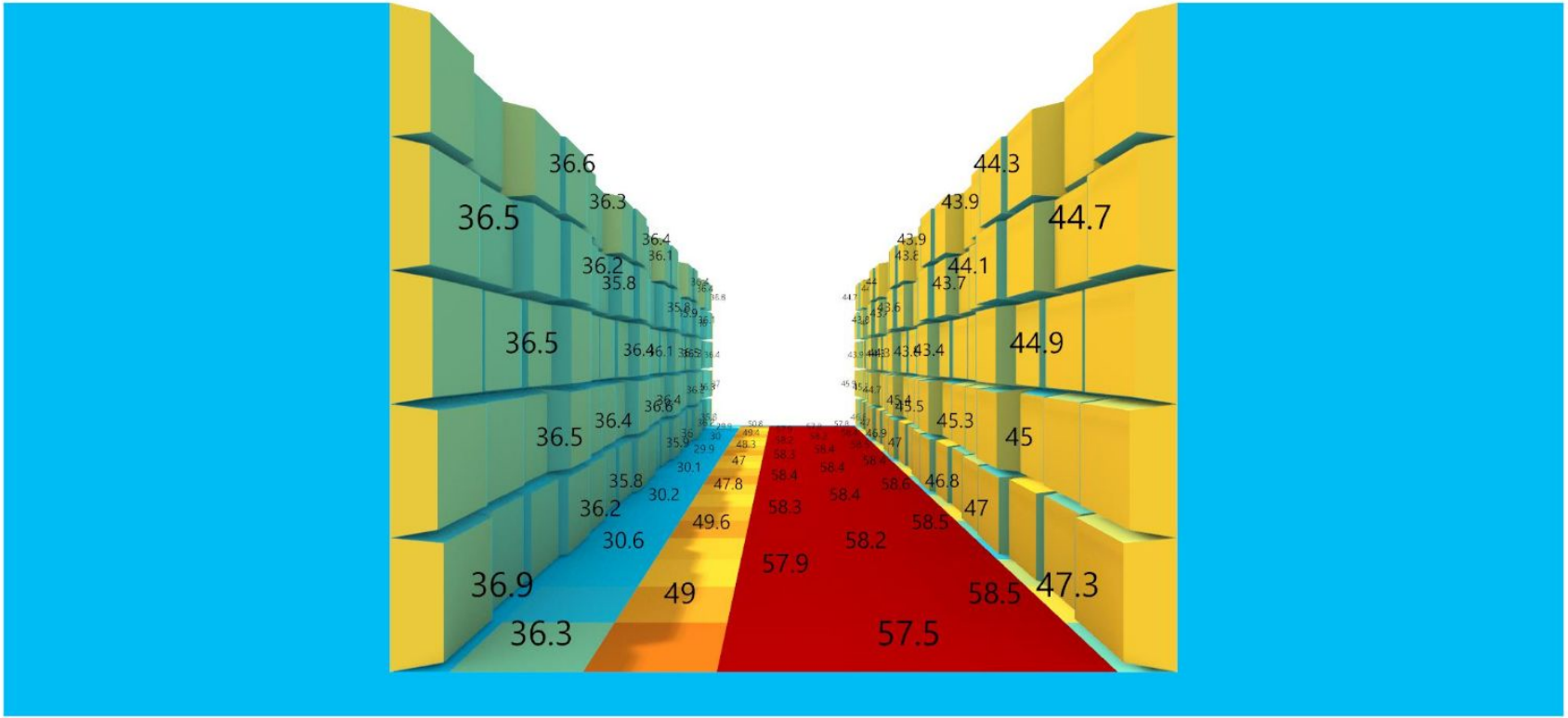
with University of Cyprus and University of Camerino



Dry Bulb Temperature



Facade Geometry and Climate Change



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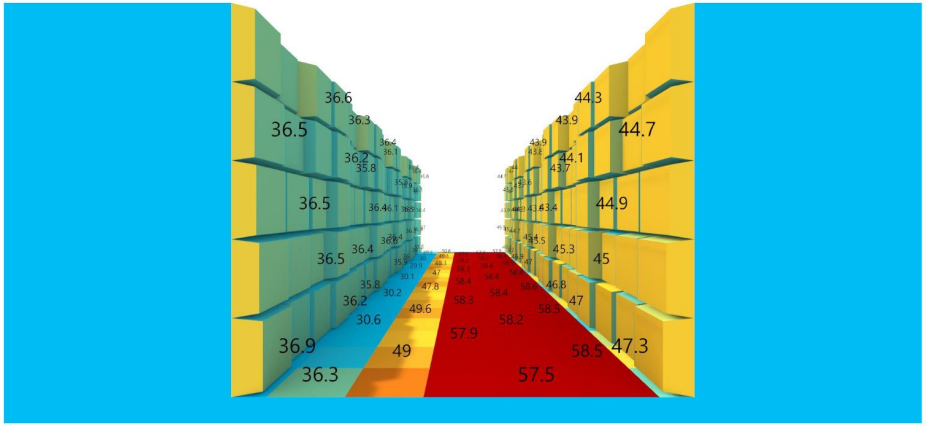
today



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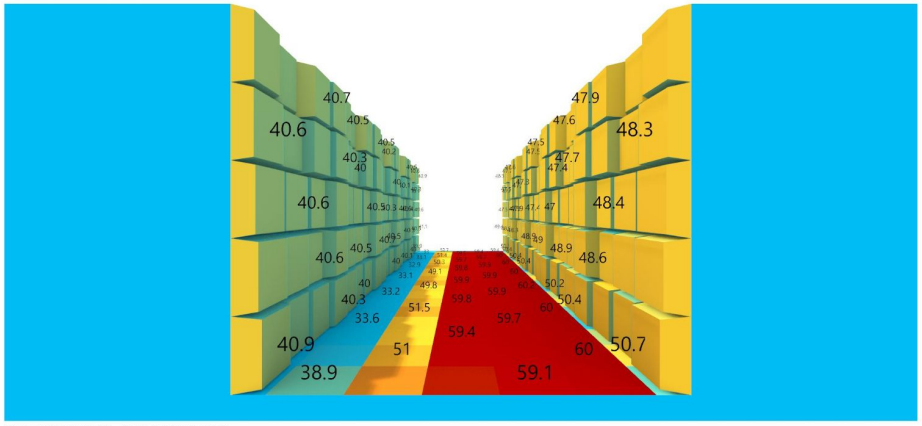
2080



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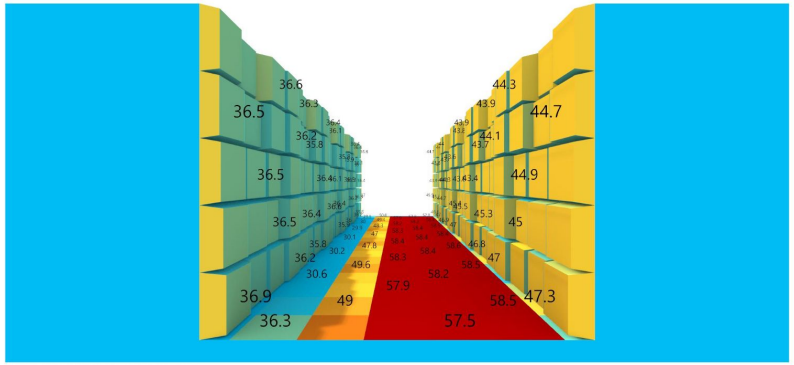
today



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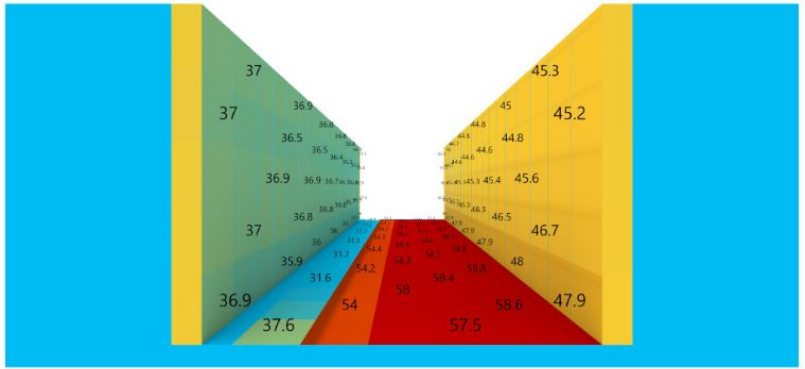

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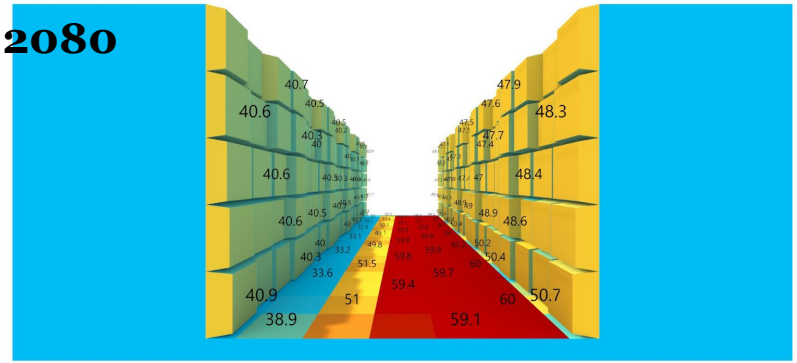
2080



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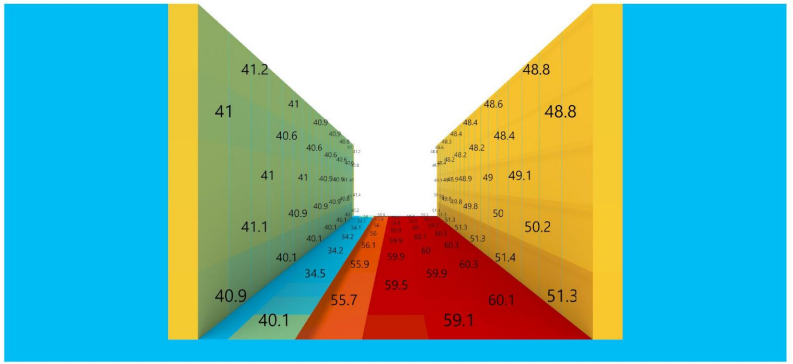

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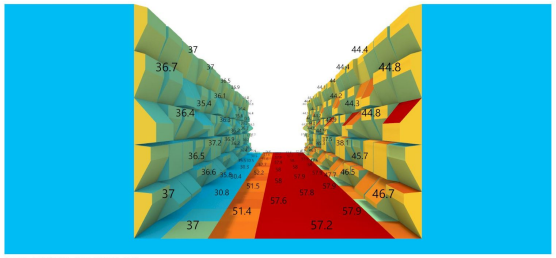
today



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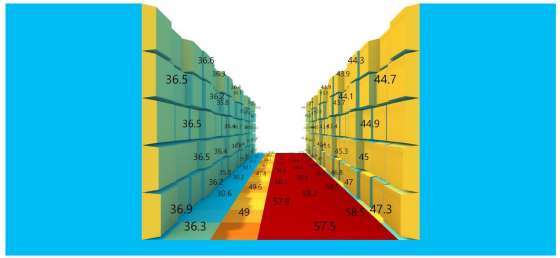

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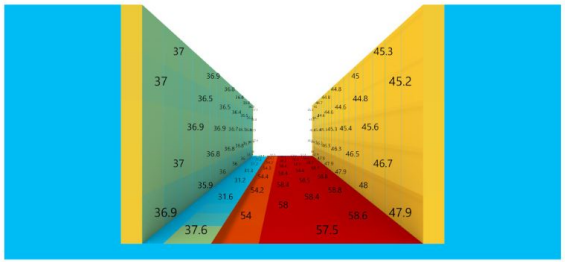

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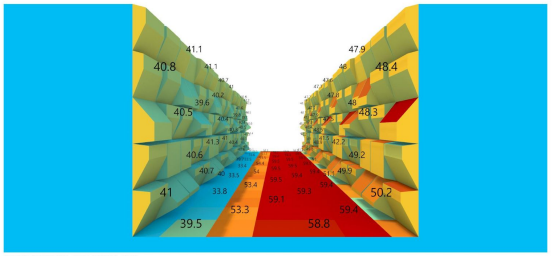
2080



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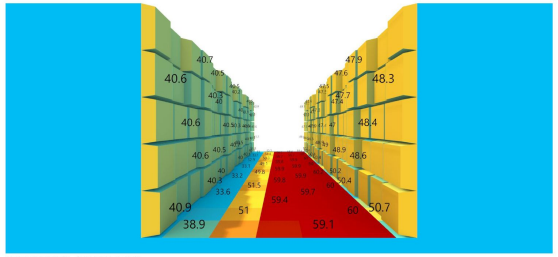

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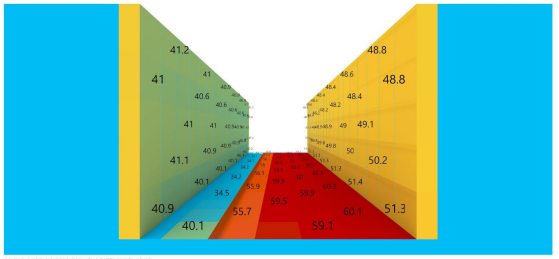


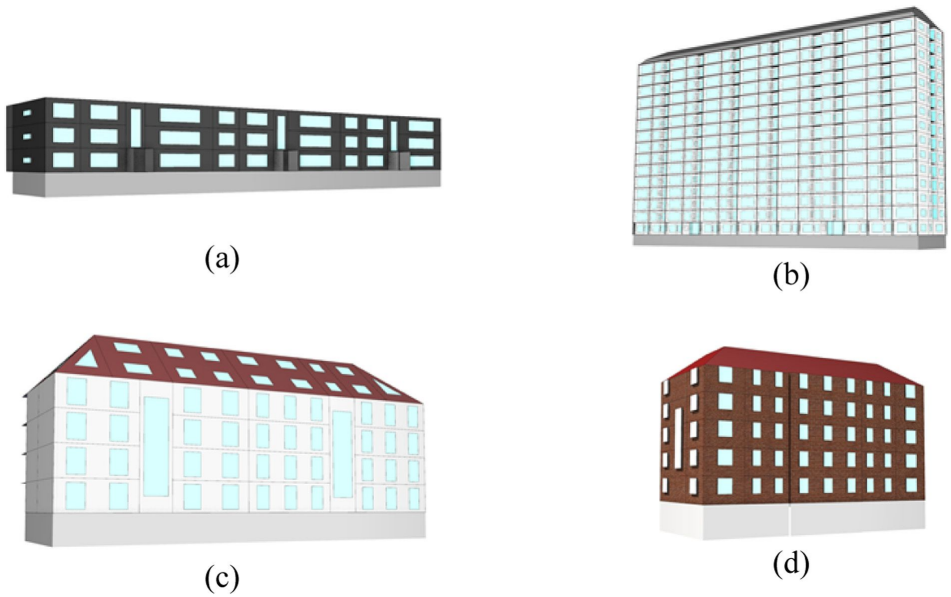
1A FAR BARE 8.9.2080 90° - SURF. TEMP °C -13.00

8) RETROFIT

The issue of today Retrofit

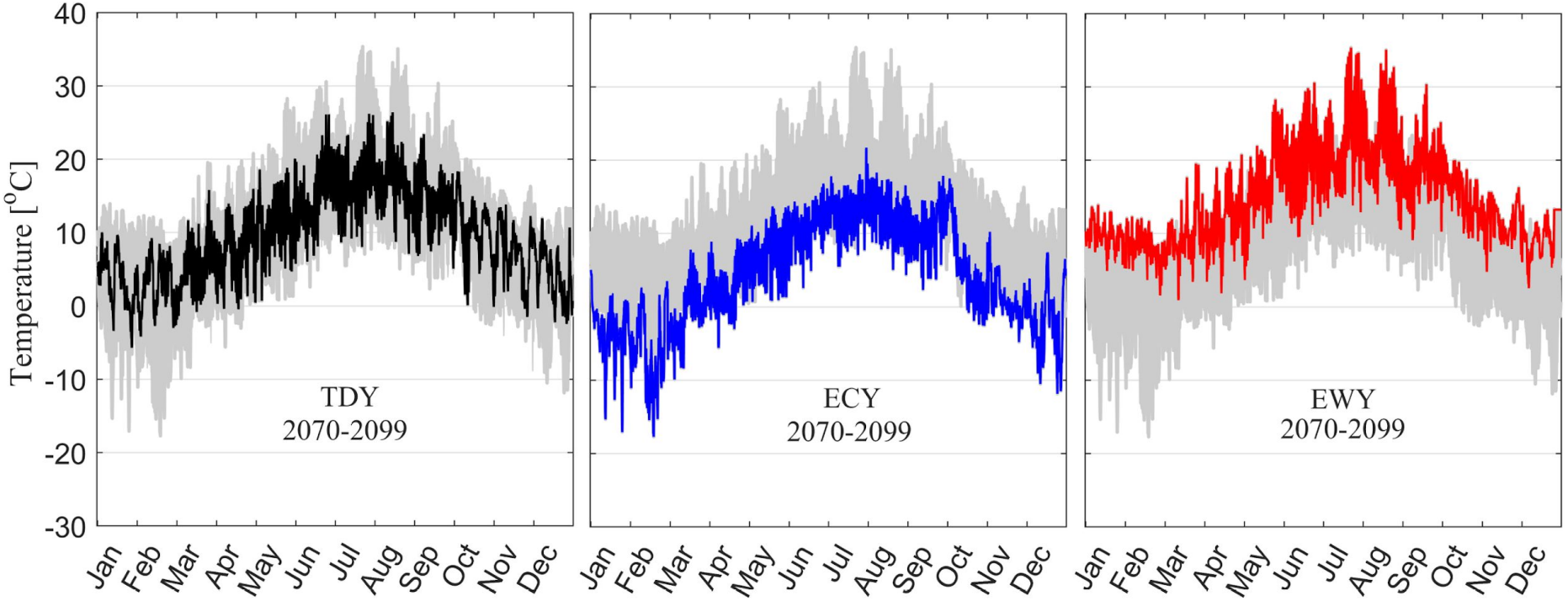
Future Climate Resilience Through Informed Decision Making in Retrofitting Projects

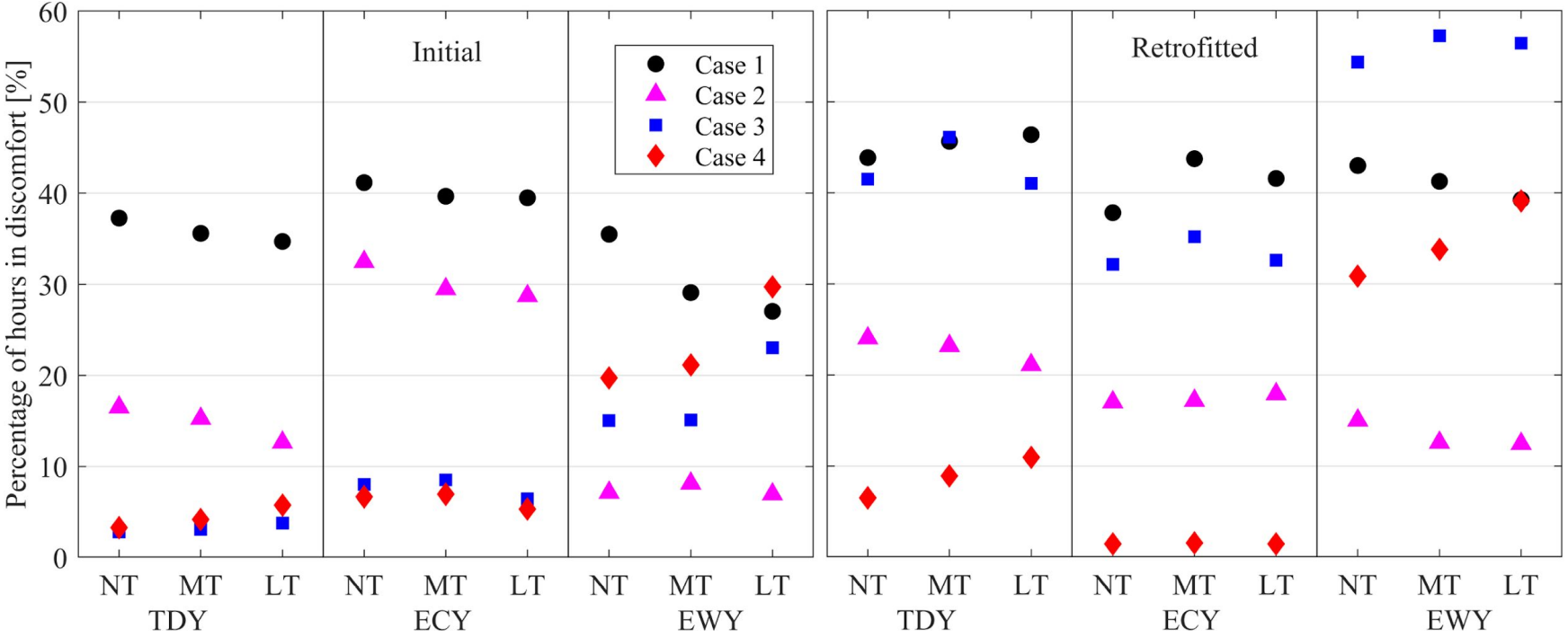
Jonas Manuel Gremmelspacher, Julija Sivolova, Emanuele Naboni, Vahid M. Nik



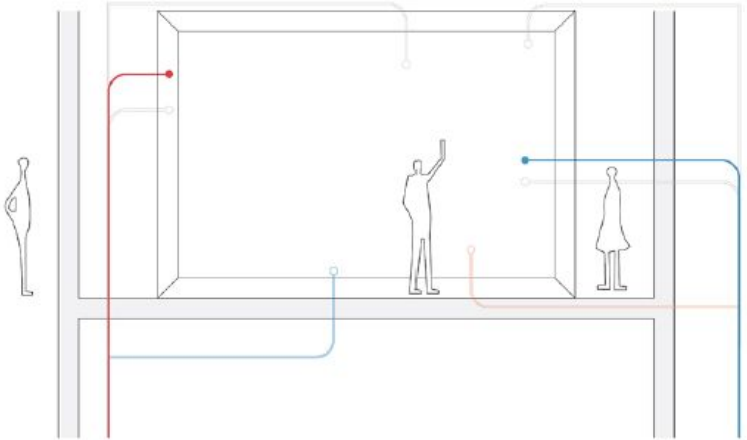
1, Aarhus, Denmark; (b) Case 2, Copenhagen, Denmark; (c) Case 3, Stuttgart, Germany; (d) Case 4, Stuttgart, Germany.

The issue of today Retrofit



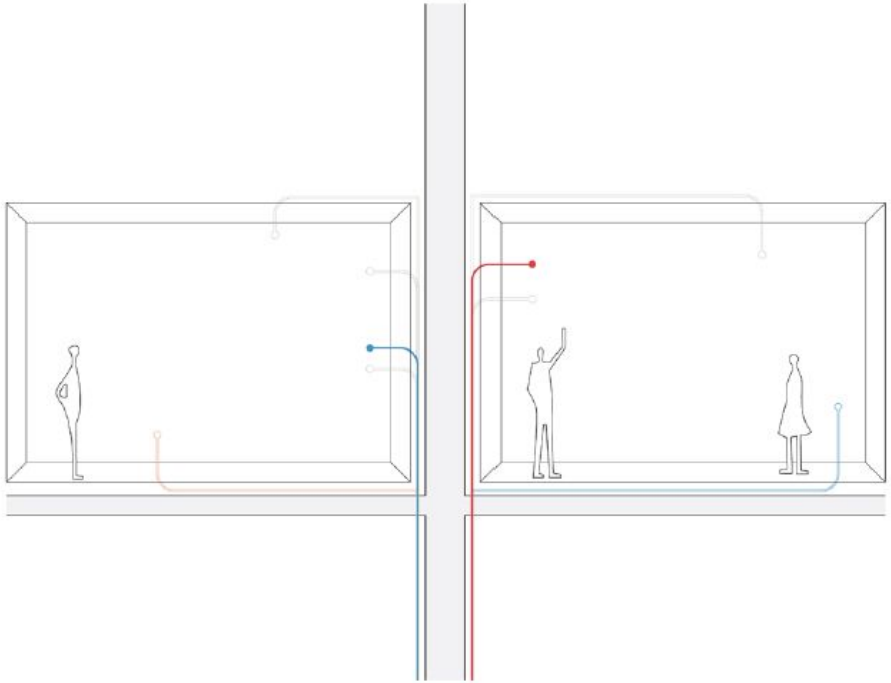

Percentage of hours in discomfort [%]
60
50
40
30
20
10
0
Initial
Retrofitted
Case 1
Case 2
Case 3
Case 4
NT
MT
LT
TDY
ECY
EWY

9) INDOORS



EXPLODING THE BUILT FABRIC

Order is driven by the climatic potential of elements, curating interactions for the occupant. The wall is truly inhabited as each space between structure and services can be occupied. The experience of the building is organic.



TRADITIONAL BUILDING

Order and alignment is dictated by efficiency, the experience of the building is prescriptive and disassociated from the external environment.

BRI Building Research & Information 2014
http://dx.doi.org/10.1080/09613218.2015.989662
Routledge
INFORMATION PAPER

Thermal pleasure in built environments: physiology of alliesthesia

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International standards that define thermal comfort in uniform environments are based on the steady-state heat balance equation that posits 'neutrality' as the optimal occupant comfort state for which environments are designed, but thermal perception is more than an outcome of a deterministic, steady-state heat balance. Thermal alliesthesia is a conceptual framework to understand the hedonics of a much larger spectrum of thermal environments than the more thoroughly researched concept of thermal neutrality. At its simplest, thermal alliesthesia states that the hedonic qualities of the thermal environment are determined as much by the general thermal state of the subject as by the environment itself. A peripheral thermal stimulus that offsets or counters a thermoregulatory load-error will be pleasantly perceived and vice versa, a stimulus that exacerbates thermoregulatory load-error will feel unpleasant. The present paper elaborates the thermophysiological hypothesis of alliesthesia with a particular focus on set-point control and the origins of thermoregulatory load-error signals, and thus distances them within the broader context of thermal pleasure. Alliesthesia provides an overarching framework within which diverse and previously disconnected findings of laboratory experiments, field studies and even comfort standards spanning the last 40 years of thermal comfort research can be more coherently understood.

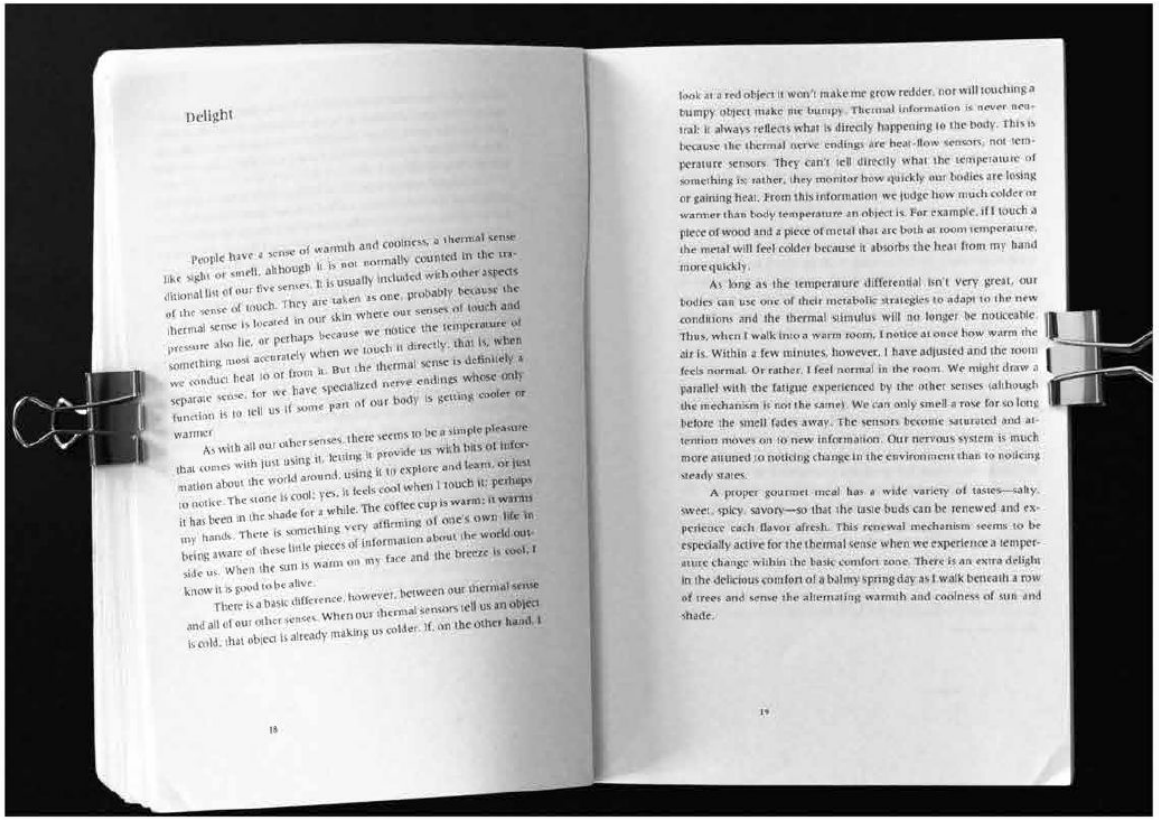
Keywords: adaptation; air-conditioning; alliesthesia; non-steady-state environments; physiology; thermal comfort; thermal pleasure; thermoreceptors

Introduction

The mainstreaming of adaptive comfort principles into the American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE) thermal comfort Standard 55 (ASHRAE, 2013) and EN15251 (2007) reflects a widespread awareness that thermal perception is more than an outcome of a deterministic, steady-state heat balance that has traditionally been used to define optimum indoor temperatures. Thermal alliesthesia has been proposed as a conceptual framework that differentiates the thermal pleasure in non-steady-state environments (de Dear, 2010) from the more thoroughly researched concept of thermal neutrality associated with steady-state environmental exposures (such as PMV/PPD). It may also offer a conceptual model of perceptual processes that determine why particular environmental configurations are unpleasant for some and pleasant for others.

This paper is the second in a series exploring alliesthesia in the context of indoor thermal comfort (de Dear, 2011). It begins with a brief summary of the hypothesis of alliesthesia and its potential to explain psychological states of thermal pleasure within the built environment. This introduction is based on a review of literature straddling the domains of thermal comfort, physiology and psychology. Subsequent papers in this series (1) will contribute empirical evidence from human subject laboratory experiments to support the hypothesis elaborated in this paper, and (2) translate this paper's hypothesis into a numerical model of thermal alliesthesia. The ultimate aim of the series of papers is to present alliesthesia as an overarching theoretical framework that reconciles previously contradictory strands of thermal comfort research and provides a more unified understanding of the many facets of thermal perception in the built environment.

Ref: Parkinson & de Dear 2014



Delight

People have a sense of warmth and coolness, a thermal sense like sight or smell, although it is not normally counted in the traditional list of our five senses. It is usually included with other aspects of the sense of touch. They are taken as one, probably because the thermal sense is located in our skin where our senses of touch and pressure also lie, or perhaps because we notice the temperature of something most accurately when we touch it directly, that is, when we conduct heat to or from it. But the thermal sense is definitely a separate sense, for we have specialized nerve endings whose only function is to tell us if some part of our body is getting cooler or warmer.

As with all our other senses, there seems to be a simple pleasure that comes with just using it, letting it provide us with bits of information about the world around, using it to explore and learn, or just to notice. The stone is cool: yes, it feels cool when I touch it; perhaps it has been in the shade for a while. The coffee cup is warm: it warms my hands. There is something very affirming of one's own life in being aware of these little pieces of information about the world outside us. When the sun is warm on my face and the breeze is cool, I know it is good to be alive.

There is a basic difference, however, between our thermal sense and all of our other senses. When our thermal sensors tell us an object is cold, that object is already making us colder. If, on the other hand, I look at a red object it won't make me grow redder, nor will touching a bumpy object make me bumpy. Thermal information is never neutral: it always reflects what is directly happening to the body. This is because the thermal nerve endings are heat-flow sensors, not temperature sensors. They can't tell directly what the temperature of something is; rather, they monitor how quickly our bodies are losing or gaining heat. From this information we judge how much colder or warmer than body temperature an object is. For example, if I touch a piece of wood and a piece of metal that are both at room temperature, the metal will feel colder because it absorbs the heat from my hand more quickly.

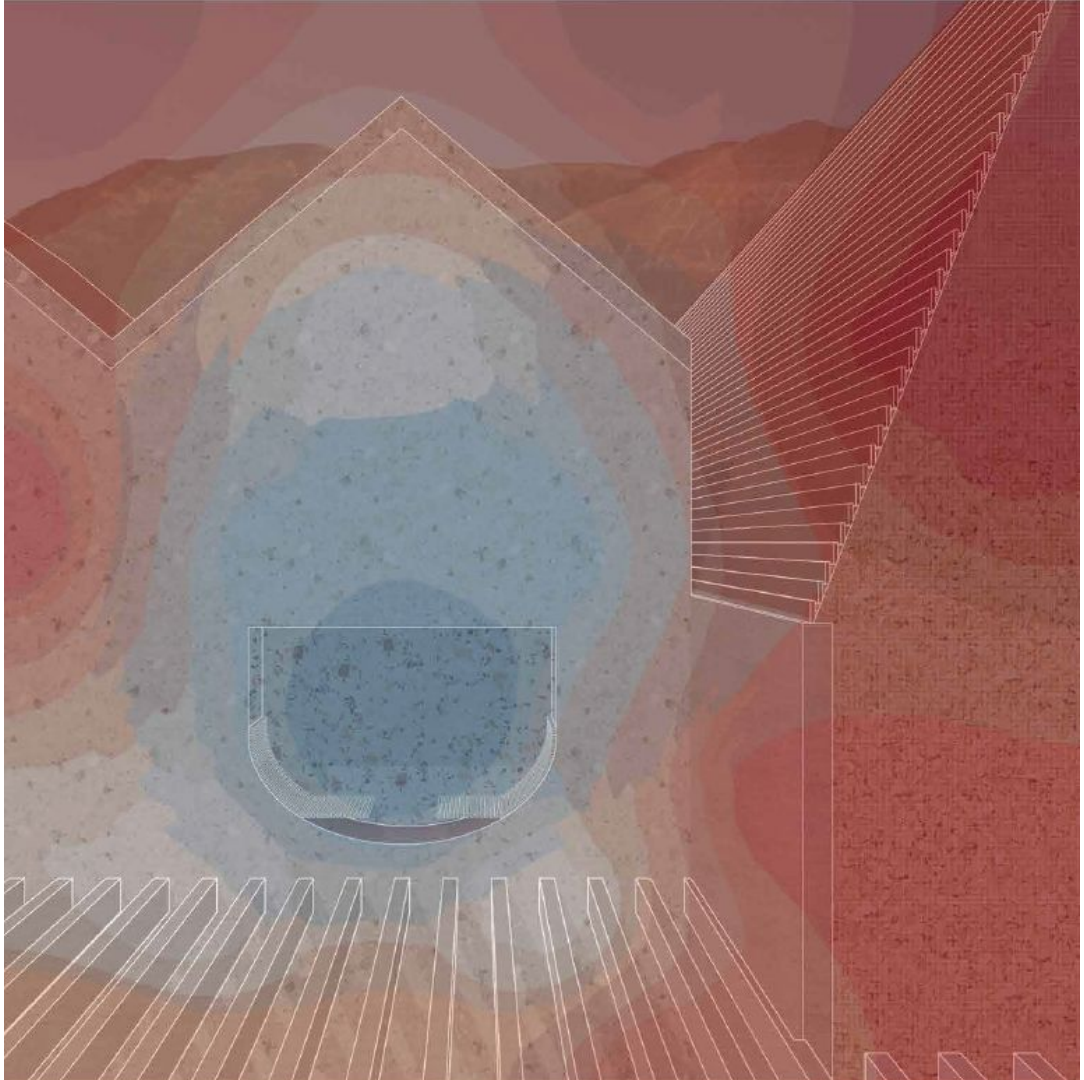
As long as the temperature differential isn't very great, our bodies can use one of their metabolic strategies to adapt to the new conditions and the thermal stimulus will no longer be noticeable. Thus, when I walk into a warm room, I notice at once how warm the air is. Within a few minutes, however, I have adjusted and the room feels normal. Or rather, I feel normal in the room. We might draw a parallel with the fatigue experienced by the other senses (although the mechanism is not the same). We can only smell a rose for so long before the smell fades away. The sensors become saturated and attention moves on to new information. Our nervous system is much more attuned to noticing change in the environment than to noticing steady states.

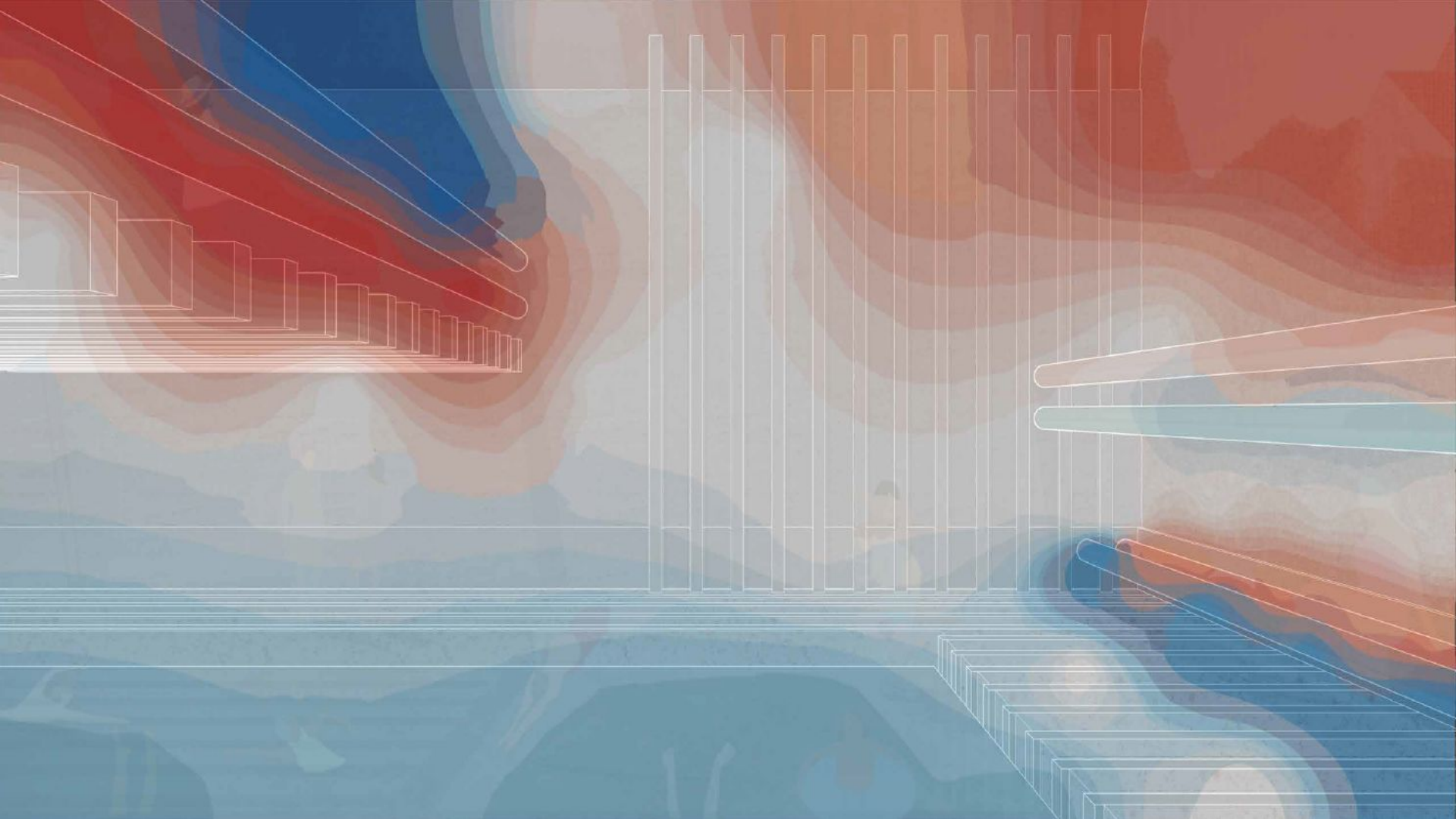
A proper gourmet meal has a wide variety of tastes—salty, sweet, spicy, savory—so that the taste buds can be renewed and experience each flavor afresh. This renewal mechanism seems to be especially active for the thermal sense when we experience a temperature change within the basic comfort zone. There is an extra delight in the delicious comfort of a balmy spring day as I walk beneath a row of trees and sense the alternating warmth and coolness of sun and shade.

18

19

Ref: Lisa Heschong





10) PERSONAL DEVICE


EXHIBIT
FIRST SEMESTER WORK 2014
THE ARCTIC
OPENING AND REFRESHMENTS
BYG. 68 - OPGANG A
FRIDAY march 6th 15:00
ARCHITECTURE
AND EXTREME
ENVIRONMENTS


EXHIBIT
FIRST SEMESTER WORK 2017/18
TANZANIA
OPENING AND REFRESHMENTS
KADK campus - BUILDING 68 - ENTRANCE A
FRIDAY february 23rd
ARCHITECTURE
AND EXTREME
ENVIRONMENTS


EXHIBIT
FIRST SEMESTER WORK 2018/19
ALASKA
OPENING AND REFRESHMENTS
KADK campus - BUILDING 68 - ENTRANCE A
THURSDAY January 31st 16:00
ARCHITECTURE
AND EXTREME
ENVIRONMENTS


EXHIBIT
FIRST SEMESTER WORK 2015/16
THE AMAZON
OPENING AND REFRESHMENTS
KADK campus - BUILDING 68 - ENTRANCE A
FRIDAY february 12th 15:00
ARCHITECTURE
AND EXTREME
ENVIRONMENTS


EXHIBIT
FIRST SEMESTER WORK 2016/17
KANGERLUSSUAQ
OPENING AND REFRESHMENTS
KADK campus - BUILDING 68 - ENTRANCE A
FRIDAY february 10th 15:00
ARCHITECTURE
AND EXTREME
ENVIRONMENTS


EXHIBIT
FIRST SEMESTER WORK 2016/17
THE GOBI
OPENING AND REFRESHMENTS
KADK campus - BUILDING 68 - ENTRANCE A
FRIDAY february 10th 15:00
ARCHITECTURE
AND EXTREME
ENVIRONMENTS

PERSONAL PROTOTYPES

Design of 210 prototypes placed globally

with David Garcia (KADK)


AVG WIND SPEED 1.5M/S
WIND GUST 2.6M/S

Amazon: Malaria proven - thermally comfortable units

Gobi Desert: Purified Air systems

Amazon: thermally adjusted windows with seedless plants

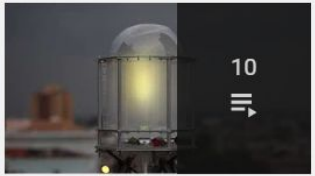
Alaska: Carbon Positive Sustainable Protein Production

architecture and extreme environments

Created playlists

2018 ALASKA

VIEW FULL PLAYLIST



2015 THE AMAZON

VIEW FULL PLAYLIST

2016 THE GOBI

VIEW FULL PLAYLIST

2014 THE ARCTIC

VIEW FULL PLAYLIST

2017 TANZANIA

VIEW FULL PLAYLIST

Uploads

PLAY ALL

AEE, ALASKA: DEPLOYABLE EMERGENCY STRUCTURE

891 views • 9 months ago

AEE, ALASKA: XYLEM FILTRATION

91 views • 9 months ago

AEE, ALASKA: THERMAL PROPERTIES OF EELGRASS

82 views • 9 months ago

AEE, ALASKA: FISH WASTE

74 views • 9 months ago

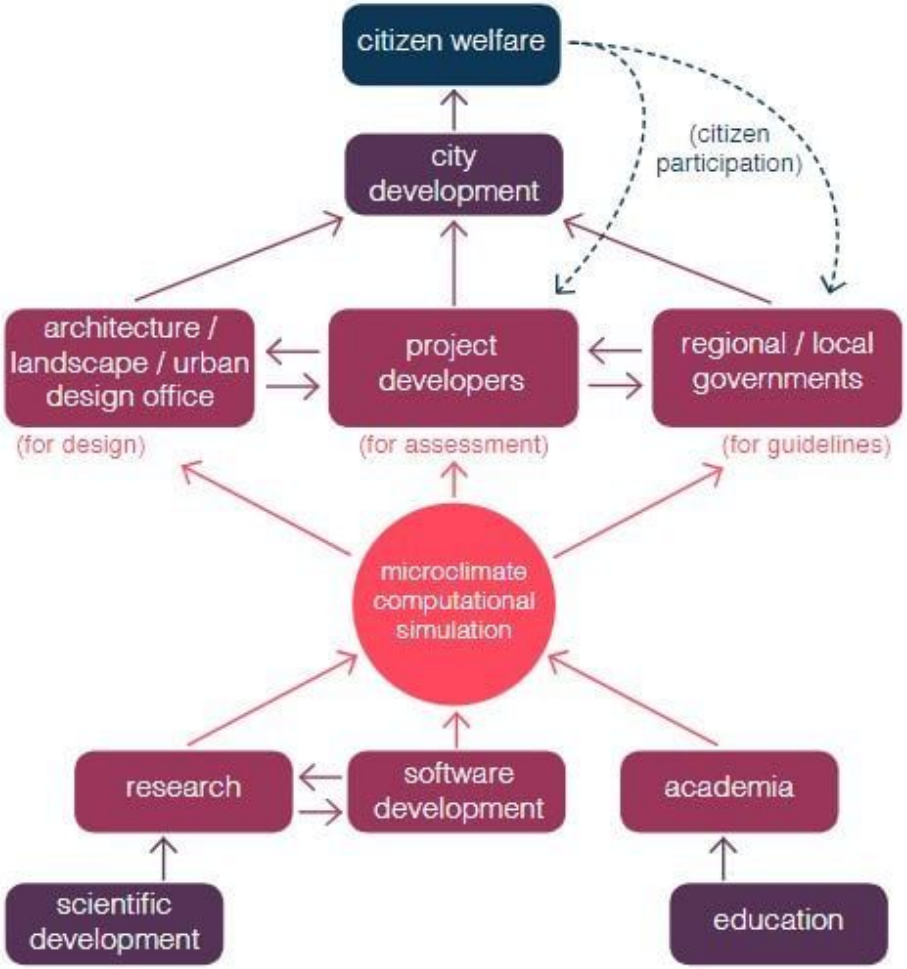
AEE, ALASKA: LOCAL TILE PRODUCTION

84 views • 9 months ago

Main Messages

Climatic Adaptation can be pursued at different scales

Its possible to interplay with climate change as a value for multiple co-benefits


citizen welfare
city development
(citizen participation)
architecture / landscape / urban design office
project developers
regional / local governments
(for design)
(for assessment)
(for guidelines)
microclimate computational simulation
research
software development
academia
scientific development
education

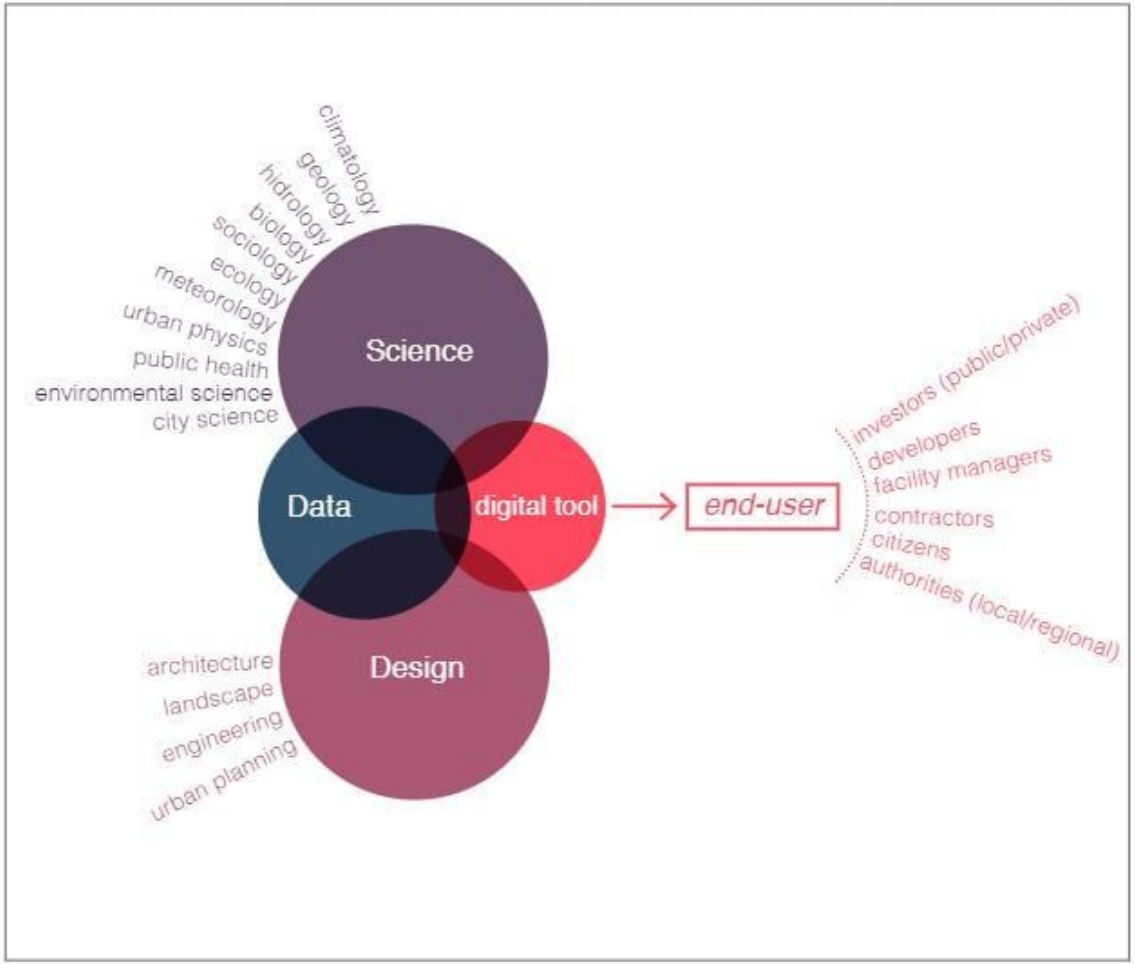
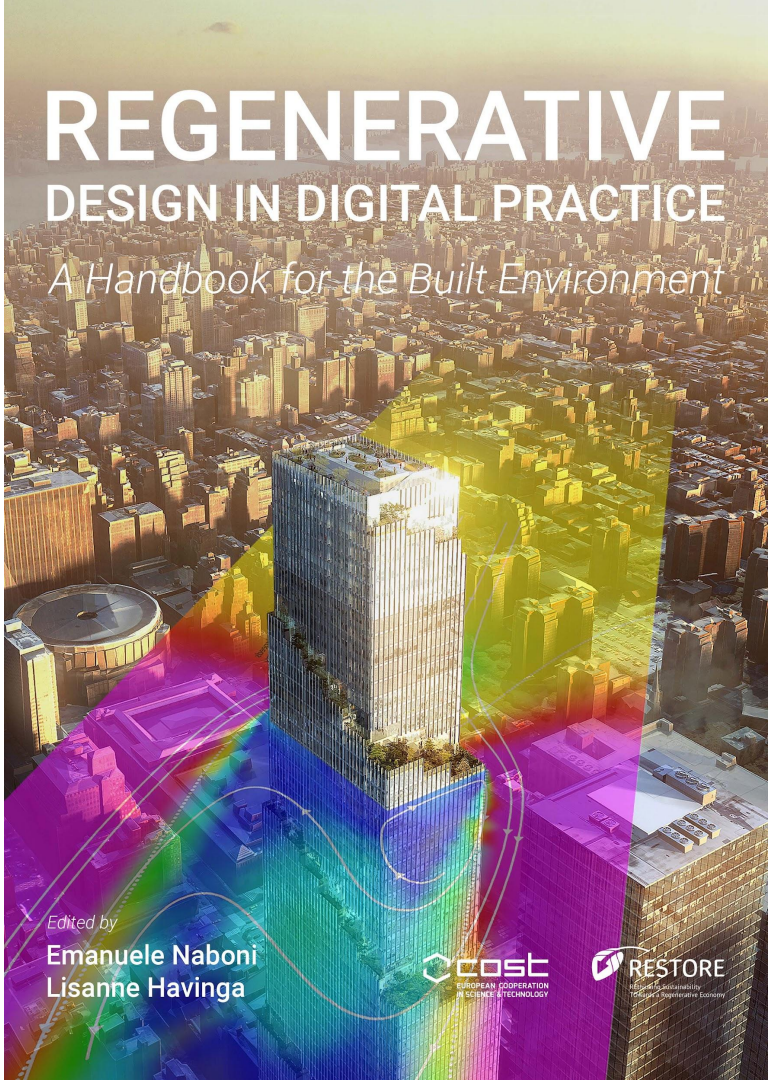


Figure 09. Diagram of interdisciplinary approach needed for the use of digital tools for microclimate development (author, 2021).
Note: Adapted from *Blending Sciences into Regenerative Design Practice,* by E.Naboni, 2019.



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