Le Mystere Picasso" Henri-Georges Clouzot 1956"
computational architecture

Focusing on structural and layout complexity.

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Chair: Design Informatics
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Site analysis (group)  
Methods for analysis: fuzzy logic & neural tree  
Perception studies  

Personal research:  
Methods for synthesis: optimization (Layout research)  

Architectural outcome  

Evaluation  
Form finding  
Manufacturability
Intelligent Design Objects (IDO)

- **Initialization of the Population**
- **Variable space**
  - Graphic representation of the variable space
- **Generation of possible solutions**
  - Genetic operations
  - Example sequences: 0000000, 1111111, 0001001, 0110011
- **Measurements**
  - Performance criterion
  - Values: 0.00047, 0.0189
- **Performance Analysis**
  - Pareto front of solutions
- **Optimization process**
  - Relaxed pareto ranking
Cognitive design approach

Computer generates a repertoire of Pareto designs and identifies the solution with maximal performance based on the solution proposed by the computational cognition. The designer identifies the Pareto design closest to his/her preferences.

Verification

1. Satisfaction of first-order preferences, and proposition of second-order preferences

Validation

2. Tuning of second-order preferences

Exploration of the designs' particularities

Favourite design solution

Modified requirements

Criteria

Designer's preferences

Difference
Site analysis

Neural tree

1. No intervention
2. Renovation Art centre
3. New Art Centre

- Art Related
- Not Art Related
- Locals
- Tourists
- Interaction
- New Job
- Better Job
- Horeca
- Existing Stores
- Public Transport
- Pedestrian
- Cycling
- Cars
- Boats
- Urban Squares
- Green Areas
- History
- Style Context

- Recreational
- Exciting Events
- People
- Banks / Money Related Business
- Job
- Tourism Effect
- Social
- Traffic
- Social
- Economic
- Accessibility
- Public Areas
- Architecture

Good Neighbourhood

- High Liveliness
- Prosperity
- Safety
- Sustainability
- Coherence of Space

End node
Node
Analysis
Methods for Analysis

- Fuzzy neural tree for human-like assessment of soft objectives

Fuzzy logic operations at neurons

decision variables

Fuzzy logic operations at neurons
Neighbourhood neural tree

Art Related
- Not Art Related
- Locals
- Tourists
- Interaction
- New Job
- Better Job
- Horeca
- Existing Stores

Recreational
- Exciting Events
- People

Banks / Money Related Business
- Job
- Tourism Effect
- Social
- Traffic

Social Traffic
- Economic
- Environment

Urban Squares
- Green Areas
- History
- Style Context

Public Transport
- Pedestrian
- Cycling
- Cars
- Boats

End node Node Analysis

Analysis

High Liveliness
- Prosperity
- Safety
- Sustainability
- Coherence of Space

Good Neighbourhood

Economic
- Prosperity

Social
- Safety
- Sustainability
- Coherence of Space

Traffic
- Safety
- Sustainability
- Coherence of Space

Accessibility
- Safety
- Sustainability
- Coherence of Space
The value of the slope $\frac{\Delta y}{\Delta x}$ is sometimes called the "rate of change" because it measures the rate of change in $y$ as a result of a change in $x$. 

sensitivity
Based on the results, we could improve the neighbourhood goodness by increasing the number of tourists, the bars and restaurants and the stores. On the other hand, an effort on increasing the frequency of the exhibitions will not affect much.
rethink the museum thematic

museums in the area + sensitivity analysis

avoid one visit user & promote social interaction

economic strategy

free visit

define museum thematic

evaluate the program
Program and users

exhibition
COMMUNITY GALLERY
GALLERY A
GALLERY B Mauritzhaus
GALLERY C
GARDEN EXHIBITION (opt)

I come to see the exhibitions

general public
RECEPTION / LOBBY
RECEPTION WARDROBE
ORIENTATION GALLERY

I work here

I come to the conferences and events

THEATRE 450 SEATS
SEATING STORAGE
WARDROBE

I come to the restaurant

ART CENTER SHOP
CAFE RESTAURANT

service
PUBLIC WC
STAFF WC/SHOWERS
JANITORIAL
MECHANICAL

storage
EXHIBITION PREPARATION (loading)
PREPARATION OFFICE
HOLDING ALL EXHIBITION SUPPORT AREAS
SHIPPING AND RECEIVING
EXHIBITION WORKSHOP

I come to the restaurant

performance space

MULTIPURPOSE

EDUCATIONAL SPACE (100 seats)
STORAGE (chairs + tables)
COMMUNITY MEETING (20 seats)

I work here

administration
RECEPTION
SERVER/TECH
STAFF KITCHEN/LOUNGE
STORAGE
MAIL/COPY/STORAGE
OFFICE A
OFFICE B
WORKSTATIONS
LIBRARY
VOLUNTEER OFFICE
Layout research

<table>
<thead>
<tr>
<th>reception / lobby</th>
<th>wardrobe</th>
<th>orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td>art center shop</td>
<td>shop</td>
<td>cafe / restaurant</td>
</tr>
</tbody>
</table>

Fuzzy area
Fuzzy height

Max. Spaciousness
Min. Area
Layout research

**reception / lobby**

- **position axis1**: 10.0
- **position axis2**: 30.3
- **position axis3**: 0.0
- **rotation**: 15
- **dimension axis1**: 4.4
- **dimension axis2**: 6.7
- **dimension axis3**: 6.0

20 parameters, 10 possible states = $10^{20}$ combinations
1 processing cycle one of the possible combinations
processor 10 GHz = $10^{10}$ seconds

more than 300 years

**general / public**

- **position axis1**: 0.410
- **position axis2**: 0.018
- **starting floor**: 0
- **dimension axis1**: 28.72
- **program area**: 340
- **number of floors**: 1
- **ceiling height**: 5.0

variables combination

restrained domain for each particular space

expensive computation
Layout research

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>position axis 1</td>
<td>0.410</td>
</tr>
<tr>
<td>position axis 2</td>
<td>0.018</td>
</tr>
<tr>
<td>starting floor</td>
<td>0</td>
</tr>
<tr>
<td>dimension axis 1</td>
<td>28.72</td>
</tr>
<tr>
<td>program area</td>
<td>340</td>
</tr>
<tr>
<td>number of floors</td>
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</tr>
<tr>
<td>ceiling height</td>
<td>5.0</td>
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</tbody>
</table>

Variables
Layout research

Variables

- position axis 1: 0.410
- position axis 2: 0.018
- starting floor: 0
- dimension axis 1: 28.72
- program area: 340
- number of floors: 1
- ceiling height: 5.0

Variables:
- p1
- p2
- sf
- d1
- pa
- nf
- ch
Determinants of the layout performance

Fulfillment of program area requirements → Variables definition

<table>
<thead>
<tr>
<th>p1</th>
<th>p2</th>
<th>sf</th>
<th>d1</th>
<th>pa</th>
<th>nf</th>
<th>ch</th>
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<tbody>
<tr>
<td>0.410</td>
<td>0.018</td>
<td>0</td>
<td>28.72</td>
<td>340</td>
<td>1</td>
<td>5.0</td>
</tr>
</tbody>
</table>

- **axis 1**: 0.0 to 0.7
- **axis 2**: 0.0 to 0.7

- **general public**
  - 0.0 to 0.7
  - 0
  - 10.0 to 30.0
  - 340
  - 1-2
  - 5.0

- **exhibition 1**
  - 0.0 to 0.7
  - 0
  - 15 to 40.0
  - 600
  - 1
  - 5.0

- **exhibition 2**
  - 0.0 to 0.7
  - 1-2
  - 10.0 to 30.0
  - 250 to 350
  - 1-2
  - 5.0 to 8.0

- **storage**
  - 0.0 to 0.7
  - 0-1
  - 6.0 to 18.0
  - 200
  - 1-2
  - 5.0

- **cafe/restaurant**
  - 0.0 to 0.7
  - 0-3
  - 0.5 to 0.8

- **multipurpose**
  - 0.0 to 0.7
  - 0-3
  - 0.5 to 0.8

- **performance**
  - 0.0 to 0.7
  - 0-3
  - 0.5 to 0.8

- **administration**
  - 0.0 to 0.7
  - 0-3
  - 0.5 to 0.8

- **service**
  - 0.0 to 0.7
  - 0-3
  - 0.5 to 0.8

- **support**
  - 0.0 to 0.7
  - 0-3
  - 0.5 to 0.8
Determinants of the layout performance

Fulfillment of program area requirements → Variables definition

Minimize overlaps

\[ \text{Vol A} + \text{Vol B} + \text{Vol C} - \text{Vol A} \cup \text{B} \cup \text{C} = \text{Vol A} \cap \text{B} \cap \text{C} \]

union intersection

Don’t exceed the site boundary

\[ \text{Vol B} - \text{Vol (B \setminus A)} = \text{Vol A} \cap \text{B} \]

difference
Determinants of the layout performance

Nearness among certain functions

\[
\begin{align*}
P_{1}.Z &= 0.0 \\
P_{2}.Z &= 0.0 \\
v_h &= 5 \\
v_v &= 12 \\
dist_h &= P_{1}\cdot P_{2} \\
l &= dist_h.Lenght \\
\text{th} &= l / v_h \\
dist_v &= \text{Math.Abs}(P_{1}.Z - P_{2}.Z) \\
tv &= dist_v / v_v \\
D &= \text{th} + tv
\end{align*}
\]

Circulation sequence

solution generation: [1, 3, 4, 2]

desired sequence: [1, 2, 3, 4]

\[
0 + 1 + 1 + 2 = 4
\]
Determinants of the layout performance

Fulfillment of program area requirements
Minimize overlaps
Don’t exceed the site boundary
Structure research  Taxonomy
Building scheme

- auditorium
- administration
- performance
- gallery
auditorium
gallery
performance
atrium

communications
performance
auditorium
administration
administration

one to many
one to many-many

value of the place
user-state-specific
real interaction between people
ubiquitous gadgets portability

interaction - portability - value of the place

one user to one pc
one/multiple user to pc/projector

(Dr. ir. Martijn Stellingwerff, "Virtual context", 2005, Delft)
1- Orientation
2- Auditorium
3- Parking
4- Storage
1- Atrium  
2- Bar  
3- Toilet  
4- Parking  
5- Exhibition support
1- Meeting room 
2- Bar 
3- Atrium 
4- Parking 
5- Storage
1- Meeting room
2- Bar
3- Atrium
4- Parking
5- Storage
1- Gallery
2- Performance
3- Storage
4- Exhibition support
1- Library
2- Gallery
3- Performance
4- Atrium
5- Orientation
gallery
### Evaluation Timeline on 7th/1/2013

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<td>Fuzzy Neural Tree</td>
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<td>File to factory</td>
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<td>Details: 1/50 &amp; 1/20</td>
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<td>Model making</td>
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**Note:**
- **P1**: September - October
- **P2**: November - December
- **P3**: January
- **P4**: February - March
- **P5**: April - July
Skin integration as load bearing structure.
Robot Fabrication Workshop 2013 Rotterdam

Foam Block

Cut piece

Glulam Beam

Expanded Poly styrene Foam Block
Polyurethane Foam Hard coat

Robotic cut / Sand / Repair holes with polyester filler
Sand / Wash / Paint
1- Border beam
2- Pilkington Profilit
   Translucent linear channel
glass system
3- Gutter.
   casted polyurethane
4- Metal connector
Timber frame
Rubber
Kalwall translucent isolation
Timber frame

3 directions

2 directions
thank you