ARCHITECTURE OF THE SENSES

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AE
Architectural Engineering + Technology
Graduation studio

Thematic research

Building technology

Architectural study

Architectural design
CONTENTS

Introduction
  Parkstad & IBA
  Fascination
  Research question
  Design question

Research
  Architectural perception
  Human perception
  Evolution of the indoor climate

Design
  Architectural
  Structure
  Building technology
  Climate

Conclusion
INTRODUCTION

Parkstad Limburg
INTRODUCTION

Parkstad Limburg

Population decline
Ageing population
Losing economic strength
Vacancy
Three themes:
Flexible city, Energy city & Recycle City

Thematics:
Vacancy, Dwelling and Care, Leisure and Employment, Mobility, Knowledge and Energy innovation, Border and Centrality, Regional Identity
Problem Statement

Rivival of Parkstad

from: http://www.iba-parkstad.nl/nl/organisatie/werkwijze
Clever Heritage
Romans and mining activities
Plans and visions

IBA Parkstad goals:

Flexible city:

Interpretation of vacant spaces, possible relations to cultural history and landscape

Cultural identity: Roman culture

Via Belgica, Roman Thermae & mining industries
INTRODUCTION

Cultural identity

Traces of Romans and mining activities

Maastricht

Heerlen

Via Belgica

mining activities

Thursday 31 March 16

from: own ill.
INTRODUCTION

Cultural identity
Romeins Heerlen, Thermae of Coriovellum

‘Via Belgica’
Cultural identity
Mining activities
Cultural identity

Mining activities
INTRODUCTION

Cultural identity
Mine workers
INTRODUCTION

Cultural identity

Mine workers
INTRODUCTION

Cultural identity
Mine workers
Personal fascination

*for ‘Clever Heritage’*

Atmospheres in buildings that facilitate multi-sensory experience. These actively incorporate visitors or users in the experience of architecture and nature through their perception.
INTRODUCTION

Personal fascination

for ‘Clever Heritage’

‘How can we facilitate a multi-sensory perception for an embodied experience of architecture?’
INTRODUCTION

Personal fascination + IBA

for ‘Clever Heritage’

‘How can I incorporate the idea of atmospheric design and multi-sensorial architecture with the IBA goals?’

Reconstructing a shared identity of Roman remnants and mining history

Solving the problem with an innovative and sustainable project
INTRODUCTION

Project: *Architecture of the senses*

Evoking multi-sensorial perception in architecture

Materialisation evoking sensorial conception

Renewable, reusable and demountable construction
Project ambition

Rethinking the contemporary presentation, role and experience of ruins and vanished historical traces

The revival of the ‘Via Belgica’

Activating the importance of sensorial awareness

An approval of the strong character and intimacy of natural materials
Thematic research

Architectural perception

Human perception

Evolution on the indoor climate
Architectural perception

*Ocular - centric*

from: http://www.mlahanas.de/Greeks/Arts/Parthenon/Curvature.jpg https://upload.wikimedia.org/wikipedia/commons/6/69/Pantheon-panini.jpg
Architectural perception

Vision and touch
Architectural perception
Reproduction and plasticity in architecture

from: https://alterrealites.files.wordpress.com/2011/12/05-4-hilberseimer-ville-verticale-2-1924-dethier-la-ville.jpg
http://www.ambienteambienti.com/wp-content/uploads/2012/02/Alberobello1.jpg
Architectural perception
Visiting places virtually
Architectural perception

_Atmosphere in architecture_

Embodied experience

_recollection_

_recognition_

_comparison_

from: http://www.istanbulfind.com/upload/original/image512614ba991a7.jpg
Architectural perception

Time perception

According to Olgyay (1963) the study of the variables in climate, biology and technology are essential for architectural perception, thus must be interlocked within the search for an architectural expression.
Human perception

Sensory perception

‘Indoor climate, is the technical term for the climate created by the house’s physical enclosure and various climate systems employed’

(Dahl, 2010, p. 23)
Human perception

*Human skin*

**Thermoreceptors**: cold and warm receptors
Skin thermoreceptors provide the data from the environment to compare against deep body temperature

**Nociceptor**, pain sense: pressure
Human perception

*Human skin*

**Thermoreceptor**

Sensitivity of cold receptor ranges from $\sim 15\, ^\circ\text{C}$ to $34\, ^\circ\text{C}$
(reacts when skin temperature is below 34)
Sensitivity of warm receptor ranges from $\sim 38\, ^\circ\text{C}$ to $43\, ^\circ\text{C}$
(reacts when skin temperature is above 38)

Human perception
the eye

Adaptability of the eye

The eye adapts to the speed of equal intervals, so we perceive the images fluently.

from: http://ursispaltenstein.ch/blog/images/uploads_img/1000_frames_of_hitchcock_5.jpg
Human perception
the nose

The perception of smell is processed via the olfactory system.

The interpretation of the signals by the olfactory brain is associated with preceding experiences of odour, that distinguishes the quality of air. The intensity and irritation of odour depends eventually on the olfactory adaptation.
The inner ear, together with the external and middle ear forms the human ear.

The interval of the sensitivity covers 20 Hz to 20,000 Hz, while the most accurate sensation is perceived with middle frequencies from 500 Hz to 5,000 Hz.
Evolution of the indoor climate

Three manners of control

Conservative

Selective

Regenerative
Evolution of the indoor climate

*Conservative*

Introduction of climate installations after Industrial Revolution ~19th Century, in combination with existing modes of heating.

Perkins’ hot water heating system 1832

Evolution of the indoor climate

Selective

The selective manner of control allows particularly the penetration of desirable environmental conditions from outside and preserves a desirable climate inside.
Evolution of the indoor climate

Selective

The selective manner of control allows particularly the penetration of desirable environmental conditions from outside and preserves a desirable climate inside.

Evolution of the indoor climate

Comfort

The comfort zone defined by Olgyay (1963)

‘Physical and physiological reactions result from this struggle for biological equilibrium. Man strives for the point at which minimum expenditure of energy is needed to adjust himself to his environment’

Evolution of the indoor climate

Regenerative

Conventional standards in global comfort databases of occupant surveys in real buildings that indicates comfort by satisfaction and performances of the occupants.

Figuur 5.9 Comforttemperatuur in relatie tot gemiddelde buitentemperatuur bij gesloten gebouwen met een centraal geregelde klimaatinstallatie

Figuur 5.10 Comforttemperatuur in relatie tot gemiddelde buitentemperatuur bij natuurlijk geventileerde gebouwen met mogelijkheden voor individuele beïnvloeding van het binnenklimaat

Evolution of the indoor climate

*Regenerative*

Both present methods for prediction of thermal sensation and exclusion of discomfort using calculations of PVM (predicted mean vote) and PPD (predicted percentage of satisfied).

Evolution of the indoor climate

Adaptive climates

Alliesthesia (Cabanac, 1971)

A given environmental stimulus is perceived as either pleasant or unpleasant depending on the subject’s internal state.

Alliesthesia is essential to regulatory negative feedback systems relying on behavioural interventional such as:

- Hunger
- Thirst
- Thermoregulation
Evolution of the indoor climate

*Adaptive climates*

**Biophilia (Wilson, 1929)**

Human’s intrinsic fascination with life and life-like processes.

Life-like processes of in the environment are clearly visible in seasonal changes, organisms adapt them selves and their lifestyle to these changes. People feel affiliated with nature and being able to observe and notify this make people comfortable and more or less ‘*a body of nature*’.
Evolution of the indoor climate

*Passive architecture*

*Bio-climatic design (deDear, 2012)*

Bio-climatic design refers to recent revival of passive design strategies

**Design principles:**

*Natural ventilation*

*Direct solar gain*

*Thermal mass*

RESEARCH

from: [http://www.esa.int/spaceinimages/Images/2005/06/Earth_s_w](http://www.esa.int/spaceinimages/Images/2005/06/Earth_s_wind_patterns)
The perception is defined by the process in the brain, since the experience is associated with early images and experiences it is difficult to decide or define an equal experience for everyone. Therefore the *environmental imagination*, where architects design with the resolution of the climatic impacts in mind is more relevant.
Inspiration

design

from: F. Yegul, Baths and Bathing in Classical Antiquity p.27

Thursday 31 March 16
Inspiration
Program

The Thermal Baths of Coriovellium are considered as subject of design, due to the multi-sensory experience and the lacking archeological facilities nowadays.
BUILDING MATERIALS IN LIMBURG
Building materials techniques
Building materials techniques

Wood
Building materials techniques

Wood

1. Renewable
2. Demountable
3. Recyclable
4. CO$_2$ storage
5. Warmth and chloride resistant
6. Common image in Limburg
7. Natural material
8. Shows lifecycle
DESIGN

Heerlen

Corriovallum
Heerlen

Corriovallum
Heerlen

*Thermae Corriovallum*
Heerlen

Thermae Corriovallum
Heerlen

*Thermae Corriovallum*
DESIGN

site plan 1: 500

Thursday 31 March 16
DESIGN

concept
exterior
DESIGN

exterior

Thursday 31 March 16
DESIGN

exterior

66/111
**DESIGN**

*Materials interior*

Cedar wood  
aromatic scent, relaxing odour

Finnish Pine  
strong, resistant structure

Hemlock tree  
darkred, efficiency against temperature

Accoya  
acetylated wood for outstanding durability

Ruwe eik + leem  
cladding for moisture balance
DESIGN

public & visitor route

station

stadhuisplein

service
Design

Entrance

70/111
DESIGN

changing
footbath & lounge
tepid bath & whirl pool
cold bath & sauna
warm bath
DESIGN

overview
salt bath & hammam
warm bath
whirl pool & salt bath
rooftop
Technical
ruin
estimated grid system
3.68 m x 3.94
3.68 x 7.88 grid
400 x 200 mm kolom
640 x 200 mm balk

3.68 x 7.88 grid
400 x 200 mm kolom
1000 x 200 mm & 440 x 200 mm balk

3.68/1.84 x 7.88 grid
400 x 100 mm kolom
640 x 200 mm balk

3.68/0.92 x 7.88 grid
400 x 100 mm kolom
440 x 200 mm balk

STRUCTURE
STRUCTURE

3.68 x 7.88 grid
400 x 200 mm kolom
640 x 200 mm balk

3.68 x 7.88 grid
400 x 200 mm kolom
1000 x 200 mm & 440
x 200 mm balk

3.68/ 1.84 x 7.88 grid
400 x 100 mm kolom
640 x 200 mm balk

3.68/ 0.92 x 7.88
grid
400 x 100 mm
kolom 440 x 200
Building elevated baths of polystreen
Optimizing energy requirement

2 climates
Optimizing energy requirement

*insulation typha panels*

240 mm - R value 4,5
Optimizing energy requirement
floor heating and specific heating
Optimizing energy requirement
floor heating and specific heating
CLIMATE

Optimizing energy requirement

heatpump
CLIMATE

Optimizing energy requirement
heat exchanger for baths and floorheating
CLIMATE

Optimizing energy requirement
Ventilation diagram
Optimizing energy requirement
mechanical in- and outlet
for energy recovery
CLIMATE

Optimizing energy requirement

green roof & rainwater capture

105/111
Optimizing comfort
Temperature based on PVM calculation

30 C, 0.5 air velocity m/s and 70 % humidity
Optimizing comfort

Temperature based on PVM calculation

30 C, 0,2 air velocity m/s and 70 % humidity
Optimizing comfort

Temperature based on PVM calculation
Optimizing comfort

Temperature based on PVM calculation
Optimizing comfort

Establishing comfort mainly by ventilation.

*Air speed is decisive for the PVM*

Additionally underfloor heating.

*Reestablishing tradition of romans*

Importance of heat gaining ventilation due vapour transport.

*The ventilation rate is tripled due evaporation.*

Using mine water energy for direct heat transfer 38 degrees C.

*For the bath and underfloor heating*
CONCLUSION

traditional heavy building, towards light construction building

unusual but characteristic architectural appearance

multisensorial architecture appealing senses

attractive ruin, innovative/different experience