Menkema Historical Garden
Earthquake population Shrinkage

Context

Botanical Garden

Program

Technology
- Structure
- Solar-tracking Louver
- Responsive skin
Research Question:
- 1. How to design a seismic resistant building?
- 2. Biocmimicry technology integrated into the architecture design to respond to the nature?

Research Approach:
1. Structure design in seismic area
2. Responsive skin: Solar-tracking louvers, deployable sun-shading facade system
Research : Seismic Design Principle

Stabilization
1. Load transfer: Stiff Foundation
2. Building configuration- Plan & Elevation
   regularity in arrangement
3. Curve wall, Bond beam

Dissipate Energy
4. Non-structure Construction: diagonal grid window
5. Technical solution: Damping joint
Design: Exhibition Education Center and Pavilion

- Base
- Timber Framework
- Curve wall
- Steel column
- Light roof
Exhibition Part Design: **Concret Base**

1. Concret strip Foundation and concret wall was placed in 1.5 meters below the ground level.
Exhibition part Design: **Timber Framework**

2. Timber column stands on the stiff concrete base to resist the earthquake force

3. Timber grid roof is lightweight and flexible
Construction Detail Of Timber grid beam
Pavilion Design: **Loadbearing wall, horizontal resistance**

1. steel bolt in between connecting adjacent part
2. solid wood stack by layers
3. steel anchor support
4. strip Foundation

Cross-Laminated Timber Wall
Pavilion Design: diagonal grid roof

Diagonal grid timber system: Light weight

reference structure application
Pavilion Design: the Roof, Eave and column

Eave: Waterproof

Damping material between Base and steel column

pile up one batten above the other and clip with steel joint.
"The Skin of biological organisms are directly analogous to the external walls of buildings: both perform multiple functions. The key challenge, I would argue, is to learn from the levels of integration and performance that can be seen in biological examples and combine that with the best that human ingenuity can deliver."

<Biomimicry Architecture>
Biomimetic Skin: *deployable facade system*

photosynthesis
pores
transpiration of water and CO2
A double-layer skin

guard cells controlling light and heat transmission
The inner layer of louvers can respond to the various light condition, such as low and high angle light, diffusion light, direct light as for heat entry and dissipation
Architecture Application: deployable surface
Responsive facade design

Non-autonomous facade system of "One Ocean" Expo pavilion

Transformation

Closed white polymer: Block sight view

From Seeing to Touching
Responsive facade design: materialization

An Landscape Museum Design by RCR Atelier

95% Transparent PVC : extend sight view
Solar-tracking Louver design
Solar-tracking louvers: Material

silicon solar cells on the glass louver panels
Solar-tracking louver: Construction

1. metal strip, edge cable
2. Keder
3. Clamping bar
4. 200um in thickness bulk solar cell, crystalline silicon
5. 3000/900mm solar-tracking sun-shading louver panels
6. 40/40/5mm alluminum frame hooking solar-tracking sun-shading louver
7. 140/12mm,80/12mm CHS rotating bar of solar-tracking sun-shading louver panels
8. tensioned PTFE coated glass-fibre cloth.
9. 40/5mm CHS supporting bar
10. steel cable connecting timber diagonal grid structure
11. 180mm steel clamp 3 layers timber grid system
12. 50/50/5mm SHS ceiling hanging frame Glass-fiber fabric, silicon coated ceiling
13. 1.5mm stainless-steel profile, rotatable connection in center
14. 3mm transparent PVC membrane
15. 220/50mm timber Edge-beam
16. 6mm metal covering plate
17. upper steel bearing plate
Climate Design & Light Environment

overheated - Temperature - Heat Pump - Passive ventilation system

Winter day

Winter night

Summer day

Summer night

Direct light

Diffusion light

Prismatic glass diffuse light
"The gardens are marked by a clear cut, orderly and symmetrical layout with principal axis and a transverse axis which intersect at the center of the house. The style proclaims "rationalism is the ruler of nature."
How Do we experience the Nature?
Spatial Sequence:
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Spatial Sequence:

Trees Boundary
Spatial Sequence:

- Trees Boundary
- Bridge-River
- Garden
- Historical Museum
- Small Square Closed Wall
- Bridge-River
- Entrance
- Avenue
Design Question: How to intervent into the existing context in a dialogue with the historical garden?

Design Approach: Extending the existing Landscape into architecture, guiding people into new garden with continuous spatial sequence.

Intervention Into Context

Original Historical Garden  Insert a new walking route into the outer range of garden
Extending the landscape of garden following center axis.
My botanical exhibition center design is at the end of the spatial sequence.
DOMESTOEN_rietorchi
wormwood
Harlem windbell
Melegris
Borage
Saxifraga granulata
沼泽兰花
艾草
哈莱姆 风铃花
川贝母
琉璃苣
虎耳草，颗粒野稻“斑丽”
DOMIESTOEN_rietorchis

沼泽兰花
wormwood
Harlem windbell
Borage
Saxifraga granulata

虎耳草，颗粒野稻“斑丽”
Botanical Garden Program

Observation
- seed plant conservation
- tree root section
- pot plant
- Verfplanten (蕨类植物)
- Tropical plant: succulents and climbers
- Dead tree root

Production
- Organic Tea, perfume making Laboratory, Plant Souvenir Factory

Protection
- Honeybee House, bird cottage

Exhibition

Selling Market

Provision